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An IBM Research Colloquium

Cognitive Systems
The New Era of Computing

November 19, 2013

IBM Research – Almaden | San Jose, California

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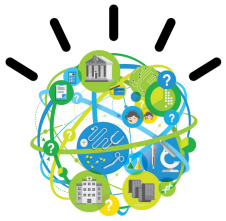

IBM

Colleagues,

Welcome to IBM Research – Almaden's Cognitive Computing Colloquium where we'll explore a new destination in technology. The interconnected, instrumented and intelligent world of Smarter Planet has brought with it ever-increasing challenges posed by Big Data. The volume and complexity of data is growing at a faster rate than the performance improvements necessary for today's systems to process. We're at the beginning of a fundamental shift in the history of computing, defined by IBM as the Cognitive Systems Era – a shift as important as the switch from tabulating machines to programmable computers that began 60 years ago.

In this emerging new era, learning and reasoning systems will partner with humans through natural interfaces to extend human cognition and scale expertise across any domain of knowledge.

I look forward to discussing the challenges and opportunities we are facing at the dawn of this new year; we've convened some of the top experts from academia and industry in one room to collaborate, share ideas and question assumptions.

At a time when clients need to be able to apply analytics to make sense of the data they have in order to achieve competitive advantage -- when analytics has moved from business initiative to business imperative -- cognitive systems will be the tools that enable the world to better manage interdependency and complexity. They will scale human expertise and unlock the time value of insight -- helping people to make better decisions in a timeframe that makes a dramatic difference to the outcome.

Thank you for participating in today's colloquium and what we hope will be a long and successful collaboration with IBM Research.

Michael

Michael Karasick
Vice President, Software Research and
Lab Director, IBM Research – Almaden

As an esteemed guest of our Cognitive Systems Colloquium, we invite our external visitors to accept a complimentary copy of our recently published book, *Smart Machines: IBM's Watson and the Era of Cognitive Computing* authored by John E. Kelly III and Steve Hamm.

You can pick up your copy at the evening reception outside of the auditorium. We appreciate your participation and attendance.

IBM

Agenda – Morning

8:15 a.m.	Registration & Continental Breakfast	
8:45 a.m.	Welcome & Introduction	Kerrie Holley, IBM
8:55 a.m.	A New Era of Computing: Cognitive Systems	Michael Karasick, IBM
9:25 a.m.	The Online Revolution: Education for Everyone	Andrew Ng, Stanford University
9:55 a.m.	Theoretical Frameworks for Cognitive Computing – Fireside Chat with IBM Fellow Ron Fagin	Dick Karp, UC Berkeley
10:20 a.m.	Networking Break	
10:50 a.m.	Neuroplasticity-based Therapeutics	Michael Merzenich, UCSF
11:25 a.m.	Reconstructing Neurons in Whole Mouse Brains	Nathan Clack, Janelia Farm
12:00 p.m.	SyNAPSE Demo – Accelerated Discovery Lab	Dharmendra Modha, IBM
12:30 p.m.	Lunch	

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Agenda – Afternoon

1:35 p.m.	What the Brain Says About Cognitive Computing	Jeff Hawkins, Palm, Grok
2:05 p.m.	20% Doctor Included	Vinod Khosla, Khosla Ventures
2:30 p.m.	Networking Break & Research Demos	
2:50 p.m.	Cognitive Computing with Associative Memories: Reasoning by Similarity	Paul Hofmann, Saffron Technologies
3:20 p.m.	Perspectives on Big Data Analytics and Insight-Generation Systems	Evangelos Simoudis, Trident Capital
3:45 p.m.	Drug Discovery: how enhanced cognitive tools might boost the analyses of biological, pharmaceutical and genetic data	Olivier Lichtarge, Baylor College of Medicine
4:20 p.m.	IBM Watson's Next Venture: Fueling New Era of Cognitive Apps Built in the Cloud by Developers	Jayashree Subrahmonia, IBM
4:35 p.m.	Silicon Valley Insights: How Will We Remember This Turning Point? with *Smart Machines* author Steve Hamm	John Hollar, Computer History Museum
5:00 p.m.	Close and reception begins	Kerrie Holley, IBM

