UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

RESMED CORP,
Petitioner,

v.

CLEVELAND MEDICAL DEVICES, INC.,
Patent Owner.

Case IPR2025-00246
U.S. Patent No. 11,857,333

DECLARATION OF DR. MICHAEL T. GOODRICH IN SUPPORT OF PATENT OWNER'S CONTINGENT MOTION TO AMEND AND REQUEST FOR PRELIMINARY GUIDANCE

TABLE OF CONTENTS

Page

I. INTRODUCTION

I, Dr. Michael T. Goodrich, declare:

1. I have been asked by Plaintiff Cleveland Medical Devices Inc. ("Patent Owner" or "CleveMed") to submit this declaration in the matter referenced above. I have reviewed U.S. Patent No. 11,857,333 ("the '333 Patent"), its prosecution history, the *inter partes* review petition that Defendant ResMed Corp. ("Petitioner" or "ResMed") submitted regarding the '333 Patent, the decision to institute by the Patent Trial and Appeal Board ("PTAB"), and the art cited in those documents. I am familiar with the technology at issue and what was known in the art at the time of the earliest priority date for the '333 Patent which is November 4, 2005.

2. I am being compensated for my work in this matter. My compensation does not depend on the outcome of this proceeding.

3. I have been asked to provide my technical opinions relating to the '333 Patent and the proposed substitute claims (Appendix A) in relation to arguments raised by Petitioner in its Petition.

4. My opinion is based on a person having ordinary skill in the art (which I understand is sometimes abbreviated "POSITA") at the time of the earliest potential claimed priority date, which I understand to be 2005. '333 Patent at Cover. My opinions in this declaration are based on my years of education, research, and experience, as well as my investigation and study of relevant materials.

II. QUALIFICATIONS

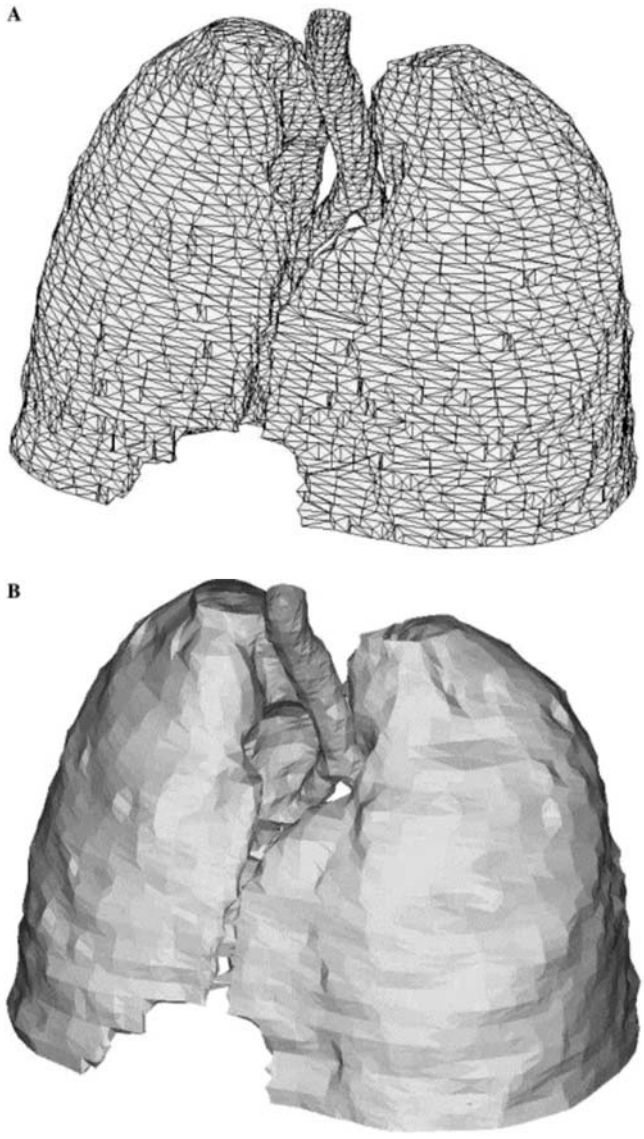
5. I summarize some of the relevant information regarding my CV (Appendix B) as follows. I received a Bachelor of Arts degree in Mathematics and Computer Science from Calvin University, in Grand Rapids, Michigan, in 1983, a Master of Science (M.S.) degree in Computer Science from Purdue University, in West Lafayette, Indiana, in 1985, and a Ph.D. in Computer Science from Purdue University in 1987.

6. I am a Distinguished Professor in the Department of Computer Science at the University of California, Irvine, where I have been a faculty member since 2001. The Distinguished Professor title is a campus-level distinction and is reserved for faculty who have achieved the highest levels of scholarship over the course of their careers. Prior to this, I was a professor in the Department of Computer Science at Johns Hopkins University from 1987-2001.

7. I have authored or coauthored over 350 publications, including several widely adopted books, such as Data Structures and Algorithms in Java, Data Structures and Algorithms in C++, Data Structures and Algorithms in Python, Introduction to Computer Security, and Algorithm Design and Applications. Altogether, my publications have, according to Google Scholar, been cited over 18,500 times. My publications include contributions to data structures and algorithms, information visualization, networking, graph algorithms, computational

geometry, distributed and parallel algorithms, cloud security, information security and privacy, and algorithm engineering. For example, using the indexing of publications listed in my CV, I have publications on networking and parallel and distributed computing, including publications Ch-1, Ch-3, Ch-6, Ch-10, J-1, J-5, J-7, J-10, J-16, J-19, J-24, J-30, J-38, J-56, J-61, J-69, J-96, C-1, C-2, C-7, C-25, C-26, C-39, C-106, C-112, C-127, C-137, C-228, C-230. Also, several of my textbooks include entire chapters on software engineering, and several of my publications, including Ch-8, Ch-12, J-45, C-53, C-62, C-63, C-64, are on algorithm engineering. In addition, I have many publications on topics specifically relevant to the subject matter of the challenged patent, as I explain below.

8. For example, I have several publications that describe technologies with medical applications. For instance, in my publications J-51 and C-93, my coauthors and I presented an efficient algorithm for interpolating a piecewise-linear surface between parallel image slices, each consisting of an arbitrary number of (possibly nested) polygons that define "material" and "non-material" regions, which is a problem with applications to medical imaging, e.g., for constructing 3-dimensional representations of organs from parallel 2-dimensional image slices, as we illustrated, for instance, by building a 3-dimensional representation of a pair of lungs from a series of 2-dimensional image slices:



J-51 at Fig. 8.

9. In my publications J-67, J-80, J-81, C-132, and O-12, I studied methods for learning someone's DNA, which of course has many medical applications, from a series of simple database queries, and in my J-80 publication I provided a case study involving 1000 (anonymized) human mitochondrial DNA sequences that showed the effectiveness of my approach to this learning problem. In my publication

C-225, my coauthors and I studied methods for learning phylogenetic trees, such as for representing the evolution of viruses, by sequences of parallel comparison queries, and, in my publication C-222, my coauthors and I studied methods for visualizing such trees.

10. Naturally, given the privacy concerns regarding patient data, information security and privacy is another important topic that has applications to medical data capture, retention, and transmission, and I have several publications in this area as well, including publications P-1, P-2, P-3, P-5, P-6, P-7, P-8, B-10, J-61, J-63, J-64, J-66, J-71, J-96, J-99, C-80, C-83, C-85, C-87, C-90, C-91, C-92, C-95, C-99, C-101, C-102, C-104, C-105, C-109, C-113, C-119, C-123, C-126, C-134, C-146, C-149, C-151, C-156, C-161, C-166, C-167, C-168, C-182, C-192, C-193, C-194, C-200, C-203, C-208, C-211, C-235, and C-243. For example, in my publication C-99, my coauthors and I studied the problem of broadcasting confidential information to a collection of small-memory devices/sensors while providing the ability to revoke an arbitrary subset of those devices (e.g., due to compromise or loss). In my publication C-101, my coauthors and I presented computationally lightweight schemes for performing biometric authentication that carry out the comparison stage without revealing any information that can later be used to impersonate the user (or reveal personal biometric information). Unlike some previous computationally expensive schemes, which made use of slower

cryptographic primitives, our work was directed at ways to authenticate users with biometric smartcards, sensors, and other computationally limited devices. Also, in my publication C-102, I presented two new approaches to improving the integrity of network broadcasts and multicasts with low storage and computation overheads, e.g., to a collection of computationally weak sensors.

11. I have also studied other computational problems involving collections of wireless sensors, such as sensors used to gather medical data. In my publications Ch-9 and C-116, my coauthors and I show how to support a location authentication and authorization protocol to securely authenticate the location claims of mobile wireless users and to securely distribute shared keys for data encryption purposes. In my publication C-118, my coauthors and I designed a mechanism for secure wireless networking, where we proposed placing fixed localization sensors that enable mobile communication devices to prove they belong to a secure region that is defined by the interior of a region, like a hospital. Each localizer views an infinite wedge of the plane, and a device can prove membership in the secure region if it is inside the wedges for a set of localizers whose common intersection contains no points outside the region. In my publications J-62 and C-115, my coauthor and I presented group-testing algorithms for resolving broadcast conflicts on a multiple access channel (MAC) and for identifying the dead sensors in a mobile ad hoc wireless network. We gave adaptive algorithms that are provably more efficient than

previous algorithms and we showed how our algorithms can be applied to solve dead sensor diagnosis. In my publications C-113 and J-66, my coauthors and I presented a protocol for securely pairing wireless electronic devices, such as between a medical sensor relay and a laptop computer, that lack any previous association and for which we wish to avoid a man-in-the-middle attack during data transmission between these devices. In this work, we investigated the use of audio for human-assisted authentication of previously un-associated devices by using a text-to-speech engine for vocalizing a robust-sounding and syntactically-correct sentence derived from the hash of a device's public key that is communicated wirelessly (e.g., using Bluetooth or IEEE 802.11 a/b/g) and by coupling vocalization on one device with the display of the same information on the other device.

12. When medical devices use cellphones to communicate data using cell towers, it is of course important that they can communicate their data effectively and efficiently, and I have done research on this topic as well. For example, in my publication C-155, my coauthors and I studied the problem of assigning a moving point to a base-station region that contains it. For instance, the moving object could be a cellphone, and the base station could represent the coverage zones of cell towers. The optimization goal we studied was to minimize the number of handovers that occur when the point moves outside its currently assigned region and must be assigned to a new one, so as to optimally maintain communication connections. We

studied this problem in terms of a competitive analysis comparing our methods against an algorithm for the offline version of this problem, when object motions are known in advance and a simple greedy strategy suffices to determine an optimal assignment of objects to base stations with as few handovers as possible.

13. My research has been supported by grants from the Defense Advanced Research Projects Agency ("DARPA"), the National Security Agency ("NSA"), the Office of Naval Research ("ONR"), the Army Research Office ("ARO"), and the National Science Foundation ("NSF").

14. In addition, I have technical expert and testifying expert consulting experience in matters involving algorithms, cryptography, machine learning, digital rights management, computer security, mobile devices (including power management), networking, software, video streaming, and storage technologies.

15. I am a Fellow of the American Association for the Advancement of Science ("AAAS"), a Fellow of the Institute of Electrical and Electronics Engineers ("IEEE"), and a Fellow of the Association for Computing Machinery ("ACM"), as well as being named as a Foreign Member of the Royal Danish Academy of Sciences and Letters. I am also a recipient of a Fulbright Scholarship (for senior specialist service to University of Aarhus, Denmark). In addition, I am a recipient of the IEEE Computer Society Technical Achievement Award ("for outstanding contributions to the design of parallel and distributed algorithms for fundamental combinatorial and

geometric problems") and the Pond Award for Excellence in Undergraduate Teaching. Also, I am an ACM Distinguished Scientist.

