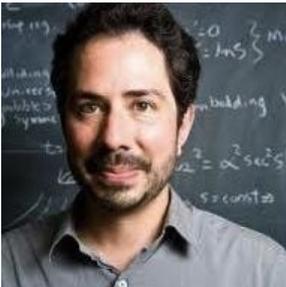


# The Future of AI: Opportunities and Challenges

*Puerto Rico, January 2-5, 2015*



**Ajay Agrawal** is the Peter Munk Professor of Entrepreneurship at the University of Toronto's Rotman School of Management, Research Associate at the National Bureau of Economic Research in Cambridge, MA, Founder of the Creative Destruction Lab, and Co-founder of The Next 36. His research is focused on the economics of science and innovation. He serves on the editorial boards of *Management Science*, the *Journal of Urban Economics*, and *The Strategic Management Journal*.



**Anthony Aguirre** has worked on a wide variety of topics in theoretical cosmology, ranging from intergalactic dust to galaxy formation to gravity physics to the large-scale structure of inflationary universes and the arrow of time. He also has strong interest in science outreach, and has appeared in numerous science documentaries. He is a co-founder of the Foundational Questions Institute and the Future of Life Institute.



**Geoff Anders** is the founder of Leverage Research, a research institute that studies psychology, cognitive enhancement, scientific methodology, and the impact of technology on society. He is also a member of the Effective Altruism movement, a movement dedicated to improving the world in the most effective ways. Like many of the members of the Effective Altruism movement, Geoff is deeply interested in the potential impact of new technologies, especially artificial intelligence.



**Blaise Agüera y Arcas** works on machine learning at Google. Previously a Distinguished Engineer at Microsoft, he has worked on augmented reality, mapping, wearable computing and natural user interfaces. He was the co-creator of Photosynth, software that assembles photos into 3D environments.



**Stuart Armstrong's** research at the Future of Humanity Institute centres on formal decision theory, the risks and possibilities of Artificial Intelligence, the long term potential for intelligent life, and anthropic (self-locating) probability. He is particularly interested in finding decision processes that give the "correct" answer under situations of anthropic ignorance and ignorance of one's own utility function, ways of mapping humanity's partially defined values onto an artificial entity, and the interaction between various existential risks. He aims to improve the understanding of the different types and natures of uncertainties surrounding human progress in the mid-to-far future.

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**Joscha Bach, Ph.D.** is an AI researcher who worked and published about cognitive architectures, mental representation, emotion, social modeling, and multi-agent systems. He earned his Ph.D. in cognitive science from the University of Osnabrück, Germany, and has built computational models of motivated decision making, perception, categorization, and concept-formation.

His book “Principles of Synthetic Intelligence” (Oxford University Press) is to appear later this year. Joscha authored *Seven Principles of Synthetic Intelligence*, *Representations for a Complex World: Combining Distributed and Localist Representations for Learning and Planning*, *Enhancing Perception and Planning of Software Agents with Emotion and Acquired Hierarchical Categories*, and *MiniPsi, der Mac-Roboter*. Currently, he is working as an entrepreneur in Berlin, Germany.



**Margaret Boden** is Research Professor of cognitive science at the Department of informatics at the University of Sussex, where her work embraces the fields of artificial intelligence, psychology, philosophy, cognitive and computer science.



**Nick Bostrom** is a Professor in the Faculty of Philosophy at Oxford University and founding Director of the Future of Humanity Institute and the Programme on the Impacts of Future Technology within the Oxford Martin School. He is the author of some 200 publications, including *Anthropic Bias*, *Global Catastrophic Risks*, *Human Enhancement*, and, most recently, the book *Superintelligence: Paths, Dangers, Strategies* (OUP, 2014). He is known for his pioneering work on existential risk, the simulation argument, anthropics, AI safety, and global consequentialism. He has received the Eugene R. Gannon Award for the Continued Pursuit of Human Advancement and been named One of the Top 100 Global Thinkers by Foreign Policy Magazine.