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Host
Kerrie Holley
IBM Fellow and CTO

Kerrie Holley, IBM Fellow, is recognized internationally for his innovative work in architecture and software engineering centered on the adoption of services and Service Oriented Architecture. Holley is also a consultant in IT Strategy and Transformation, enterprise architecture and application development. Currently part of IBM Research working on the confluence of social, mobile, analytics and cloud in areas of architecture, API adoption, API economy, scalable services, and related application development and system development models for APIs. Previously, Kerrie served as a CTO in IBM Global Business Services. Kerrie continues to collaborate and engage with clients as architect and consultant on research topics, innovation and approaches to increase business value and time to market using IT.

Fellow is the highest technical honor a scientist, engineer, or programmer at IBM can achieve. Thomas J Watson, Jr., founded the program to promote creativity among exceptional technical professionals. Since inception in 1963 only 231 IBM Fellows have been appointed.

Mr. Holley is an author, IBM Master Inventor and holds several patents. He has a BA and Juris Doctorate from DePaul University and School of Law.

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Michael Karasick
IBM

Cognitive Systems:
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The interconnected, instrumented and intelligent world of Smarter Planet has brought with it ever-increasing challenges posed by Big Data. The volume and complexity of data is growing at a faster rate than the performance improvements necessary for today's systems to process. By 2015, there will be almost 9000 exabytes of data in the world, growing to over 40,000 exabytes bytes by 2020 (source: IDC). We're at the beginning of a fundamental shift in the history of computing, defined by IBM as the Cognitive Systems Era – a shift as important as the switch from tabulating machines to programmable computers that began 60 years ago.

In this emerging new era, learning and reasoning systems will partner with humans through natural interfaces to extend human cognition and scale expertise across any domain of knowledge.

Cognitive systems do more than calculate difficult equations at great speeds. These systems sense, learn, predict, and, in some ways, think. They interact with humans the way we work, as opposed to forcing humans to interact with computers the way computers work. We will explore our journey from tabulating to programmable to cognitive systems.

Biography

I'm a communications strategist and writer for IBM, where I have worked since 2009. At IBM, I co-authored the company's centennial book, Making the World Work Better. I write a mix of essays, white papers and blog postings for the Smarter Planet blog (http://asmarterplanet.com)

Previously, I was a journalist for 30 years, the last 12 at BusinessWeek, where I wrote about innovation, globalization, and leadership. Before that, I worked for PC Week, The San Jose Mercury News, The New Haven Register, and other newspapers. I published two other books, Bangalore Tiger, about the rise of the Indian tech industry, and The Race for Perfect, about innovation in mobile computing. I grew up in a coal mining town in Western Pennsylvania.

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Steve Hamm
IBM

Moderator
Perspective: What does this new era of computing mean for the Silicon Valley?

With the introduction of learning systems and this notion of 'cognitive computing,' we now believe we are at another significant turning point in computing. Having seen the turns and tides of technology over the past few decades, how do you think we'll remember this moment in 20 years? We heard John Kelly talk about the three eras of computing - tabulating, programmable and now learning systems - how do you think this will be referred to and remembered historically, in the museum, in the Valley, in the context of what's happening today with big data? Is Watson the seminal point in this journey?

Biography

Dr. Michael Karasick, Vice President Software; Vice President and Lab Director of IBM Research – Almaden; and Research Software Strategy leader, oversees scientists and engineers performing exploratory and applied research worldwide.

Prior to his current role, Karasick was VP of Business and Technical Strategy for IBM's Software business in Somers, NY. He led technical initiatives spanning all IBM Software brands encompassing key industry and horizontal standards work, Linux support and IBM platform workload optimization. Before moving to New York, Karasick was for three years Director of Development for Lotus-China – responsible for products such as Lotus Symphony.

Karasick has served as CTO and Director of Architecture for IBM's Pervasive Computing Division, leading the design and evolution of middleware and device software. He has also led the Pervasive Computing Systems and Software team at TJ Watson Research Center, focusing on hardware design, system development, cognitive psychology and usability, user interface design, speech, and middleware.