16. I am a co-inventor on several U.S. patents, including U.S. Patent No. 7,257,711, "Efficient Authenticated Dictionaries with Skip Lists and Commutative Hashing," which discloses secure distributed data authentication schemes. I am also co-inventor of U.S. Patent No. 7,299,219, "High Refresh-Rate Retrieval of Freshly Published Content using Distributed Crawling," which discloses a technology for quickly retrieving website data that can change frequently, so as to be stored in a search engine. I am also co-inventor of U.S. No. Patent 8,681,145, "Attribute Transfer Between Computer Models Including Identifying Isomorphic Regions in Polygonal Meshes," which teaches how to map one mesh-based computer model to another. In addition, I am co-inventor of U.S. Patent No. 9,152,716, "Techniques for Verifying Search Results Over a Distributed Collection," which discloses a system for searching the Internet so as to produce verifiable search results that can be produced by a search engine.

17. I have taught courses at Johns Hopkins University, Brown University, and University of California, Irvine, at both the undergraduate and graduate levels. Topics of my courses have included computer security, algorithms, data structures, information visualization, computer graphics, networking, algorithm engineering, computational geometry, and parallel processing. In addition, I have mentored 26

PhD students over the years, who have written their PhD theses on topics in algorithms, data structures, information visualizations, networking, parallel processing, and computer security and privacy.

18. I have served as an editor on several technical journals, including Computational Geometry: Theory and Applications, Journal of Computer & System Sciences, Journal of Graph Algorithms and Applications, Int. Journal of Computational Geometry & Applications, and Information Processing Letters. I have also served on many program committees (PCs) for top conferences and workshops in Computer Science, including serving as PC chair in several instances. Examples include ACM Symposium on Computational Geometry ("SoCG"), ACM Symposium on Theory of Computing ("STOC"), Workshop/Symposium on Algorithms and Data Structures ("WADS"), Algorithm Engineering and Experimentation ("ALENEX"), which I cofounded with Dr. Catherine McGeoch in 1999), IEEE Symposium on Foundations of Computer Science ("FOCS"), ACM-SIAM Symposium on Discrete Algorithms (SODA), International Symposium on Graph Drawing ("GD"), International Colloquium on Automata, Languages, and Programming ("ICALP"), ACM Conference on Computer and Communications Security ("CCS"), European Symposium on Algorithms ("ESA"), IEEE International Parallel and Distributed Processing Symposium ("IPDPS"), ACM Symposium on Parallel Algorithms and Architectures ("SPAA"), ACM Symposium

on Advances in Geographic Information Systems ("GIS"), IEEE Symposium on Security and Privacy ("S&P"), IEEE International Conference on Big Data, IEEE International Conference on Data Engineering ("ICDE"), and International Symposium on Algorithms and Computation ("ISAAC"), and DAGS Conference on Electronic Publishing and the Information Superhighway.

III. APPLICABLE STANDARDS AND CONTROLLING PRINCIPLES

A. Claim Construction

19. I have been informed through counsel that during this inter partes review proceeding (because this petition for inter partes review was filed after November 13, 2018), claims terms should be given their "ordinary and customary meaning as would be understood by a person of ordinary skill in the art in question at the time of the invention." I have further been informed that for determining the meaning of a disputed claim term, it is appropriate to "look principally to the intrinsic evidence of the record, examining the claim language itself, the written description, and the prosecution history." I understand that a term is introduced with an indefinite "an" article and subsequently referred to with the definite "the" article. I further understand that extrinsic evidence can be helpful in demonstrating how a term is used in the art, and how the plain meaning is applied in the context of the intrinsic record.

20. I understand that the Patent Office will look to the specification and prosecution history in construing a given claim term. I understand the Patent Office will also sometimes look to other evidence, which I am informed is called "extrinsic" evidence, including dictionary definitions, for how a person of ordinary skill in the art would have understood a claim term.

21. I understand that a patent's "specification" includes all of the figures, discussion, and claims within the patent, including those that are incorporated by reference. I understand that the "prosecution history" includes the statements made to and dialogue with the patent office in the course of obtaining the patent, and that the prosecution history of any parent application can contain relevant information.

B. Obviousness

22. I understand that an issued patent claim is invalid as obvious if it can be shown that the differences between the patented subject matter and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a person having ordinary skill in the art. Relevant considerations include the level of ordinary skill in the art; the scope and content of the prior art; differences between the prior art and the claims at issue; and the so called objective indicia, or secondary considerations, of nonobviousness.

23. I understand that in order to evaluate the obviousness of a claim over a given prior art combination, I should analyze whether the prior art references,

included collectively in the combination, disclose each and every element of the allegedly invalid claim as those references are read by the person of ordinary skill in the art at the time of the invention. Then I am to determine whether that combination makes the claims of the '948 Patent obvious to the person of ordinary skill in the art by a preponderance of the evidence, at the time of the inventions. I understand that such preponderance of the evidence is satisfied if the proposition is likely to be true than not true.

24. I understand that the obviousness inquiry requires that the prior art be considered in its entirety.

25. I understand that even where all of the claim limitations are expressly disclosed in the prior art references, there must be some showing that a person of ordinary skill in the art would have been motivated to combine such prior art references and that there would have been a reasonable expectation of successfully achieving the claimed invention from such combination.

26. I understand in considering the obviousness of a claimed invention, one should not view the invention and the prior art with the benefit of hindsight. It is for that reason, I understand that obviousness is assessed by the person of ordinary skill in the art at the time the invention was made. In this regard, I am informed and I understand that the invention cannot be used as a guide to selecting and understanding the prior art. I understand that the appropriate standard is to determine

whether a person of skill in the art would be motivated to combine references, not whether they could.

27. I understand that obviousness cannot be predicated on what was unknown at the time of the invention, even if the inherency of a certain feature is later established. I understand that unknown properties of the prior art may not be relied upon to provide the rationale for modifying or combining the prior art to reach the claimed subject matter.

28. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.

IV. PERSON OF ORDINARY SKILL IN THE ART

29. I understand that the factors to be considered in determining the level of ordinary skill in the art to be: (1) the educational level of active workers in the field, including the named inventors of the patent; (2) the type of problems encountered in the art; (3) prior art solutions to those problems; (4) the rapidity with which innovations are made; and (5) the sophistication of the technology in the art. I further understand that in a given case, every factor may not be present, and one or more factors may predominate.

30. I understand that CleveMed applied the following definition of a POSITA in 2005, as someone having "a bachelor's degree in mechanical engineering, electrical engineering, computer science, biomedical engineering, or a similar technical field, with at least two years of relevant product design experience working with diagnostic sensor systems and network data systems, such as networked PAP machines. Additional experience could substitute for less education, and additional education could likewise substitute for less experience." Pet. at 3-4.

31. Based on my training and experience, I believe that I am a person of at least ordinary skill in the relevant art (as highlighted in the Qualifications section and Appendix B), and have been since at least the earliest priority date of the '333 Patent, which I understand permits me to give an opinion about the qualifications of one of ordinary skill at the time of the invention. In addition, I have taught undergraduate and graduate computer science and engineering students since the mid-1980s.

V. IN MY OPINION THE SUBSTITUTE CLAIMS ARE PATENTABLE OVER THE INSTITUED GROUNDS

32. I understand that Grounds 1 and 2 each rely on Toge as a primary reference. Ground 1 relies on Toge in view of Kumar, and Ground 2 relies on Toge

in view of Kumar and Norman. *See* Pet. at 1.[1] Substitute Independent Claim 30 introduces the following claim features that in my opinion are not disclosed in Toge, and the other asserted references do not fill in the gap because either they too lack disclosure, or a POSITA would not have been motivated to have made the combination to arrive at the claimed invention:

- "the therapy administered by the PAP or CPAP device [] configured to be adjusted by the first software on the subject's cellular phone;"
- "a subject's cellular phone with downloadable first software" that "using the first software further provided to receive and display" the subject's sleep data; and
- "a remote internet site hosted on at least one server."

Substitute Independent Claim 30 (Appendix A).

A. In My Opinion, the Asserted Art Does Not Disclose a Patient's Cell Phone That Adjusts the PAP or CPAP Therapy (Grounds 1 and 2)

33. It is my opinion that the asserted art, including Toge, Kumar, and Norman, does not disclose a software on a patient's cell phone that is configured to

[1] I note that Grounds 1 and 2 challenge independent claim 15 while the other two grounds challenge claims depending from the independent claim. *See* Pet. at 1. Accordingly, my analysis herein is centered on the independent claim as challenged in Grounds 1 and 2 and which also applies to the other grounds.

adjust the therapy administered by the patient's PAP or CPAP device, as recited in substitute Independent Claim 30. *See* Appendix A, Substitute Independent Claim 30.

34. It is my opinion that the claim limitation is novel and nonobvious because no asserted art in the grounds discloses a PAP/CPAP device therapy being adjusted by the patient's cell phone. Toge discloses pushing "necessary" or "crucial" data to a physician's computer, so that the physician can remotely monitor the patient's PAP therapy and respond to medical emergencies. Toge at Abstract, ¶¶ [0001]-[0006], [0046], [0047], [0054], [0057]. Accordingly, Toge's system includes physician-side computers and physician-side mobile terminals that allow physicians to review patient sleep data and respond to medical emergencies, if necessary. *Id*. at ¶¶ [0018]-[0019], [0039], [0047], [0054]. However, Toge's system does not include a patient's cell phone, let alone one that adjusts the PAP device.

35. It is my opinion that Kumar and Norman also do not disclose PAP therapy adjustment by a patient's cell device. Nowhere do these references discuss the use of a patient's cell phone to modify a CPAP/PAP device therapy treatment. Although Kumar discloses a patient-side computing device, this device simply manages the transmission of data between the patient-side medical device and the web server. *See* Kumar at ¶¶ [0018], [0072], Claims 5, 9. And rather than a patient or medical provider adjusting the therapy of a PAP device, Norman discloses a PAP

device that automatically adjusts its own treatment pressure in response to sensor data. *See* Norman at Title, Abstract, ¶¶ [0007], [0023]. Thus, it is my opinion that like Toge, these references also do not disclose the use a patient's cell phone to adjust the PAP device's treatment therapy.

36. For at least these reasons, it is my opinion that substitute Independent Claim 30 and its dependents are patentable over Toge, Kumar, and Norman.

B. In My Opinion, Toge in View of Kumar Does Not Teach a Patient's Cell Phone with Downloadable Software That Receives and Displays Patient's Sleep Data (Grounds 1 and 2)

37. It is my opinion that Toge in view of Kumar does not teach the claim features of a patient's cell phone with downloadable first software receiving and displaying sleep data as recited in substitute Independent Claim 30. It is my opinion that this claim feature is novel and nonobvious because Toge does not disclose the use of patient's cell phone in its system, and a POSITA would not have been motivated to add a patient's cell phone to Toge's system because Toge is directed to the physician so there was no problem that needed solving that would have motivated this modification.

38. Toge does not disclose a patient's cell phone, let alone any claimed associated features, because its system is directed to solving the problem related to a physician's remote monitoring, as discussed above. Toge at Abstract ("Enabling remote monitoring of the patient's condition"), ¶ [0018] ("***Medical institution***

personnel such as physicians and nurses can access the transmitted data using the physician side computer 4."), ¶ [0047] ("[I]f the oxygen saturation, for example, falls below 90%, ***physicians can take emergency measures***") (emphases added); *see also id*. at ¶ [0039], [0055].