**Erik Brynjolfsson** is the Director of the MIT Initiative on the Digital Economy, a Professor at the MIT Sloan School, Chairman of the Sloan Management Review and a Research Associate at the National Bureau of Economic Research. His widely cited research examines a variety of aspects of information technology, strategy, productivity, marketing and employment has been recognized with 10 Best Paper prizes and five patents. He teaches a popular MBA courses on the Economics of Information and an executive program on Big Data. His talk for the opening session of TED 2013 laid out an optimistic vision for the future of economic growth.

Prof. Brynjolfsson is a director or advisor for several technology-intensive firms and lectures worldwide on technology and strategy. His books include New York Times Bestseller *The Second Machine Age: Work, Progress and Prosperity in a time of Brilliant Technologies*, co-authored with Andrew McAfee. He received AB and SM degrees from Harvard and a PhD from MIT.

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**Professor Ryan Calo** researches the intersection of law and emerging technology, with an emphasis on robotics and the Internet. His work on drones, driverless cars, privacy, and other topics has appeared in law reviews and major news outlets, including the New York Times, the Wall Street Journal, and NPR. Professor Calo has also testified before the full Judiciary Committee of the United States Senate. In 2014, he was named one of the most important people in robotics by Business Insider.



**Shamil Chandaria** is a Partner of Amplitude Capital, winner of the HFR award for best European managed futures hedge fund in 2007 and 2009 Barron's Hedge Fund 100. Dr. Chandaria is also a Partner of Ocean Capital - a structured asset finance company. Dr. Chandaria has a portfolio of several technology companies including: Ip-Only Telecommunication AB, a telecom operator in Sweden with a fibre network around Scandinavia. He is an honorary research fellow at the Institute of Philosophy, School of Advanced Study, London University. He has a PhD in Financial Economics the London School of Economics, an MA in Philosophy from University College London and a BA in Economics and Natural Sciences from Cambridge University where he was a senior scholar.



**Nancy Chang** works at the intersection of computation, cognition and linguistics, focusing on embodied models of language understanding and use. Her doctoral research at Berkeley modeled children's first steps into grammar, followed by post-doctoral research at Sony Computer Science Laboratory and the Université Sorbonne Nouvelle. As part of the Machine Intelligence team at Google, she has worked on semantic parsing for conversational search and commonsense reasoning for deeper natural language understanding.



With a background in education and philosophy, **Meia Chita-Tegmark** has strong interests in the future of humanity and big picture questions. She conducts research at the Center for Autism Research Excellence at Boston University. She is interested in a variety of topics in developmental psychology, such as atypical language development, attention mechanisms and learning strategies. She is a co-founder of the Future of Life Institute.

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**Charina Choi** is a scientist and community advocate focused on the power of technology to advance societal change. She currently leads Executive Communications for Research at Google, working to craft Google's vision and strategy for artificial intelligence. Charina joined Google from the White House Office of Science and Technology Policy, where she managed technology commercialization, advanced materials policy, and open education. She is the founder of Sciimpact, an annual science conference for students from underserved Bay Area high schools, and served on the founding committee for the Lawrence Berkeley National Laboratory Institute for Globally Transformative Technologies. Trained as a nanoscientist, Charina has published several papers and patents on the design of nanoscale materials for optoelectronics. She holds a B.S. from Stanford University and a Ph.D. from the University of California, Berkeley.



**Paul Christiano** is a PhD student in theoretical computer science at UC Berkeley. His work in algorithms and learning theory has won best paper and best student paper awards at the Symposium on Theory of Computing. He blogs about AI and philanthropy at [rationalaltruist.com](http://rationalaltruist.com).



**Steve Crossan** currently leads Google's Social Impact work in EMEA. A Googler since 2005, he previously founded and lead Google's Cultural Institute in Paris after spells with Maps, Search and Gmail. During the Egyptian internet shutdown in 2011 he lead a small team building speak2tweet. Prior to Google he founded 2 successful startups in the UK after beginning his career with Amnesty International.