Karasick has published numerous papers in the areas of software engineering, geometric modeling, programming languages and compilers and pervasive computing. He is a member of the ACM and IEEE. He received an Hons B.S. from the University of Manitoba, MS from McGill University, and Ph.d from McGill and Cornell Universities, all in Computer Science. Karasick is an IBM Master Inventor.

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Andrew Ng
Stanford University

The Online Revolution: Education for Everyone

In 2011, Stanford University offered three online courses, which anyone in the world could enroll in and take for free. Together, these three courses had enrollments of around 350,000 students, making this one of the largest experiments in online education ever performed. Since the beginning of 2012, we have transitioned this effort into a new venture, Coursera, a social entrepreneurship company whose mission is to make high-quality education accessible to everyone by allowing the best universities to offer courses to everyone around the world, for free. Coursera classes provide a real course experience to students, including video content, interactive exercises with meaningful feedback, using both auto-grading and peer-grading, and a rich peer-to-peer interaction around the course materials. Currently, Coursera has 100 university and other partners, and over 5 million students enrolled in its more than 500 courses. These courses span a range of topics including computer science, business, medicine, science, humanities, social sciences, and more. In this talk, I'll report on this far-reaching experiment in education, and why we believe this model can provide both an improved classroom experience for our on-campus students, via a flipped classroom model, as well as a meaningful learning experience for the millions of students around the world who would otherwise never have access to education of this quality.

Biography

John C. Hollar is President and Chief Executive Officer of the Computer History Museum, the world's leading institution exploring the history of computing and its ongoing impact on society.

Since joining the Museum, Hollar has led the development and execution of a new strategic plan that has produced significant growth in the Museum and its mission. The centerpiece is "Revolution: The First 2000 Years of Computing." "Revolution" is a multi-platform history experience that features the Museum's largest-ever exhibition.

Hollar has expanded the Museum's production of film and digital media to make the major stories of computer history, and its pioneers, vivid and engaging for a wide audience. He has accelerated annual and capital fundraising, including establishing a founders' stock program for Silicon Valley startups. He has formed strategic relationships with National Public Radio, Intel, Microsoft, Google, SAP, the Western Association of Venture Capital (WAVC) and other national and international institutions, and introduced a new education program.

Hollar previously was President of Penguin Television Ltd and Pearson Broadband Ltd in London as a senior executive of Pearson plc, the FTSE 100 global media and education company. Before that he served as Executive Vice President of the Public Broadcasting Service (PBS), where he launched the award-winning PBS.org, PBSKids.org and a wide array of national education services, including PBS TeacherLine. He has been the executive producer of more than 100hours of documentary and children's television. He is the winner of a 2003 BAFTA and the 2001Milia d'Or in digital content among many other awards. He is a voting member of BAFTA, a Fellow of the Royal Society for the Arts and a past member of the selection committee for the Fulbright Awards conferred by the US/UK Fulbright Commission in London.

Hollar holds bachelor's degrees in journalism and political science from Southern Methodist University and a juris doctor from Harvard Law School.

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John Hollar
Computer History Museum

Perspective: What does this new era of computing mean for the Silicon Valley?

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Biography

Andrew Ng is a Co-founder of Coursera, and a Computer Science faculty member at Stanford. In 2011, he led the development of Stanford University's main MOOC (Massive Open Online Courses) platform, and also taught an online Machine Learning class that was offered to over 100,000 students, leading to the founding of Coursera. Ng's goal is to give everyone in the world access to a high quality education, for free. Today, Coursera partners with top universities to offer high quality, free online courses. With 90 partners, over 400 courses, and 5 million students, Coursera is currently the largest MOOC platform in the world. Outside online education, Ng's research work is in machine learning; he is also the Director of the Stanford Artificial Intelligence Lab.