39. Because Toge's system already independently operates effectively for its purpose, a POSITA would not have had a reason to add a patient's cell phone with downloadable software. In fact, I note that Petitioner admits that Toge's PAP device includes a PAP display screen that already allows a patient to view their sleep data. Petitioner does not dispute this. *See ResMed Corp. v. Cleveland Med. Devices, Inc.*, No. IPR2025-00160 (the "-00160 IPR"), Paper 1 at 33 (arguing that a PAP device as in Toge includes "a screen suitable for displaying data to the patient"). Thus, aside from there being no need for a patient's cell phone, it would also have been completely unnecessary because of the display screen.

40. For at least this reason, it is my opinion that substitute Independent Claim 30 and its dependents are patentable over Toge, Kumar, and Norman.

C. In my Opinion, Toge Alone or in View of Kumar Does Not Teach a "Remote Internet Site" That is "Hosted on At Least One Server"

41. In my opinion Toge in view of Kumar does not teach the "remote internet site hosted on at least one server" features as recited in substitute Independent Claim 30. Toge does not disclose "a remote internet site" that is "hosted

on at least one server," as conceded in its co-pending IPR challenge against related U.S. Patent No. 11,786,680 (the "'680 Patent"). -00160 IPR, Paper 1 at 45-46. Kumar does not resolve Toge's deficiency. In the Petition, Petitioner modifies Toge's system with Kumar's web server (hosting a browser-based engine) accessible via a web page. *See id*. However, a POSITA would not have found it obvious to make such a modification because it would have interfered with Toge's purpose of pushing crucial treatment data to the physician-side devices.

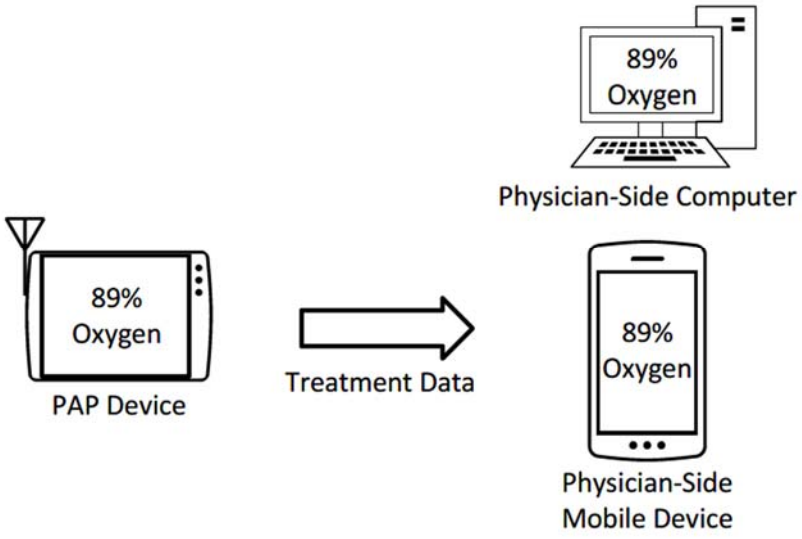
1. Toge Does Not Disclose a "Remote Internet Site" That is "Hosted on At Least One Server"

42. Toge does not disclose "remote internet site" that is "hosted on at least one server." I understand that Petitioner does not dispute this in the co-pending -00160 IPR. *See* -00160 IPR, Paper 1 at 45-46 (relying on Kumar's web server for similar claim limitations in the '680 Patent).

43. Instead of including a remote internet site hosted on a server, where data is stored, further analyzed, and provided upon request as in the '333 Patent, Toge's system pushes patient data to the doctor's computer and mobile device for analysis and without request. *Compare* '333 Patent at 51:38-63, Substitute Independent Claim 30 *with* Toge at ¶¶ [0050]-[0054].[2] The physician's devices,

[2] Toge's system implements a push protocol as the physician-side devices passively accepts the data without making any request. Ex. 2019 at 25-26 (describing that in

therefore, automatically receive "necessary" and "crucial" treatment data (e.g., oxygen saturation of 89%) so that they can analyze the data and take emergency measures. *See* Toge at ¶¶ [0019], [0047], [0054].



Toge at Fig. 1; *see also id*. at ¶¶ [0060]-[0061]. Even in the embodiment where the relay device is separate from the PAP device, this "necessary" or "crucial" treatment data is still pushed to the physician-side devices. Toge at ¶ [0016].

44. There is, therefore, in my opinion, no "remote internet site" in Toge's system, expressly or inherently, because patient data is pushed to the necessary physician-side devices without traversing any such site. *See* Toge at ¶ [0009]. In

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a push protocol, the "receiver[] ***passively accept[s]*** whatever the sender[] push[es]to them") (emphasis added).

fact, changing Toge's system to require client devices to request data from a web server—which uses a pull protocol instead of a push protocol—would have interfered with Toge's ability to push crucial treatment data to the physician-side devices. Ex. 2020 at 2-3 (describing that "HTTP is a pull protocol" as "information can only be pulled from a web server after a client's request").

45. In view of the foregoing, it is my opinion that Toge does not disclose a "remote internet site" that is "hosted on at least one server."

2. Modifying Toge With Kumar Would Have Interfered with Toge's Purpose

46. It is my opinion that Kumar's web server teaching does not cure the Toge deficiency because Kumar's web server would interfere with Toge's purpose.

47. The purpose of Toge's system is to push "necessary" or "crucial" data to physician-side devices so that physicians can monitor their patients and take emergency action when needed. *See* Toge at Abstract, ¶¶ [0001]-[0006], [0046], [0047], [0054], [0057]. Toge explains that by setting a threshold (for example, 90% oxygen saturation), the physician-side devices are pushed "crucial data" when the threshold is met such that physicians "can take emergency measures" (adjusting the pressure of the PAP device, for example). *Id*. at ¶ [0047]; *see also id.* at ¶¶ [0039], [0054] ("[I]t becomes possible to selectively transmit only the necessary or crucial

data to the physician-side computer 4 or portable device 5.").[3] In this way, physicians can care for their patients who are in critical condition without having to log into a web page and make requests for data.

48. Implementing a web server that transmits the data upon a client request would interfere with Toge's purpose. In the client/server-model, a physician would request the data from the web server instead of the data being pushed to the physician. Ex. 2034, Ex. 2035 at 2-3. Because data is pulled only upon request, a POSITA would appreciate that Toge's purpose of pushing, without request, "necessary" or "crucial" (Toge at ¶ [0054]) treatment data would be interfered with. Ex. 2019 at 25-26; Ex. 2020 at 2-3. Because of this, a POSITA would not have modified Toge's system with Kumar.

VI. CONCLUSION

49. In view of the foregoing, it is my opinion that the substitute claims of the '333 Patent are patentable over the Petition grounds.

50. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and

[3] A push protocol is where "a sender can deliver traffic ***at will*** to a receiver" and the "receiver[] ***passively accept[s]*** whatever the sender[] push[es] to them." Ex. 2019 at 25-26 (emphases added).

that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Executed on the 29th day of October 2025 in Irvine, California.

Dr. Michael T. Goodrich

APPENDIX A

APPENDIX A

Listing of Claims

CleveMed presents the following contingent substitute claims for claims 15-29. Pursuant to 37 C.F.R. § 1.121(c)(2), the use of strikethroughs/double brackets indicate deleted text and underlining indicates inserted text.

Claims 1-14 (not challenged)

Claims15-29. (Canceled).

[[15.]] 30. (Proposed Substitute for Claim 15) A method of treating a subject's sleep apnea comprising steps of:

providing a therapy to a subject using a PAP or CPAP device while sleeping, the PAP or CPAP comprising a flow or pressure sensor, and a processor both which are integrated into the PAP or CPAP device;

collecting data with the PAP or CPAP device from the flow or pressure sensor during a time period of the therapy;

analyzing with the processor the collected data to determine a quantified level of severity data based on the subject's sleep apnea symptoms during the therapy;

transmitting, in either order, both 1) the collected data and/or the quantified level of severity data to a subject's cellular phone with downloadable first software via a radio frequency wireless link; and 2) the collected data and/or the quantified level of severity data to a remote internet site hosted on at least one server ~~the remote~~

~~station~~ from either a) the PAP or CPAP device via a cellular system, or b) the subject's cellular phone to the remote internet site ~~a remote station~~ via the cellular system or [[the]] Internet for further analysis with a second processor on the at least one server ~~or a server at the remote station~~ and review of the collected data, the quantified level of severity and/or this analysis by a clinician, technician, or physician at a remote computer; [[and]]

further determining [[the]] therapy efficacy data with either the processor of the PAP or CPAP device, the second processor ~~or server~~ configured with a second software stored on a computer readable medium at the at least one server ~~at the remote station~~, or the subject's cellular phone using the first software further provided to receive and display the quantified level of severity data and/or therapy efficacy data to the subject ~~or a care provider~~; and

wherein the therapy administered by the PAP or CPAP device is configured to be adjusted by the first software on the subject's cellular phone and the remote computer of the clinician, technician, or physician based on the wirelessly transmitted collected data, quantified level of severity data, or the therapy efficacy data.

[[16.]] 31. (Proposed Substitute for Claim 16) The method of claim [[15]] 30, wherein the subject's cellular phone and the PAP or CPAP device each have a

Bluetooth standard wireless RF connection and can communicate directly with each other through the wireless connection in real time.

[[19.]] 32. (Proposed Substitute for Claim 19) The method of claim [[15]] 30, wherein the steps of the method can be used to train the PAP or CPAP to adjust or titrate itself to better identify and distinguish between obstructive, central and complex sleep apneas during a second time period with data from the first sensor.

[[21.]] 33. (Proposed Substitute for Claim 21) The method of claim [[20]] 30, wherein the PAP or CPAP is adjusted or titrated in real-time by the technician, clinician or physician from the remote computer ~~a remote location~~.

[[22.]] 34. (Proposed Substitute for Claim 22) The method of claim [[15]] 30, including the step of storing the collected data, the quantified level of severity data from either the PAP or CPAP device transmitted to the ~~remote station~~ remote internet site, and/or data based on the transferred data on a database with similar data from treatments of many other subjects.

[[23.]] 35. (Proposed Substitute for Claim 23) The method of claim [[22]] 34, wherein the database is stored on the at least one server, which consists of either a central server or on a group of servers remote to the test location, the central server[[s]] or the group of servers and upon which the second software is stored on a computer readable medium and executed by the central server or the group of servers.

[[24.]] 36. (Proposed Substitute for Claim 24) The method of claim [[23]] 34, including the step of analyzing the data on the database with a relationship algorithm or a neural network to determine an optimal treatment for the subject.

[[25.]] 37. (Proposed Substitute for Claim 25) The method of claim [[23]] 30, wherein the PAP or CPAP device, the software on the subject's cellular phone or the remote internet site ~~remote station~~ determines a total sleep time.

[[26.]] 38. (Proposed Substitute for Claim 26) The method of claim [[23]] 30, wherein the processor of the PAP or CPAP device analyzes the collected data, in part, using one or more of a Short-Time Fourier Transform, a Discrete Fourier Transform, a Fast Fourier Transform, a recursively identified system model, a standard deviation technique, a time-frequency signal analysis and/or a Wavelet signal analysis to determine the quantified level of severity data.