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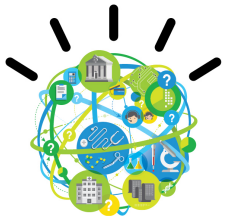

Dick Karp
UC Berkeley

Theoretical Frameworks for Cognitive Computing

Ultimately we would like to build hardware/software systems that: can see, hear and understand spoken language, including metaphor and irony; are self-aware and can set their own goals; exhibit emotions and perceive the mental states of their human partners; perform associative memory retrieval; are endowed with built-in subroutines for elementary, repetitive responses; are capable of fine motor control; and can form human/computer social networks that perform tasks collectively.

In this fireside chat with IBM Fellow Ron Fagin, Dick will address areas including computer architectures, algorithmic challenges, theory in relation to basic perceptual human tasks, applications, and the impact of cognitive computing on society.

Biography

Jay Subrahmonia is VP, Engineering and Delivery for Watson Solutions in IBM's Software Group. She manages a team to deliver commercial product and solutions based on Watson to customers in multiple industries. Her team of engineers builds the core commercial product, and works with customers to deliver Watson based solutions. She also the manages the Watson SaaS delivery team.

Prior to this role, Jay was Director of Cloud Labs and Advanced Customer Solutions in IBM's Software group. She has a PhD in Electrical Engineering from Brown University and BTech in Electrical Engineering from Indian Institute of Technology, Mumbai.

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Jayashree Subrahmonia
IBM

Beyond Jeopardy: Putting Watson to Work

The mission of Watson Solutions is to commercialize the innovative Watson technology developed by IBM Research that won Jeopardy in February 2011. IBM Watson represents a third era of computing called Cognitive computing that represents a evolution from assistance, to understanding, to decision making, to finally discovery, creating new insights and value . IBM Watson leverages deep content analysis and evidence based reasoning to bring a new form of intelligence to the value of goods and services delivered to business. It accomplishes this based on a set of transformational technologies which leverage natural language, hypothesis generation, and evidence based learning. It combines these technologies and applies massively parallel probabilistic processing techniques to fundamentally change the way businesses look at solving problems. In this talk, Jay will share examples of how Watson is being put to work in a number of industries, and the recent announcement on opening Watson to an ecosystem of developers in the cloud, and fueling a new era of cognitive apps.

Biography

Richard M. Karp was born in Boston, Massachusetts on January 3, 1935. He attended Boston Latin School and Harvard University, receiving the Ph.D. in 1959. From 1959 to 1968 he was a member of the Mathematical Sciences Department at IBM Research. From 1968 to 1994 and from 1999 to the present he has been a Professor at the University of California, Berkeley, where he held the Class of 1939 Chair and is currently a University Professor and Director of the Simons Institute for the Theory of Computing.From 1988 to 1995 and 1999 to 2012 he was a Research Scientist at the International Computer Science Institute in Berkeley. From 1995 to 1999 he was a Professor at the University of Washington. During the 1985-86 academic year he was the co-organizer of a Computational Complexity Year at the Mathematical sciences research Institute in Berkeley. During the 1999-2000 academic year he was the Hewlett-Packard Visiting Professor at the Mathematical Sciences Research Institute.

The unifying theme in Karp's work has been the study of combinatorial algorithms. His 1972 paper ``Reducibility Among Combinatorial Problems'' showed that many of the most commonly studied combinatorial problems are NP-complete, and hence likely to be intractable. Much of his work has concerned parallel algorithms, the probabilistic analysis of combinatorial optimization algorithms and the construction of randomized algorithms for combinatorial problems. His current activities center around algorithmic methods in genomics. He has supervised forty-two Ph.D. dissertations.

His honors and awards include: U.S. National Medal of Science, Turing Award, Kyoto Prize, Fulkerson Prize, Harvey Prize (Technion), Centennial Medal (Harvard), Lanchester Prize, Von Neumann Theory Prize, Von Neumann Lectureship, Distinguished Teaching Award (Berkeley), Faculty Research Lecturer (Berkeley), Miller Research Professor (Berkeley), Babbage Prize and ten honorary doctorates. He is a member of the U.S. National Academies of Sciences and Engineering, the American Philosophical Society and the French Academy of Sciences, and a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the Association for Computing Machinery and the Institute for Operations Research and Management Science.