[[27.]] 39. (Proposed Substitute for Claim 27) The method of claim [[23]] 30, wherein the processor of the PAP or CPAP device analyzes the collected data, in part, using a time-frequency signal analysis to determine the quantified level of severity data.

[[28.]] 40. (Proposed Substitute for Claim 28) The method of claim [[15]] 30, wherein the PAP or CPAP further comprises a firmware and/or a third software which along with the first software can be updated from the remote internet site ~~remote station~~ or a different remote server.

[[29.]] 41. (Proposed Substitute for Claim 29) The method of claim [[15]] 30, further comprising the step of alerting the subject's technician, clinician or physician of issues related to the therapy efficacy.

APPENDIX B

CURRICULUM VITAE
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EDUCATION

Ph.D.	1987	*Efficient Parallel Techniques for Computational Geometry* Computer Science, Purdue Univ. (Mikhail J. Atallah, advisor)
M.S.	1985	Computer Science, Purdue Univ.
B.A.	1983	Mathematics and Computer Science, Calvin Univ.

PROFESSIONAL EXPERIENCE

July '19 to present	Distinguished Professor, Dept. of Computer Science Univ. of California, Irvine
March '10 to present	Technical Director, Center for Algorithms and Theory of Computation Univ. of California, Irvine
April '07 to June '19	Chancellor's Professor, Dept. of Computer Science Univ. of California, Irvine
July '12 to June '13	Chair, Dept. of Computer Science Univ. of California, Irvine
October '06 to June '12	Assoc. Dean for Faculty Dev., Bren School of Info. and Comp. Sci. Univ. of California, Irvine
July '01 to March '07	Professor, Dept. of Computer Science Univ. of California, Irvine
Fall '00	Visiting Professor of Computer Science Brown Univ.
July '96 to June '02	Professor of Computer Science (on leave, from July '01) Johns Hopkins Univ.
July '92 to June '96	Associate Professor of Computer Science Johns Hopkins Univ.
Spring '94	Visiting Associate Professor of Computer Science Univ. of Illinois, Urbana-Champaign
July '87 to June '92	Assistant Professor of Computer Science Johns Hopkins Univ.
Aug. '83 to June '87	Teaching Assistant, Research Assistant Purdue Univ.
Summer '83	Summer intern Argonne National Laboratory

RESEARCH INTERESTS

Algorithm and data structure design
Networking and parallel and distributed computing
Computer security and information assurance and privacy
Machine learning and computer vision
Databases and high-performance data management
Information visualization and graph drawing
Computational geometry and computer graphics

PRIZES, HONORS, AND AWARDS

- *Compere Loveless Fellowship in Computer Sciences*, Purdue Univ., 1985
- *Research Initiation Award*, National Science Foundation, 1988
- *Oraculum Award for Excellence in Teaching*, Johns Hopkins, 1993, 1994, 1995
- *ACM Recognition of Service Award*, 1996
- *Robert B. Pond, Sr. Award for Excellence in Undergraduate Teaching*, Johns Hopkins, 1998
- *Elected Senior Member*, the Institute of Electrical and Electronics Engineers (IEEE), 1999
- *Spirit of Technology Transition Award*, DARPA Dynamic Coalitions Program, 2002
- *Brown Univ. Award for Technological Innovation* (with Roberto Tamassia, Nikos Triandopoulos, Danfeng Yao, and D. Ellis), 2006
- *ACM Distinguished Scientist*, 2006
- *Edward J. McCluskey Technical Achievement Award*, IEEE Computer Society, "for outstanding contributions to the design of parallel and distributed algorithms for fundamental combinatorial and geometric problems," 2007
- *Fulbright Scholar*, for senior specialist service to University of Aarhus, Denmark, 2007
- *Fellow of the San Diego Supercomputer Center*, 2007
- *Fellow of the American Association for the Advancement of Science (AAAS)*, "for distinguished contributions to parallel and distributed algorithms for combinatorial and geometric problems, and excellence in teaching, academic and professional service, and textbook writing," 2007
- *Named as Chancellor's Professor*, for "demonstrated unusual academic merit and whose continued promise for scholarly achievement is unusually high," Univ. of California, Irvine, 2007
- *Fellow of the Institute of Electrical and Electronics Engineers (IEEE)*, "for contributions to parallel and distributed algorithms for combinatorial and geometric problems," 2009
- *Fellow of the ACM*, "for contributions to data structures and algorithms for combinatorial and geometric problems," 2009
- *ICS Dean's Award for Research*, "for contributions in the area of parallel and distributed algorithms," 2014
- *Chancellor's Award for Excellence in Fostering Undergraduate Research*, Univ. of California, Irvine, 2016
- *Faculty Mentor of the Month*, Undergraduate Research Opportunities Program (UROP), Univ. of California, Irvine, April 2016
- *Elected as a foreign member*, Royal Danish Academy of Sciences and Letters, April 2018
- *Named as Distinguished Professor*, for achieving "the highest levels of scholarship" over the course of a career and having "earned national and international level distinctions and honors of the highest level," Univ. of California, Irvine, 2019
- *Recipient, Alejandro López-Ortiz Best Paper Award*, for "Zip-zip Trees: Making Zip Trees More Balanced, Biased, Compact, or Persistent," 18th Algorithms and Data Structures Symposium, 2023.
- *Recipient, SIGMOD Research Highlight Award*, for "History-Independent Dynamic Partitioning: Operation-Order Privacy in Ordered Data Structures," 2024. This award recognizes research projects that exemplify core database research and that address an important problem, represent a definitive milestone in solving the problem, and have the potential of significant impact.
- *Distinguished Science Alumni Award*, Purdue University, 2025.

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- Total citations: over 18,500
- H-index (top H publications with at least H citations): 77

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P-5. Roberto Tamassia, Michael T. Goodrich, and Nikos Triandopoulos, "Super-efficient Verification of Dynamic Outsourced Databases," International Patent Application Pub. No. WO 2008/014002, January 31, 2008.

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P-7. Michael T. Goodrich, Danfeng Yao, and Roberto Tamassia, "Notarized Federated Identity Management," International Patent Application Pub. No. WO 2008/020991, February 21, 2008.

P-8. Roberto Tamassia, Michael T. Goodrich, Nikos Triandopoulos, and Charalampos Papmanthou, "Authentication for Operations over an Outsourced File System Stored by an Untrusted Unit," International Patent Application Pub. No. WO 2008/147400, December 4, 2008.

P-9. Rasmus Tamstorf, Michael T. Goodrich, David Eppstein, "Attribute Transfer Between Computer Models Including Identifying Isomorphic Regions in Polygonal Meshes," U.S. Patent No. 8,681,145, March 25, 2014.

P-10. Nikos Triandopoulos, Michael T. Goodrich, Duy Nguyen, Olga Ohrimenko, Charalampos Papmanthou, Roberto Tamassia, Cristina V. Lopes, "Techniques for Verifying Search Results Over a Distributed Collection," U.S. Patent No. 9,152,716, October 6, 2015.

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B-2. Michael T. Goodrich and Catherine C. McGeoch, eds., *Algorithm Engineering and Experimentation*, Lecture Notes in Computer Science (LNCS), Vol. 1619, Springer, 1999.

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B-4. Michael T. Goodrich and Roberto Tamassia, *Algorithm Design: Foundations, Analysis, and Internet Examples*, John Wiley and Sons, Inc., 2002.

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B-7. Michael T. Goodrich and Roberto Tamassia, *Data Structures and Algorithms in Java, Third Edition*, John Wiley and Sons, Inc., 2004.

B-8. Michael T. Goodrich and Roberto Tamassia, *Data Structures and Algorithms in Java, Fourth Edition*, John Wiley and Sons, Inc., 2006.

B-9. Michael T. Goodrich and Roberto Tamassia, *Data Structures and Algorithms in Java, Fifth Edition*, John Wiley and Sons, Inc., 2011.

B-10. Michael T. Goodrich and Roberto Tamassia, *Introduction to Computer Security*, Addison-Wesley, 2011.

B-11. Michael T. Goodrich, Roberto Tamassia, and David Mount, *Data Structures and Algorithms in C++, Second Edition*, John Wiley and Sons, Inc., 2011.

B-12. Michael T. Goodrich, Roberto Tamassia, and Michael Goldwasser, *Data Structures and Algorithms in Python*, John Wiley and Sons, Inc., 2013.

B-13. Michael T. Goodrich, Roberto Tamassia, and Michael Goldwasser, *Data Structures and Algorithms in Java, Sixth Edition*, John Wiley and Sons, Inc., 2014.

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J-33. Michael T. Goodrich, "An Improved Ray Shooting Method for Constructive Solid Geometry Models via Tree Contraction," *International Journal of Computational Geometry & Applications*, **8**(1), 1998, 1–23.

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Journal Advisory Board Membership:

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Program Committee Service:

7th ACM Symp. on Computational Geometry (SoCG), 1991
1991 Workshop on Algorithms and Data Structures (WADS)
8th ACM Symp. on Computational Geometry (SoCG), 1992
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1996 SIAM Discrete Mathematics Conference
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Co-chair, Workshop on Algorithm Engineering and Experimentation (ALENEX), 1999
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5th Int. Conference on Applied Cryptography and Network Security (ACNS), 2007
21st IEEE Int. Parallel & Distributed Processing Symp. (IPDPS), 2007
19th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2007
5th Workshop on Algorithms and Models for the Web-Graph (WAW), 2007
7th Int. Workshop on Experimental Algorithms (WEA), 2008
Second Int. Frontiers of Algorithmics Workshop (FAW), 2008
16th ACM SIGSPATIAL Int. Symp. on Adv. in Geographic Information Systems (GIS), 2008
17th ACM SIGSPATIAL Int. Symp. on Adv. in Geographic Information Systems (GIS), 2009

31st IEEE Symp. on Security and Privacy (S&P), 2010
18th Int. Symp. on Graph Drawing (GD), 2010
2011 Workshop on Analytic Algorithmics and Combinatorics (ANALCO)
8th Workshop on Algorithms and Models for the Web Graph (WAW), 2011
19th Int. Symp. on Graph Drawing (GD), 2011
24th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2012
20th European Symp. on Algorithms (ESA), 2012
2013 IEEE Int. Conf. on Big Data (BigData), 2013
30th IEEE Int. Conf. on Data Engineering (ICDE), 2014
21st ACM Conf. on Computer and Communication Security (CCS), 2014
Symp. on Algorithms and Data Structures (WADS), 2015
ACM Cloud Computing Security Workshop (CCSW), 2015
Int. Symp. on Graph Drawing (GD), 2015
co-chair, 2016 Workshop on Algorithm Engineering and Experiments (ALENEX)
2016 Workshop on Massive Data Algorithmics (MASSIVE)
2016 Int. Symp. on Algorithms and Computation (ISAAC)
29th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2017
25th ACM SIGSPATIAL Int. Conf. on Adv. in Geographic Information Systems (GIS), 2017
26th European Symp. on Algorithms (ESA), 2018
26th ACM SIGSPATIAL Int. Conf. on Adv. in Geographic Information Systems (GIS), 2018
2nd SIAM Symp. on Simplicity in Algorithms (SOSA), 2019
ACM SIGSPATIAL Int. Workshop on Spatial Gems, 2019
2021 SIAM Symp. on Applied Computational & Discrete Algorithms (ACDA)
2023 SIAM Symp. on Algorithm Engineering and Experimentation (ALENEX)
35th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2023
7th SIAM Symp. on Simplicity in Algorithms (SOSA), 2024
37th ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2025
34th Int. Symp. on Graph Drawing and Network Visualization (GD), 2026

Conference/Workshop Committee Service:

Conference chair, 12th ACM Symp. on Computational Geometry, 1996
Organizer, 1st CGC Workshop on Computational Geometry, 1996
Co-chair, 1999 Dagstuhl Workshop on Computational Geometry, 1999
Conference chair, Graph Drawing, 2002
Co-organizer, Hawaiian Workshop on Parallel Algorithms, 2017, 2019
Member, Symp. on Theory of Computing (STOC) Test of Time Award Committee, 2024

Steering Committee and Executive Committee Service:

Member at large, ACM SIG on Algorithms & Comp. Theory (SIGACT) Exec. Comm., 1993–97
Member, Exec. comm. for 1996 Federated Computing Research Conference (FCRC)
co-Founder and member, Steering Comm. for Workshop on Algorithm Engineering and Experimentation (ALENEX), 1999–2017 (chair, 2014–16)
co-Chair, Steering Comm. for ACM Symp. on Computational Geometry, 1999–2001
Member, Steering Comm. for Graph Drawing Conference, 2000–03, 2014–16
Conference Chair, ACM SIG on Algorithms & Comp. Theory (SIGACT), 2005–09

Center and Institute Affiliations:

Center for Machine Learning and Intelligent Systems, UCI
Cybersecurity Policy & Research Institute, UCI
Center for Algorithms and Theory of Computation, UCI
Algorithms, Combinatorics and Optimization Center, UCI

Postdoctoral Fellows:

1. Timothy Chan, Johns Hopkins, 1996. (Now at Univ. of Illinois)
2. Gill Barequet, Johns Hopkins, 1996-98. (Now at Technion)
3. Pawel Gajer, Johns Hopkins, 2000. (Now at Univ. of Maryland)
4. Amitabh Chaudhary, UC-Irvine, 2002-2004. (Now at U. Chicago)
5. Amitabha Bagchi, UC-Irvine, 2002-2004. (Now at IIT-Dehli)
6. Martin Nöllenburg, UC-Irvine, 2010, mentored jointly with David Eppstein. (Now at TU Wien)
7. Maarten Löffler, UC-Irvine, 2010-2011, mentored jointly with David Eppstein. (Now at Utrecht University)
8. Md. Jawaherul Alam, UC-Irvine, 2015-16. (Now at Amazon)
9. Giordano Da Lozzo, UC-Irvine, 2016-2017, mentored jointly with David Eppstein. (Now at "Roma Tre" University)

Ph.D. Students:

1. Mujtaba Ghouse, "Randomized Parallel Computational Geometry in Theory and Practice," Johns Hopkins Univ., May 1993.
2. Paul Tanenbaum, "On Geometric Representations of Partially Ordered Sets," Johns Hopkins Univ., May 1995 (co-advised with Edward Scheinerman).
3. Mark Orletsky, "Practical Methods for Geometric Searching Problems with Experimental Validation," Johns Hopkins Univ., May 1996.
4. Kumar Ramaiyer, "Geometric Data Structures and Applications," Johns Hopkins Univ., Aug. 1996.
5. Christian A. Duncan, "Balanced Aspect Ratio Trees," Johns Hopkins Univ., Aug. 1999.
6. Christopher Wagner, "Graph Visualization and Network Routing," Johns Hopkins Univ., Oct. 1999 (co-advised with Prof. Lenore Cowen).
7. Stephen Kobourov, "Algorithms for Drawing Large Graphs," Johns Hopkins Univ., May 2000.
8. Amitabha Bagchi, "Efficient Strategies for Topics in Internet Algorithmics," Johns Hopkins Univ., Oct. 2002.
9. Amitabh Chaudhary, "Applied Spatial Data Structures for Large Data Sets," Johns Hopkins Univ., Oct. 2002.
10. Breno De Medeiros, "New Cryptographic Primitives with Applications to Information Privacy and Corporate Confidentiality," Johns Hopkins Univ., May 2004 (co-advised with Giuseppe Ateniese).
11. "Jeremy" Yu Meng, "Confluent Graph Drawing," UC-Irvine, June 2006.
12. Jonathan Zheng Sun, "Algorithms for Hierarchical Structures, with Applications to Security and Geometry," UC-Irvine, Aug. 2006.
13. Nodari Sitchinava, "Parallel External Memory Model—A Parallel Model for Multi-core Architectures," UC-Irvine, Sep. 2009.
14. Darren Strash, "Algorithms for Sparse Geometric Graphs and Social Networks," UC-Irvine, May 2011 (co-advised with with David Eppstein).
15. Lowell Trott, "Geometric Algorithms for Social Network Analysis," UC-Irvine, May 2013.
16. Joseph Simons, "New Dynamics in Geometric Data Structures," UC-Irvine, May 2014.
17. Pawel Pszona, "Practical Algorithms for Sparse Graphs," UC-Irvine, May 2014.
18. William E. Devanny, "An Assortment of Sorts: Three Modern Variations on the Classic Sorting Problem," UC-Irvine, July 2017 (co-advised with David Eppstein).

19. Siddharth Gupta, "Topological Algorithms for Geographic and Geometric Graphs," UC-Irvine, Aug. 2018 (co-advised with with David Eppstein).
20. Timothy Johnson, "Graph Drawing Representations and Metrics with Applications," UC-Irvine, Aug. 2018.
21. Juan Besa, "Optimization Problems in Directed Graph Visualization," UC-Irvine, Aug. 2019.
22. Nil Mamano Grande, "New Applications of the Nearest-Neighbor Chain Algorithm," UC-Irvine, Sep. 2019 (co-advised with David Eppstein).
23. Pedro Matias, "Exact Learning of Sequences from Queries and Trackers," UC-Irvine, May 2021
24. Martha Osegueda, "Constructing, Counting and Matching Combinatorial and Geometric Shapes," UC-Irvine, May 2022
25. Ramtin Afshar, "Exact Learning of Graphs Using Queries," UC-Irvine, Feb. 2023
26. Evrim Ozel, "Efficient Algorithms for Road Networks and Noisy Sorting: an Experimental and Theoretical Perspective," UC-Irvine, May 2024

Ph.D. Committee Service:

John Augustine	UC-Irvine	Advancement to candidacy, September 2003
Nikos Triandopoulos	Brown U.	Thesis prelim., February 2004
Einar Mykletun	UC-Irvine	Advancement to candidacy, March 2004
Kartic Subr	UC-Irvine	Advancement to candidacy, September 2004
S. Joshua Swamidass	UC-Irvine	Advancement to candidacy, April 2005
Jeong Hyun Yi	UC-Irvine	Thesis defense, August, 2005
Nodari Sitchinava	UC-Irvine	Advancement to candidacy, chair, December 2005
John Augustine	UC-Irvine	Thesis defense, July 2006
Maithili Narasimha	UC-Irvine	Thesis defense, August, 2006
Josiah Carlson	UC-Irvine	Advancement to candidacy, August 2006
Xiaomin Liu	UC-Irvine	Advancement to candidacy, September 2006
Gabor Madl	UC-Irvine	Advancement to candidacy, September 2006
Nikos Triandopoulos	Brown U.	Thesis defense, September 2006
Rabia Nuray-Turan	UC-Irvine	Advancement to candidacy, May 2007
S. Joshua Swamidass	UC-Irvine	Thesis defense, June 2007
Michael Sirivianos	UC-Irvine	Advancement to candidacy, June 2007
Kevin Wortman	UC-Irvine	Advancement to candidacy, August 2007
Di Ma	UC-Irvine	Advancement to candidacy, December 2007
Josiah Carlson	UC-Irvine	Thesis defense, December 2007
Michael Nelson	UC-Irvine	Advancement to candidacy, chair, March 2008
Minas Gjoka	UC-Irvine	Advancement to candidacy, June 2008
Sara Javanmardi	UC-Irvine	Advancement to candidacy, June 2008
Ali Zandi	UC-Irvine	Advancement to candidacy, September 2008
Jihye Kim	UC-Irvine	Thesis defense, September 2008
Darren Strash	UC-Irvine	Advancement to candidacy, December 2008
Kevin Wortman	UC-Irvine	Topic defense, January 2009
Nodari Sitchinava	UC-Irvine	Topic defense, chair, June 2009
Fabio Soldo	UC-Irvine	Advancement to candidacy, July 2009
Emil De Cristofaro	UC-Irvine	Advancement to candidacy, July 2009
Di Ma	UC-Irvine	Thesis defense, August 2009
Yanbin Lu	UC-Irvine	Advancement to candidacy, December 2009
Anh Le	UC-Irvine	Advancement to candidacy, April 2010

Lowell Trott	UC-Irvine	Advancement to candidacy, June 2010
Xiaomin Liu	UC-Irvine	Thesis defense, August 2010
Josh Olsen	UC-Irvine	Advancement to candidacy, September 2010
Yasser Altowim	UC-Irvine	Advancement to candidacy, December 2010
Angela Wong	UC-Irvine	Advancement to candidacy, May 2011
Joshua Hill	UC-Irvine	Advancement to candidacy, September 2011
Alex Abatzoglou	UC-Irvine	Advancement to candidacy, September 2011
Michael Wolfe	UC-Irvine	Masters Thesis defense, October 2011
Olya Ohrimenko	Brown Univ.	PhD Thesis proposal, October 2011
Yanbin Lu	UC-Irvine	PhD Thesis defense, November 2011
Chun Meng	UC-Irvine	Advancement to candidacy, December 2011
Abinesh Ramakrishnan	UC-Irvine	Advancement to candidacy, March 2012
Pegah Sattari	UC-Irvine	PhD Thesis defense, April 2012
Michael Bannister	UC-Irvine	PhD Thesis defense, May 2015
Yingyi Bu	UC-Irvine	PhD Thesis defense, August 2015
Jenny Lam	UC-Irvine	PhD Thesis defense, November 2015
Timothy Johnson	UC-Irvine	Advancement to candidacy, chair, June 2016
Jiayu Xu	UC-Irvine	Advancement to candidacy, November 2016
Sky Faber	UC-Irvine	PhD Thesis defense, November 2016
Juan Jose Besa Vial	UC-Irvine	Advancement to candidacy, chair, March 2017
William Devanny	UC-Irvine	PhD Thesis defense, co-chair, July 2017
Ingo van Duijn	Aarhus Univ.	PhD Thesis defense, September 2017
Siddharth Gupta	UC-Irvine	Advancement to candidacy, January 2018
Boyang Wei	UC-Irvine	PhD Thesis defense, August 2018
Timothy Johnson	UC-Irvine	PhD Thesis defense, chair, August 2018
Siddharth Gupta	UC-Irvine	PhD Thesis defense, August 2018
Pedro Matias	UC-Irvine	Advancement to candidacy, chair, May 2019
Juan Jose Besa Vial	UC-Irvine	PhD Thesis defense, chair, August 2019
Sameera Chayyur	UC-Irvine	Advancement to candidacy, September 2019
Nil Mamano Grande	UC-Irvine	PhD Thesis defense, co-chair, September 2019
Yihan Sun	CMU	PhD Thesis defense, October 2019
Martha Osegueda	UC-Irvine	Advancement to candidacy, chair, June 2020
Tatiana Bradley	UC-Irvine	PhD Thesis defense, December 2020
Julius Ceasar Aguma	UC-Irvine	Advancement to candidacy, December 2020
Ramtin Afshar	UC-Irvine	Advancement to candidacy, chair, March 2021
Pedro Matias	UC-Irvine	PhD Thesis defense, chair, May 2021
Elham Havvaei	UC-Irvine	PhD Thesis defense, May 2021
Daniel Frishberg	UC-Irvine	Advancement to candidacy, May 2021
Hadi Khodabandeh	UC-Irvine	Advancement to candidacy, July 2021
Sameera Ghayyur	UC-Irvine	PhD topic defense, February 2022
Evrim Ozel	UC-Irvine	Advancement to candidacy, chair, May 2022
Rohith Gangam	UC-Irvine	Advancement to candidacy, May 2022
Martha Osegueda	UC-Irvine	PhD Thesis defense, chair, May 2022
Yanqi Gu	UC-Irvine	Advancement to candidacy, June 2022
Sameera Ghayyur	UC-Irvine	PhD Thesis defense, August 2022
Rasmus K. Petersen	Aarhus Univ.	PhD Thesis defense, Sept. 2022
Zihan Yu	UC-Irvine	Advancement to candidacy, Nov. 2022
Ramtin Afshar	UC-Irvine	PhD Thesis defense, chair, Feb. 2023