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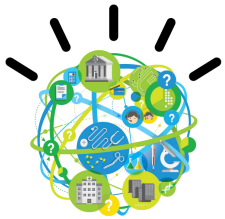

Ron Fagin
IBM

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In this fireside chat with Turing Award and Kyoto Prize winner Dick Karp, Ron will facilitate a conversation around cognitive systems that includes Dick's insights on computer architectures, algorithmic challenges, theory in relation to basic perceptual human tasks, applications, and the impact of cognitive computing on society.

Biography

Olivier Lichtarge, M.D., Ph.D., is Cullen Endowed Professor of Molecular and Human Genetics, and Director of the Computational and Integrative Biomedical Research Center at Baylor College of Medicine. He has pioneered evolution-based algorithms to annotate protein functional sites and, from this, predict protein function, guide mutational protein engineering, and assess the impact of mutations on fitness. The latter work is now being expanded to identify mutational biomarkers and direct personalized therapy. His work combines mathematics and physics with AI methods and network analysis and has been applied widely in diverse proteins of pharmaceutical interest. A frequent guest of the IHES, in France, he served as reviewer and then Chair of the MSFD Computational Study Section at the NIH Center for Scientific Review. Most recently he developed a research program on Knowledge Integration in close collaboration with IBM, to combine text analysis and big data with the hope to connect known facts into new hypothesis for scientific and clinical discovery.

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Olivier Lichtarge
Baylor College of Medicine

Drug discovery: how enhanced cognitive tools might boost the analyses of biological, pharmaceutical and genetic data

With publications and databases growing exponentially, no one can assimilate, recall and accurately process all of the known facts and relationships relevant to solve problems. In biomedical research, papers on specialized topics often run in the tens of thousands and topic areas contain orders of magnitude more. Thus, only a sliver of the relevant knowledge guides hypotheses: a wasteful approach. This fundamental bottleneck is not unique to biology: facts in every area of human activity are mushrooming beyond our cognitive and analytic abilities. Here, we propose to build an Artificial Intelligence Knowledge Integration Tool (KnIT) to make whole, and computationally addressable, the information currently fractured into separate publications and discrete database entries. Although the work is preliminary, and many problems remain, encouraging initial examples suggest that such a broad view of all extent information can lead to novel discoveries.

Biography

Ronald Fagin is an IBM Fellow at the IBM Almaden Research Center. He has won an IBM Corporate Award, eight IBM Outstanding Innovation Awards, an IBM Outstanding Technical Achievement Award, and two IBM key patent awards. He has published well over 100 papers, and has co-authored a book on "Reasoning about Knowledge." He has served on more than 30 conference program committees, including serving as Program Committee Chair of four different conferences. He received his B.A. in mathematics from Dartmouth College, and his Ph.D. in mathematics from the University of California at Berkeley. He was named a Fellow of IEEE for "contributions to finite-model theory and to relational database theory." He was named a Fellow of ACM for "creating the field of finite model theory and for fundamental research in relational database theory and in reasoning about knowledge." He was named a Fellow of AAAS (American Association for the Advancement of Science), for "fundamental contributions to computational complexity theory, database theory, and the theory of multi-agent systems." He was named Docteur Honoris Causa by the University of Paris, and a "Highly Cited Researcher" by ISI (the Institute for Scientific Information). He won Best Paper awards at the 1985 International Joint Conference on Artificial Intelligence, the 2001 ACM Symposium on Principles of Database Systems, and the 2010 International Conference on Database Theory. He won Test-of-Time Awards at the 2011 ACM Symposium on Principles of Database Systems and the 2013 International Conference on Database Theory. He won a 2011 IEEE Technical Achievement Award “for pioneering contributions to the theory of rank and score aggregation,” and the 2012 IEEE W. Wallace McDowell Award “for fundamental and lasting contributions to the theory of databases.” He was the winner of the 2004 ACM SIGMOD Edgar F. Codd Innovations Award, a lifetime achievement award in databases, for "fundamental contributions to database theory."

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Michael Merzenich
UCSF

Neuroplasticity-Based Therapeutics

A growing understanding of neuroplasticity science has led to the development of a new class of cloud-delivered therapeutic tools, now being applied in a growing number of psychiatric and neurological patient populations. Here, I shall briefly summarize underlying neuroplasticity principles, describe how we have evolved intensive computer-guided neurological-recovery tools, then document behavioral and neurological outcomes demonstrating the medical values of this new approach.

Biography

Evangelos Simoudis is a Sr. Managing Director of Trident. Evangelos joined Trident Capital in 2005. Evangelos focuses on investments in Internet and software businesses. Prior to Trident, Evangelos spent 5 years as a partner at Apax Partners, a private equity and venture capital firm where he invested and served on the boards of early and mid-stage IT companies.

Prior to entering venture capital, Evangelos had more than 20 years experience in high-technology industries, in executive roles spanning operations, marketing, sales and engineering. His experience as a technology executive includes serving as President and CEO of Customer Analytics, a Trident-backed, eCRM company acquired by Xchange, Inc. (NASDAQ: EXAP), and as Vice President of Business Intelligence Solutions at IBM.

Evangelos earned a PhD in computer science from Brandeis University, where serves on the university's Science Advisory Board, and a BS in electrical engineering from Caltech, where he serves on the Institute's Information Science and Technology Board.

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Evangelos Simoudis
Trident Capital

Perspectives on Big Data Analytics and Insight-Generation Systems

Over the past 30 years we have developed larger data warehouses and created faster and more intuitive tools for analyzing, modeling and reporting on the warehoused data. Unfortunately our ability to act based on the results of the derived models abad analyses remains limited. In fact, in recent years we have started losing ground as more data is captured and stored inexpensively by a new generation of data management technologies. We are started to understand the need for systems that generate, or assist in the generation of, actionable insights rather than simple analytics. I will discuss the characteristics of insightful systems and provide examples from application areas where such systems are starting to be developed and deployed.

Biography

Michael Merzenich was trained in neuroscience at Johns Hopkins University and the University of Wisconsin, joining the UCSF faculties in Otolaryngology, Physiology and Neuroscience in 1971. His research has focused on the functional organization of the brain and the brain's inherent plasticity, as it contributes to our understanding of our human performance abilities, and as it informs the development of strategies designed to re-normalize brain function in psychiatrically and neurologically impaired populations. With UCSF's cooperation, he co-founded two companies that has translated his science into education, consumer and medical areas. Scientific Learning Corp. focuses on improving language, learning and broader cognitive abilities in normal and in struggling school-aged children. Posit Science Corp. develops and applies computer-delivered programs to grow brainpower in normal consumer and work-force populations, to grow resilience again collapse into acquired neurological catastrophes, and/or to re-normalize brain function insofar as possible in psychiatric and neurologically impaired populations. In other research, one of the 3 major commercial cochlear implants was developed in his UCSF laboratory. Merzenich has been the recipient of numerous distinctions and awards, and is a member of the National Academy of Science and Institute of Medicine.

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Nathan Clack
Janelia Farm

Imaging and Reconstructing Neurons in Whole Mouse Brains

Today, the world is on the cusp of a new phase in the evolution of computing — the era of cognitive systems. We anticipate that cognitive computing will revolutionize and accelerate discoveries in a vast array of fields. At HHMI's Janelia Farm Research campus, big data and analytics are beginning to revolutionize how researchers relate neuronal circuits to behavior. Dr. Nathan Clack, Research Specialist at Janelia Farms, will discuss how cognitive computing is enabling analysis of neuronal connections and characterization of the behavior of flies and mice.

Biography

Paul is Chief Technology Officer at Saffron Technology. Before joining Saffron Paul was Vice President Research at SAP Labs in the heart of Silicon Valley. His background is entrenched in research as Senior Scientist and Assistant Professor at outstanding European and American Universities (Northwestern University, U.S., Munich Institue of Technology and Darmstadt Institue of Technology, Germany) and he is an expert in computer simulations and graphics (Ph.D., research and teaching in Nonlinear Dynamics and Chaos Theory), authoring numerous publications and books, including a book on SCM and environmental information systems as well as performance management and productivity of supply chains. Paul was visiting scientist at MIT, Cambridge in 2009.