Shanshan Han	UC-Irvine	Advancement to candidacy, Feb. 2023
Zhanhang (Marco) Liang	UC-Irvine	Advancement to candidacy, Mar. 2023
Shion Fukuzawa	UC-Irvine	Advancement to candidacy, co-chair, Mar. 2023
Ryuto Kitagawa	UC-Irvine	Advancement to candidacy, chair, May 2024
Ofek Gila	UC-Irvine	Advancement to candidacy, chair, May 2024
Po-Chu Hsu	UC-Irvine	Advancement to candidacy, May 2024
Yanqi Gu	UC-Irvine	PhD Thesis defense, May 2024
Evrim Ozel	UC-Irvine	PhD Thesis defense, chair, May 2024
Hadi Khodabandeh	UC-Irvine	PhD Thesis defense, June 2024
Alfred (Songyu) Liu	UC-Irvine	Advancement to candidacy, chair, Nov. 2024
Parnian Shahkar	UC-Irvine	Advancement to candidacy, Nov. 2024
Stelios Stavroukakis	UC-Irvine	Advancement to candidacy, Nov. 2024
Zhiqian Zhou	UC-Irvine	Advancement to candidacy, Feb. 2025
Apurva Rai	UC-Irvine	Advancement to candidacy, Mar. 2025
Phillip Nazarian	UC-Irvine	Advancement to candidacy, June 2025

University Service:

Ph.D. Requirements Committee, Dept. of Computer Science, chair: 1987–89
Graduate Admissions Committee, Dept. of Computer Science, 1991–1993 (chair: 1992)
Faculty Recruiting Committee, Dept. of Computer Science, 1993,95,96 (chair: 1996)
Steering Committee, Whiting School of Engineering, 1990–93 (chair, 1993)
Johns Hopkins Homewood Academic Computing Oversight Committee, 1990–93
Curriculum Committee, Whiting School of Engineering, 1994–96
Strategic Planning Committee, Whiting School of Engineering, 1999–00
Graduate Policy Committee, UCI Dept. of Information & Computer Science (ICS), 2001–02
Faculty Search Committee in Cryptography, UCI Dept. of ICS, 2001–03
School of Info. and Computer Science Executive Committee, 2002–04
UCI Committee on Educational Policy (CEP), 2002–03, 2004–06
UCI Change of Major Criteria Committee, 2002–03
UCI CEP Policy Subcommittee, 2002–2003
Distinguished Faculty Search Committee, Bren School of ICS, 2004–11 (chair, 2007–08)
Equity Advisor, Bren School of ICS, 2005–09
Dean's Advisory Council, Bren School of ICS, 2007–13
Associate Dean for Faculty Development, Bren School of ICS, 2006–12
Chair, Department of Computer Science, Bren School of ICS, 2012–13
Master of Computer Science Development Committee, Bren School of ICS, 2013–16
Stragic Planning Committee, Dept. of Computer Science, Bren School of ICS, 2015–16
Executive Committee, Bren School of ICS, 2017–18
UC-Irvine Senate Committee on Scholarly Honors & Awards, 2017–20
UC-Irvine Special Research Program Review Committee for CalIT2, 2018–19
UC-Irvine Year of Scholarly Values Advisory Committee, 2024–
Master of Computer Science Steering/Admissions Comm., Bren School of ICS, 2016–22, 2024–

Courses Taught and Developed:

Advanced Parallel Computing (developed and taught at Johns Hopkins)
Cyber-Puzzlers (designed and taught at UCI)
Computer Literacy (taught at Purdue, developed at Johns Hopkins)
Computer Programming for Scientists and Engineers (taught at Purdue)
Computer Security Algorithms (developed and taught at UCI)

Computational Models (revised and taught at Johns Hopkins)
Computational Geometry (revised and taught at Johns Hopkins and UCI)
Compiler Theory and Design (revised and taught at Johns Hopkins)
Computer Graphics (taught at Johns Hopkins)
Cyber-Fraud Detection and Prevention (designed and taught at UCI)
Data Structures (revised and taught at Johns Hopkins and UCI)
Graph Algorithms (revised and taught at UCI)
Formal Languages and Automata Theory (revised and taught at UCI)
Fundamentals of Algorithms with Applications (revised and taught at UCI)
Introduction to Algorithms (developed and taught at Johns Hopkins and UCI)
Internet Algorithmics (developed and taught at Johns Hopkins, Brown, and UCI)
Design and Analysis of Algorithms (revised and taught at Johns Hopkins and UCI)
Parallel Algorithms (developed and taught at Johns Hopkins and Univ. of Illinois)
Project in Algorithms and Data Structures (revised and taught at UCI)
Text Processing and Pattern Matching (developed and taught at UCI)

Consulting:

Army Research Laboratory, Fort Belvior, 1995
Battelle Research Triangle, Columbus Division, 1996
AT&T, 1998
Univ. of Miami, 1999
Algomagic Technologies, Inc., 2000–2005
Brown University, 2000–2007
Purdue University, 2002
APAC Security, Inc., 2005
Walt Disney Animation Studios, 2009
Technical expert and expert witness, 2012–
3M, 2015

GRANTS AND CONTRACTS

1. PI, "Research Initiation Award: Parallel and Sequential Computational Geometry," National Science Foundation (NSF Grant CCR-8810568), $32,914, 1988–90.
2. co-PI, "Paradigms for Parallel Algorithm Design," NSF and DARPA (as NSF Grant CCR-8908092), $523,837, 1989–93 (with S. Rao Kosaraju (PI), S. Kasif, and G. Sullivan).
3. PI, "Parallel Computation and Computational Geometry," NSF (Grant CCR-9003299), $67,436, 1990–93.
4. co-PI, "A Facility for Experimental Validation," NSF (Grant CDA-9015667), $1,476,147, 1991–96 (with G. Masson (PI), J.K. Johnstone, S. Kasif, S. Rao Kosaraju, S. Salzberg, S. Smith, G. Sullivan, L. Wolff, and A. Zwarico).
5. PI, "Parallel Network Algorithms for Cell Suppression," The Bureau of the Census (JSA 91-23), $14,998 1991–92.
6. PI, "A Geometric Framework for the Exploration & Analysis of Astrophysical Data," NSF (Grant IRI-9116843), $535,553, 1991–96 (with S. Salzberg and H. Ford (from Physics and Astronomy Dept.)).
7. PI, "Research Experiences for Undergraduates supplement to IRI-9116843," NSF, $4,000, 1993–94 (with S. Salzberg and H. Ford).
8. PI, "Constructing, Maintaining, and Searching Geometric Structures," NSF (Grant CCR-9300079), $134,976, 1993–96.

9. co-PI, "Robust and Applicable Geometric Computing," Army Research Office (ARO MURI Grant DAAH04-96-1-0013), $4,500,000, 1996–2000 (with F. Preparata (PI, Brown U.), Roberto Tamassia (Brown U.), S. Rao Kosaraju, J. Vitter (Duke U.), and P. Agarwal (Duke U.)). Subaward size: $1,466,640.
10. PI, "Application-Motivated Geometric Algorithm Design," NSF (Grant CCR-9625289), $107,389, 1996-98.
11. co-PI, "vBNS Connectivity for the Johns Hopkins University," NSF, $350,000, 1997–99 (with T.O. Poehler (PI), D.J. Binko, J.G. Neal, and A.S. Szalay).
12. co-PI, "Product Donation, Technology for Education Program," Intel Corporation, $480,071, 1997–2001 (with T.O. Poehler (PI), J.H. Anderson, A.S. Szalay, and M. Robbins).
13. co-PI, "A Networked Computing Environment for the Manipulation & Visualization of Geometric Data" (Research Infrastructure), NSF, $1,638,785, 1997–2003 (with L.B. Wolff (PI), Y. Amir, S.R. Kosaraju, S. Kumar, Roberto Tamassia (Brown U.), R.H. Taylor, and D. Yarowsky).
14. PI, "Geometric Algorithm Design and Implementation," NSF, Grant CCR-9732300, $224,982, 1998–2002.
15. PI, "Certification Management Infrastructure – Certificate Revocation," $52,023, 1998, NSA LUCITE grant.
16. PI, "Software Engineering Data Loading, Analysis, and Reporting," $41,614, 1998, NSA LUCITE grant.
17. PI, "Establishing a LUCITE Collaboration Environment," $10,018, 1998, NSA LUCITE grant.
18. PI, "In Support of a Secure Multilingual Collabortive Computing Environment," $51,471, 1999-2000, NSA LUCITE grant.
19. PI, "Accessing Large Distributed Archives in Astronomy and Particle Physics," $199,981. subcontract to UCI from Johns Hopkins Univ. on NSF Grant PHY-9980044 (total budget, $2,500,000), 1999–2004.
20. PI, "Efficient and Scalable Infrastructure Support for Dynamic Coalitions," $1,495,000, DARPA Grant F30602-00-2-0509, 2000-2003 (with Robert Cohen and Roberto Tamassia), including $227,893 subaward to UCI (with Gene Tsudik).
21. PI, "Graph Visualization and Geometric Algorithm Design," $400,000, NSF Grant CCR-0098068, 2001-2004 (with Roberto Tamssia).
22. PI, "Collaborative Research: Teaching Data Structures to the Millennium Generation," $125,00, NSF Grant DUE-0231467, 2003–2005.
23. PI, "Collaborative Research: An Algorithmic Approach to Cyber-Security," $100,000, NSF Grant CCR-0311720, 2003–2006.
24. PI, "The OptIPuter," $900,000, subcontract from UCSD on NSF ITR grant CCR-0225642 (total budget, $13.5 million), 2002–2007 (with Padhraic Smyth and Kane Kim).
25. PI, "ITR: Algorithms for the Technology of Trust," $300,000, NSF Grant CCR-0312760, 2003–2009.
26. co-PI, "SDCI Data New: Trust Management for Open Collaborative Information Repositories: The CalSWIM Cyberinfrastructure," NSF grant OCI-0724806, $1,103,590, 2007–2012.
27. co-PI, "Support for Machine Learning Techniques for Cyber-Fraud Detection," Experian Corporation, $200,000 gift, 2008.
28. PI, "IPS: Collaborative Research: Privacy Management, Measurement, and Visualization in Distributed Environments," NSF Grant IIS-0713046, $224,851, 2007–2009.
29. PI, "Collaborative Research: Algorithms for Graphs on Surfaces," $400,000, NSF Grant CCR-0830403, 2008–2011.

30. PI, "ROA Supplement: IPS: Collaborative Research: Privacy Management, Measurement, and Visualization in Distributed Environments," NSF Grant IIS-0847968, $25,000, 2008–2009.
31. co-investigator, "Scalable Methods for the Analysis of Network-Based Data," Office of Naval Research: Multidisciplinary University Research Initiative (MURI) Award, number N00014-08-1-1015, $529,152, 2008–2014.
32. PI, "EAGER: Usable Location Privacy for Mobile Devices," NSF Grant 0953071, $300,000, 2009–2011.
33. PI, "TC:Large:Collaborative Research: Towards Trustworthy Interactions in the Cloud," NSF Grant 1011840, $500,000, 2010-2015.
34. PI, "TWC: Medium: Collaborative: Privacy-Preserving Distributed Storage and Computation," NSF Grant 1228639, $390,738, 2012-2018.
35. PI, "Support for Research on Geometric Motion Planning," 3M Corporation, $40,000 gift, 2014.
36. PI, "A4V: Automated Analysis of Algorithm Attack Vulnerabilities," subcontract 10036982-UCI from University of Utah for DARPA agreement no. AFRL FA8750-15-2-0092, $980,000, 2015–2019.
37. PI, "TWC: Small: Collaborative: Practical Security Protocols via Advanced Data Structures," NSF Grant 1526631, $166,638, 2015–2018.
38. PI, "NSF-BSF: AF: Small: Geometric Realizations and Evolving Data," NSF Grant 1815073, $474,392, 2018–2022.
39. PI, "Collaborative Research: AF: Medium: Algorithms for Geometric Graphs," NSF Grant 2212129, $799,800, 2022–2026.

SELECTED INVITED TALKS

- "Probabilistic Packet Marking for Large-Scale IP Traceback," Purdue Univ., 2003
- "Algorithms for Data Authentication," Harvey Mudd College, 2003
- "Efficient Tree-Based Revocation in Groups of Low-State Devices," Univ. of Arizona, 2004
- "Leap-Frog Packet Linking and Diverse Key Distributions for Improved Integrity in Network Broadcasts," Southern California Security and Cryptography Workshop, 2005
- "Is Your Business Privacy Protected?," NEXT Connections, 2005
- "Distributed Peer-to-peer Data Structures," Harvard Univ., 2006
- "Balancing Life with an Academic Research Career," Grace Hopper Conference, 2006
- "Computer Security in the Large," Univ. Texas, San Antonio, 2006
- "Inspirations in Parallelism and Computational Geometry," Brown Univ., 2006
- "Efficiency and Security Issues for Distributed Data Structures," Computer Science Distinguished Lecture Series, Johns Hopkins Univ., 2006
- "Efficiency and Security Issues for Distributed Data Structures," UCLA, 2006
- "Efficiency and Security Issues for Distributed Data Structures," Edison Distinguished Lecturer Series, Univ. of Notre Dame, 2006
- "Efficiency and Security Issues for Distributed Data Structures," Computer Science Distinguished Lecturer Series, Texas A & M Univ., 2006
- "Algorithms for Secure Computing and Searching with Applications to Medical Informatics," Purdue Univ., 2006
- "Blood on the Computer: How Algorithms for Testing Blood Samples can be Used for DNA Sequencing, Wireless Broadcasting, and Network Security," Univ. of Southern California, 2007

- "Blood on the Computer: How Algorithms for Testing Blood Samples can be Used for DNA Sequencing, Wireless Broadcasting, and Network Security," Univ. California, San Diego, 2007
- "Blood on the Computer: How Algorithms for Testing Blood Samples can be Used for DNA Sequencing, Wireless Broadcasting, and Network Security," Univ. Minnesota, 2007
- "Blood on the Database: How Algorithms for Testing Blood Samples can be Used for Database Integrity," Invited Keynote, 21st Annual IFIP WG 11.3 Working Conference on Data and Applications Security (DBSec), 2007
- "Space-Efficient Straggler Identification," ALCOM Seminar, Univ. of Aarhus, 2007
- "Blood on the Computer: How Algorithms for Testing Blood Samples can be used in Modern Applications," ALCOM Seminar, Univ. of Aarhus, 2007
- "Studying Road Networks Through an Algorithmic Lens," ALCOM Seminar, Univ. of Aarhus, 2008
- "Studying Geometric Graph Properties of Road Networks Through an Algorithmic Lens," Int. Workshop on Computing: from Theory to Practice, 2009
- "Randomized Shellsort: A Simple Oblivious Sorting Algorithm," Distinguished Lecture Series, Department of Computer Science, Brown University, 2009
- "Simulating Parallel Algorithms in the MapReduce Framework with Applications to Parallel Computational Geometry," MASSIVE 2010
- "Data Cloning Attacks for Nearest-Neighbor Searching based on Retroactive Data Structures," Department of Computer Science, UCSB, 2011
- "Turning Privacy Leaks into Floods: Surreptitious Discovery of Social Network Friendships and Other Sensitve Binary Attribute Vectors," Department of Computer Science Distinguished Lecturer Series, Univ. of Illinois, Chicago, 2011
- "Turning Privacy Leaks into Floods: Surreptitious Discovery of Social Network Friendships and Other Sensitve Binary Attribute Vectors," Department of Computer Science, Purdue Univ., 2011
- "Spin-the-bottle Sort and Annealing Sort: Oblivious Sorting via Round-robin Random Comparisons," Department of Computer Science, Brown Univ., 2012
- "Using Data-Oblivious Algorithms for Private Cloud Storage Access," Qatar University, 2013
- "Using Data-Oblivious Algorithms for Private Cloud Storage Access," Department of Computer Science and Engineering Distinguished Speaker Series, University of Buffalo, 2013
- "Force-Directed Graph Drawing Using Social Gravity and Scaling," invited talk, ICERM Workshop on Stochastic Graph Models, Providence, RI, 2014
- "Invertible Bloom Lookup Tables and Their Applications in Large-Scale Data Analysis," invited key-note speaker, Algorithms for Big Data, Frankfurt, Germany, 2014
- "Invertible Bloom Lookup Tables and Their Applications in Large-Scale Data Analysis," Brown University, Providence, RI, 2014
- "Studying Road Networks Through an Algorithmic Lens," Bold Aspirations Visitor and Lecture, University of Kansas, 2015
- "Learning Character Strings via Mastermind Queries, with Case Studies," Invited Lecture, Workshop on Pattern Matching, Data Structures and Compression, Bar-Ilan University, Tel Aviv, Israel, 2016
- "Invertible Bloom Lookup Tables and Their Applications in Data Analysis," University of Hawaii, 2016
- "Invertible Bloom Lookup Tables," Purdue University, 2016
- "Combinatorial Pair Testing: Distinguishing Workers from Slackers," Calvin Univ., 2016

- "Invertible Bloom Lookup Tables," University of California, Riverside, 2016
- "2-3 Cuckoo Filters for Faster Triangle Listing and Set Intersection," Technion, Israel Institute of Technology, Haifa, Israel, 2017
- "2-3 Cuckoo Filters for Faster Triangle Listing and Set Intersection," University of Arizona, 2017
- "Parallel Computational Geometry," First Hawaii Workshop on Parallel Algorithms and Data Structures, University of Hawaii, 2017
- "Fighting Gerrymandering with Algorithmic Fairness," Calvin University, 2019
- "Fighting Gerrymandering with Algorithmic Fairness," Carnegie Mellon University, 2019
- "Sorting Evolving Data in Parallel," Second Hawaii Workshop on Parallel Algorithms and Data Structures, University of Hawaii, 2019
- "Dealing with Big Data via External Memory Algorithms and Data Structures," Aarhus University, Denmark, 2021
- "Dealing with Big Data via External Memory Algorithms and Data Structures," Royal Danish Academy of Sciences and Letters, 2021
- "Augmenting Networks for Greedy Routing," Dept. of Electrical and Computer Engineering, Distinguished Lecturer Series, Iowa State University, 2023
- "Augmenting Networks for Greedy Routing," Dept. of Computer Science, University of California, Riverside, 2024
- "Exact Matching Algorithms," Dept. of Computer Science, University of Hawaii, 2024
- "When Algorithms and Architectures Meet," Dept. of Computer Science, Purdue University, 2025
- "Computational Geometry with Probabilistically Noisy Primitive Errors," Schloss Dagstuhl – Leibniz Center for Informatics, Germany, 2025
- "Privacy-Preserving Data-Oblivious Geometric Algorithms for Geographic Data," Brown University, 2025

TECHNICAL EXPERT CONSULTING SUMMARY
(LAST FIVE YEARS)

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TECHNICAL EXPERT CONSULTING

The following is a listing of prior and current expert consulting since 2020, but it may not include confidential information, as per written agreements.

1. Apr. 2016 to Sep. 2024, Technical expert and deponent, retained through Kramer Levin LLP on behalf of Acceleration Bay LLC, in IPR proceedings and patent litigation, Acceleration Bay LLC v. Activision Bizzard, Inc., Electronic Arts Inc., Take-Two Interactive Software, Inc., Rockstar Games, Inc., and 2K Sports, Inc. Civil Actions No. 1:16-cv-00453-RGA, No. 1:16-cv-00454-RGA, No. 1:16-cv-00455-RGA (D. Del.), IPR2015-01951, IPR2015-01953, IPR2015-01964, IPR2015-01970, IPR2015-01972, IPR2015-01996, IPR2016-00724, and IPR2016-00747 (PTAB).

2. May 2016 to Apr. 2023, Technical expert and deponent, retained through Kramer Levin LLP (transferred to Fish & Richardson) on behalf of Finjan, Inc., in PTO proceedings and patent litigations, Finjan, Inc. v. Blue Coat, Finjan, Inc. v. ESET, LLC, Finjan, Inc. v. Juniper Networks, Inc., Finjan, Inc. v. Cisco Systems, Inc., Finjan, Inc. v. Qualys, Inc., Finjan, Inc. v. Rapid7, Inc., and Finjan, Inc. v. SonicWall, Inc., IPR2015-01974, IPR2015-01979, IPR2016-00478, IPR2016-00159 (PTAB), 5:15-cv-03295-BLF-PSG (N.D. Cal.), 3:17-cv-05659-WHA (N.D. Cal.), 3:17-cv-0183-CAB-BGS (S.D. Cal.), 17-cv-0072-BLF-SVK (N.D. Cal.), 4:18-cv-07229-YGR (N.D. Cal.), 1:18cv-01519-MN (Del.), and 5:17-cv-04467-BLF (N.D. Cal.).

3. Jan. 2017 to Jan. 2021, Technical expert and deponent, retained by Fitzpatrick, Cella, Harper & Scinto, Venable LLP, on behalf of Koninklijke Philips N.V. and U.S. Philips Corp., in patent litigation, Philips v. Acer Inc., ASUSTeK Computer, Double Power Tech., HTC, Southern Telecom, Visual Land, Zowee Marketing Co., Ltd., Shenzen Zowee Technology Co., Ltd., YiFang USA, Inc. d/b/a EFun, Inc., and Intervenor/Counterclaim Defendant Microsoft Corporation. Civil Actions No. 15-1125-GMS, No. 15-1126-GMS, No. 15-1127-GMS, No. 15-1128-GMS, No. 15-1130-GMS, No. 15-1131-GMS, No. 15-1170-GMS (D. Del.), and 4:18-cv-01885-HSG (N.D. Cal., Oakland Div.).