Paul joined SAP in 2001 as Director for Business Development EMEA SAP AG. Paul has created the Value Based Selling program for SAP in EMEA. Prior to joining SAP, Paul was Plant Manager at BASF's Catalysts Global Business Unit. After joining BASF 1989, Paul headed the development of object-oriented production planning and scheduling software for BASF's plants in its IT division. He implemented SAP's Business Suite in BASF's Chemicals Division.

Paul received his Ph.D. in Physics at the Darmstadt University of Technology, Germany, after completing his Bachelor in biotechnology and a master's degree in Chemistry from the University of Vienna.

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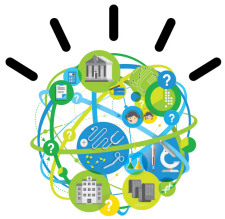
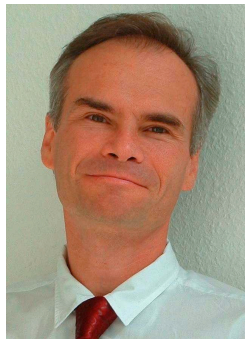


Paul Hofmann
Saffron Technologies



Cognitive Computing With Associative Memories – Reasoning by Similarity

We combine two very powerful concepts of the 20th century, Associative Memories and Kolmogorov Complexity for cognitive computing. Associative Memories mimic how humans learn and think using only connections and counts like the synapses of the brain. Saffron Technology has implemented the most efficient Associative Memory storing graphs as matrices in a triple score. The Associative Memory functions as a universal compressor for approximating Kolmogorov Complexity K(x). The universal cognitive distance based on K(x) is used for reasoning by similarity to find without knowing and predict.

We'll show use cases from health care – Mt. Sinai Hospital NY, national security – JIATF, global risk – The Bill and Melinda Gates Foundation, and maintenance and repair – Boeing.

Biography

Nathan Clack works on high-content microscopy and vision problems. He completed his Ph.D. Biophysics in 2007 at the University of California at Berkeley. In 2008, he started working at the Howard Hughes Medical Institute's Janelia Farm research campus developing behavioral video analysis of mice. Since 2010, he's worked on building a platform for high-speed imaging entire mouse brains at axon-level resolution.

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Dharmendra Modha
IBM

Cognitive Computing: SyNAPSE Demonstration

Ever-growing streams of data are creating a burgeoning demand for bandwidth and computational power that traditional computer architectures are hard-pressed to meet. At the nexus of supercomputing, neuroscience and nanotechnology, IBM is developing a new brain-inspired, non-Von Neumann computer architecture that emulates the brain's abilities for sensation, perception, action, interaction, and cognition, while rivaling the brain's low power consumption and compact size.

IBM is moving computation to the data, taking in vastly varied kinds of data, analyzing and integrating real-time information in a context-dependent way, and dealing with the ambiguity found in complex, real-world environments. These synaptic computing systems gather and interpret real-world data as it occurs, enabling them to identify hard-to-find patterns in various environments such as public safety, natural disasters, traffic, agriculture and healthcare.

Biography

Vinod Khosla is an entrepreneur, investor, and technology fan. He is the founder of Khosla Ventures, focused on impactful clean technology and information technology investments. Mr. Khosla was a co-founder of Daisy systems and founding CEO of Sun Microsystems where he pioneered open systems and commercial RISC processors. One of Mr. Khosla's greatest passions is being a mentor to entrepreneurs, assisting entrepreneurs and helping them build technology based businesses. Mr. Khosla is driven by the desire to make positive impact through scaling alternative energy, achieving petroleum independence, and promoting a pragmatic approach to the environment. He is also passionate about Social Entrepreneurship. Vinod holds a Bachelor of Technology in Electrical Engineering from IIT, New Delhi, a Master's in Biomedical Engineering from Carnegie Mellon University and an MBA from the Stanford Graduate School of Business.