4. Jun. 2018 to present, Technical expert, declarant, deponent, and testifying trial expert witness, retained through Kramer Levin LLP (now HSF Kramer) on behalf of Centripetal Networks, Inc., in IPRs and patent litigation, Centripetal Networks, Inc. v. Keysight Technologies, Inc., Ixia, and Cisco. Civil Actions No. 2:17-cv-00383/HCM-LRL and 2:18-cv-00094-HCM-LRL (E.D. Virginia), 2:22-cv-00002 (E.D. Virginia), IPR2018-01386, IPR2018-01443, IPR2018-01444, IPR2018-01512, IPR2018-01513, IPR2022-01525, IPR2023-00445, IPR2023-00446, IPR2023-00448 (PTAB), and Inv. No. 337-TA-1314 (ITC).

5. Feb. 2019 to present, Technical expert, declarant, deponent, and testifying trial expert witness, retained through Reichman Jorgensen LLP on behalf of Kove IO, Inc., in patent litigation, Kove IO, Inc. v. Amazon Web Services, Inc., Civil Action No. 1:18-cv-08175 (N.D. Illinois, Eastern Div.).

6. Jun. 2019 to Jun. 2023, Technical expert, declarant, and deponent, retained through Kramer Levin LLP on behalf of CUPP Cybersecurity LLC, in patent litigation, CUPP Cybersecurity LLC, et al., v. Trend Micro, Inc. IPR2021-00813, IPR2021-01236, IPR2021-01237 (PTAB), Civil Action no. 3:18-cv-01251-M, 3:20-cv-03206-M (N.D. Texas).

7. Jul. 2020 to Feb. 2021, Technical expert and declarant, retained through Goodwin Procter LLP on behalf of MobileIron, Inc., in patent litigation, MobileIron, Inc. v. BlackBerry Corp. IPR2020-01741 (PTAB).

8. Aug. 2020 to present, Technical expert and declarant, retained through Thompson & Knight LLP (now Holland & Knight) on behalf of Broadcom Corp., in patent litigation, Broadcom Corp. and Avago Technologies International Sales PTE. Limited v. Netflix, Inc. Civil actions no. 8:20-cv-529 (C.D. Cal.), 3:20-cv-04677-JD (N.D. Cal.).

9. Nov. 2020 to Dec. 2021, Technical expert and deponent, retained through Kramer Levin LLP on behalf of Midwest Athletics and Sports Alliance LLC (MASA), in patent litigation, Midwest Athletics and Sports Alliance LLC v. RICOH USA, Inc., and Midwest Athletics and Sports Alliance LLC v. Xerox Corp. Civil Action Nos. 19-CV-00514 (E.D. Penn.) and 6:19-CV-06036-EAW-JFW (W.D. New York).

10. Mar. 2021 to Feb. 2024, Technical expert, declarant, and deponent, retained through Nix Patterson LLP on behalf of Ikorongo Technology LLC, in patent litigation, Ikorongo v. Samsung, LG, Lyft, Uber, and Bumble Trading, Civil Action Nos. 6:20-cv-00256-ADA, 6:20-cv-00257-ADA, 6:20-cv-00258-ADA, 6:20-cv-00259-ADA, 6:20-cv-00843-ADA (W.D. Texas, Waco), and IPR2021-00204 (PTAB).

11. May 2021 to Aug. 2024, Technical expert, declarant, and deponent, retained by McKool Smith on behalf of SEVEN Networks LLC in patent litigation, SEVEN Networks, LLC v. Motorola Mobility LLC. Civil Action Nos. 2:21-cv-88 (E.D. Texas) and 3:21-cv-1036 (N.D. Texas).

12. Aug. 2021 to present, Technical expert, declarant, and deponent, retained through Holland & Knight LLP on behalf of CA, Inc., in patent litigation, CA, Inc. and Avago Technologies International Sales PTE. Limited v. Netflix, Inc. Civil action no. 2:21-cv-00080-JRG-RSP (E.D. Texas).

13. Aug. 2021 to present, Technical expert, declarant, deponent, and testifying trial expert witness, retained through Kramer Levin LLP (now HSF Kramer) on behalf of Centripetal Networks, Inc., in patent litigation and IPRs, Centripetal Networks, Inc. v. Palo Alto Networks,

Inc. Civil Action No. 2:21-cv-00137 (E.D. Virginia, Norfolk Div.), IPR2021-01149, IPR2021-01150, IPR2021-01152, IPR2021-01157, IPR2022-00182 (PTAB).

14. Jul. 2022 to May 2024, Technical expert, deponant, and declarant, retained through McKool Smith on behalf of the State of Texas, in litigation State of Texas v. Meta Platforms, Inc., Cause No. 22-0121.

15. Aug. 2022 to present, Technical expert and declarant, retained through Stamoulis & Weinblatt LLC on behalf of Ameranth, Inc., in a patent-related matter.

16. Sep. 2022 to present, Technical expert, deponent, and declarant, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of VideoLabs, Inc., in patent-related matters, VideoLabs v. Netflix, and Starz Entertainment, LLC, et al. v. VL Collective IP, LLC and VideoLabs, Inc., Civil Action No. 21-cv-1448-JLH (D. Del.), IPR2022-01086, IPR2023-00628, IPR2023-00630, IPR2023-00891.

17. Nov. 2022 to Jun. 2023, Technical expert and declarant, retained through McKool Smith on behalf of American Airlines, Inc., in a patent-related litigation, R2 Solutions LLC v. American Airlines, Inc., Civil Action No.4:22-cv-00353 (E.D. Tex.).

18. Feb. 2023 to Nov. 2023, Technical expert and declarant, retained through Kirkland and Ellis LLP on behalf of Forcepoint LLC in a patent-related litigation, Webroot, Inc. et al. v. Forcepoint LLC, Case No. 6:22-cv-00341-ADA (W.D. Tex.).

19. Feb. 2023 to Dec. 2023, Technical expert and declarant, retained through Holland & Knight LLP on behalf of MDSave Shared Services, Inc., in a patent-related litigation.

20. Aug. 2023 to Sep. 2024, Technical expert, declarant, and deponent, retained though Kramer Levin LLP on behalf of Acceleration Bay LLC in patent-related litigation, Acceleration Bay LLC v. Amazon Web Services, Inc., Case No. 1:22-cv-904 (D. Del.).

21. Feb. 2024 to May 2024, Technical expert and declarant, retained through McKool Smith on behalf of AlphaSense, Inc., in patent litigation, AlphaSense, Oy and AlphaSense, Inc. v. Tegus, Inc. and Bamsec, LLC, Case No. cv-23-1030-MN (D. Del.).

22. Mar. 2024 to present, Technical expert, retained through Holland & Knight LLP on behalf of Cellular South, Inc., d/b/a C Spire, Inc. in patent-related litigation.

23. May 2024 to Jan. 2025, Technical expert and declarant, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of Kove IO, Inc., in patent litigation, Kove IO, Inc. v. Google, LLC, No. 1:23-cv-04244 (N.D. Ill.).

24. May 2024 to present, Technical expert, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of Malikie Innovations Limited and Key Patent Innovations Limited, in patent litigation.

25. July 2024 to present, Technical expert, declarant, and deponent, retained through McKool Smith on behalf of Carbyne Biometrics, LLC, in patent litigation, Apple, Inc., Petitioner v. Carbyne Biometrics, LLC, Patent Owner in Case: (1) IPR2024-00329, U.S. Patent No. 9,972,010; (2) IPR2024-00330, U.S. Patent No. 10,713,656; (3) IPR2024-00331, U.S. Patent No. 11,526,886; (4) IPR2024-00332, U.S. Patent No. 10,929,512; (5) IPR2024-00333, U.S. Patent No. 11,475,105; (6) IPR2024-00334, U.S. Patent No. 11,514,138; and (7) IPR2024-00507, U.S. Patent No. 11,475,105.

26. Oct. 2024 to present, Technical expert, declarant, and deponent, retained through Kramer Levin LLP (now HSF Kramer) on behalf of Cyandia, Inc., in patent litigation Cyandia, Inc. v. SAP America, Inc., and SAP SE, Case No. 2:22-cv-00096-JRG.

27. Nov. 2024 to present, Technical expert and declarant, Kramer Levin LLP (now HSF Kramer) on behalf of NTECH Properties, Inc. in patent litigation NTECH Properties, Inc. in v. ByteDance LTD., ByteDance PTE. LTD, TikTok PTE. LTD., and TikTok Inc., Case No. 2:24-cv-00130-JRG and IPR2024-01340, IPR2024-01341, IPR2024-01342, and IPR2024-01343.

28. Dec. 2024 to present, Technical expert, retained through Kramer Levin LLP (now HSF Kramer) and Noerr Partnerschaftsgesellschaft mbB on behalf of Centripetal Networks, Inc., in UPC proceedings between Centripetal and Keysight Technologies, Inc. at Mannheim Local Division, case no. 414/2024.

29. Dec. 2024 to present, Technical expert, retained through McKool Smith on behalf of American Airlines, Inc., in patent-related litigation, Intellectual Ventures I LLC et al. v. American Airlines, Inc., No. 4:24-cv-980 (E.D. Tex.).

30. Apr. 2025 to present, Technical expert, retained through Reichman Jorgensen on behalf of Corent Technology, Inc., in patent-related litigation.

31. Apr. 2025 to present, Technical expert, retained through Reichman Jorgensen on behalf of Xtone, Inc., in patent-related litigation, Xtone, Inc. v. Amazon.com, Inc., Amazon Web Services, Inc. and Amazon.com Services, LLC.

32. Apr. 2025 to present, Technical expert, retained through McKool Smith on behalf of AT&T Corp., in patent-related litigation, Headwater Research, LLC v. AT&T Corp. *et al.*, Case No. 2:25-cv-00215.

33. May 2025 to Aug. 2025, Technical expert, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of VideoLabs, Inc., in patent-related matters, VideoLabs v. Meta Platforms, Inc., et al., Civil Action No. 22-cv-00680 (D. Del.).

34. May 2025 to present, Technical expert, declarant, and deponent, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of CardWare, Inc., in patent-related matters, CardWare Inc. v. Apple Inc., WDTX-1-25-cv-00446-ADA, CardWare Inc. v. Google LLC, WDTX-7-24-cv-00278 (W.D. Tex.).

35. June 2025 to present, Technical expert, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of Droplets, Inc., in patent-related matters, Droplets, Inc. v. Ford Motor Company, 2:24-cv-00968 (E.D. Tex.); Droplets, Inc. v. Walmart Inc., 2:24-cv-00970 (E.D. Tex.); Droplets, Inc. v. The Home Depot, Inc. et al., 2:24-cv-00969 (E.D. Tex.).

36. July 2025 to present, Technical expert, retained through Reichman Jorgensen Lehman & Feldberg LLP on behalf of Primos Storage, LLC, in patent-related matters, Primos Storage v. Amazon Litigation.

37. July 2025 to present, Technical expert, retained through McKool Smith on behalf of Nova-Cloud Licensing LLC, in patent-related litigation, NovaCloud v. Meta.

38. July 2025 to present, Technical expert, retained through HSF Kramer on behalf Cleveland Medical Devices, Inc., in patent-related litigation, IPR2025-00157-160, IPR2025-00246-247.

39. Sept. 2025 to present, Technical expert, retained through McKool Smith on behalf of NovaCloud Licensing LLC, in patent-related litigation, NovaCloud v. IBM.

40. Oct. 2025 to present, Technical expert, retained through McKool Smith on behalf of NovaCloud Licensing LLC, in patent-related litigation, NovaCloud v. Amazon.