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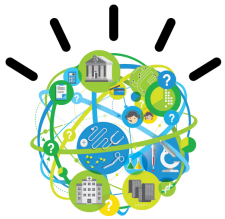
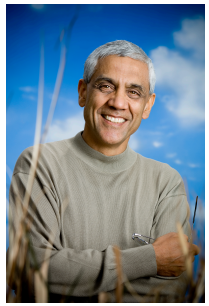


Vinod Khosla
Khosla Ventures

20% Doctor Included: Speculations & musings of a technology optimist



Healthcare today is often really the “practice of medicine” rather than the “science of medicine”. Healthcare should be much more scientific and data-driven, but that’s hard for the average physician to pull off without technology, because of the increasing amount of data and research released every year. Technology makes up for human deficiencies and amplifies strengths. Automated healthcare will amplify physicians by arming them with more complete, synthesized, and up-to-date research data, all leading to better patient outcomes, and next-generation medicine will be the scientific arrival at diagnostic and treatment conclusions & real testing of what’s actually going on in your body. It will also be much more personalized than your physician can provide. This transition will start with point innovations that seem immaterial, but, when there are enough of them, they will integrate with each other and start to feel like a revolution. Eventually, this shift in how healthcare is delivered will allow for less money to be spent on capital equipment, cutting health care costs. It will allow us to provide care to those who don’t have it now. And, it will prevent simple things from getting worse before being addressed. In this talk, Vinod will address practice vs. science, the maturation process of learning systems in this context, and how automation could be used to enable the science of medicine while preserving the human element of healthcare.

Biography

Dr. Dharmendra Modha is the founder of IBM’s Cognitive Computing group at IBM Research – Almaden and the principal investigator for DARPA SyNAPSE team globally. In this role, Dr. Modha leads a global team across neuroscience, nanoscience and supercomputing to build a computing system that emulate the brain’s abilities for perception, action, and cognition – all while consuming many orders of magnitudes less power and space than today’s computers.

He has significantly contributed to IBM’s businesses via scientific and technological innovations in caching mechanisms for DS8000, clustering algorithms for services, and coding theory for disk drives.

At IBM, he has won the Pat Goldberg Memorial Best Paper award twice, an Outstanding Innovation Award, an Outstanding Technical Achievement Award, and Communication Systems Best Paper Award. He holds 30 U.S. patents, and is an IBM Master Inventor. In 2010, he was elected to the IBM Academy of Technology.

Dr. Modha has authored over 60 publications in international journals and conferences. He is a Fellow of Institute of Electrical and Electronics Engineers and a member of American Association for Advancement of Science, Association for Computing Machinery, and Society for Neuroscience.Dr. Modha holds a B.Tech. in Computer Science and Engineering from IIT Bombay and a Ph.D. in Electrical and Computer Engineering from University of California at San Diego.≈

An IBM Research Colloquium

Cognitive Systems
The New Era of Computing

November 19, 2013
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Jeff Hawkins
Founder of Palm, Grok
(formerly known as Numenta)

What the Brain Says About Cognitive Computing

The neocortex is the only example we have of a cognitive system. I will argue that understanding the principles of how the neocortex works and then building machines that work on those principles is the only way to build intelligent machines, machines we would call "cognitive".

I will describe the progress we are making in understanding how the neocortex works and demonstrate how we are turning that knowledge into useful technology and products.

Biography

Jeff Hawkins is co-founder of Grok (formerly known as Numenta). Jeff was a founder of two mobile computing companies, Palm and Handspring, and was the architect of many computing products such as the PalmPilot and Treo smartphone. Throughout his life Jeff has also been active in neuroscience and modeling the neocortex. In 2002 he founded the Redwood Neuroscience Institute, a scientific institute focused on understanding how the neocortex processes information. The institute is now located at U.C. Berkeley. In 2004 he wrote the book On Intelligence, which describes progress in understanding the neocortex. In 2005 he co-founded Numenta (now Grok), a start-up company building a technology based on neocortical theory. In 2013 Grok placed its cortical learning algorithms into an open source project called NuPIC. Grok plans to launch its first commercial product based on these algorithms in early 2014. It is Jeff's hope that Grok and NuPIC will play a catalytic role in the emerging field of machine intelligence.

Jeff Hawkins earned his B.S. in electrical engineering from Cornell University in 1979. He was elected to the National Academy of Engineering in 2003.