**Daniel Dewey** is the Alexander Tamas Research Fellow on Machine Superintelligence and the Future of AI at the Future of Humanity Institute. He was previously at Google, Intel Labs Pittsburgh, and Carnegie Mellon University.

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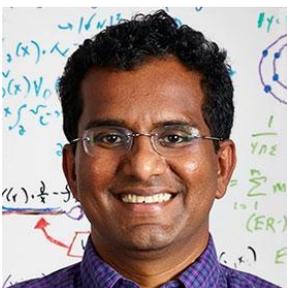
**Thomas Dietterich** is one of the founders of the field of Machine Learning. Among his research contributions was the application of error-correcting output coding to multiclass classification, the formalization of the multiple-instance problem, the MAXQ framework for hierarchical reinforcement learning, and the development of methods for integrating non-parametric regression trees into probabilistic graphical models. Among his writings are a chapter of the Handbook of Artificial Intelligence, the book Readings in Machine Learning, and his frequently-cited review articles “Machine Learning Research: Four Current Directions” and “Ensemble Methods in Machine Learning”. He served as Executive Editor of Machine Learning (1992-98) and helped co-found the Journal of Machine Learning Research. He is currently the editor of the MIT Press series on Adaptive Computation and Machine Learning. He also served as co-editor of the Morgan-Claypool Synthesis Series on Artificial Intelligence and Machine Learning. He has organized several conferences and workshops including serving as Technical Program Co-Chair of the National Conference on Artificial Intelligence (AAAI-90), Technical Program Chair of the Neural Information Processing Systems (NIPS-2000) and General Chair of NIPS-2001. He served as founding President of the International Machine Learning Society, and he is currently a member of the Steering Committee of the Asian Conference on Machine Learning and the President of AAAI.



**Owain Evans** is a PhD student in MIT's Department of Linguistics and Philosophy. He is currently working with MIT's Probabilistic Computing Project on tools and applications for Venture, and previously worked on Bayesian cognitive science with Josh Tenenbaum.



**Benja Fallenstein** does mathematical research on Friendly AI, including problems of self-reference and issues in decision and game theory when an AI reasons about future versions of itself or about other, similarly powerful agents in its environment; models of logical uncertainty, i.e., uncertainty about what mathematical statements are true; models of anthropic reasoning; and the specification of safe AI goals. Benja is also interested in formal verification and in programming languages with integrated proof checkers. Benja holds a Bachelors in Mathematics from University of Vienna.



**Dileep George** was previously CTO of Numenta, an AI company he cofounded with Jeff Hawkins and Donna Dubinsky. Before Numenta, Dileep was a Research Fellow at the Redwood Neuroscience Institute. Dileep has authored 22 patents and several influential papers on the mathematics of brain circuits. Dileep's research on hierarchical models of the brain earned him a PhD in Electrical Engineering from Stanford University. He earned his MS in EE from Stanford and his BS from IIT in Bombay.

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**Katja Grace** is a researcher at the Machine Intelligence Research Institute (MIRI) in Berkeley. There she investigates topics such as rates and distributions of algorithmic progress, past responses to technological threats, and historical cases of abrupt change. She blogs at [meteuphoric.wordpress.com](http://meteuphoric.wordpress.com).



**Joshua D. Greene** is Professor of Psychology, a member of the Center for Brain Science faculty, and the director of the Moral Cognition Lab at Harvard University. His work focuses on the intersection of psychology, neuroscience, and moral philosophy.



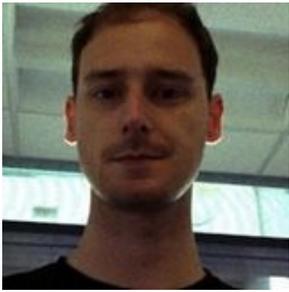
**Robin Dale Hanson** is an associate professor of economics at George Mason University and a research associate at the Future of Humanity Institute of Oxford University. He is known as an expert on idea futures, markets and was involved in the creation of the Foresight Exchange and DARPA's FutureMAP project. He invented market scoring rules like LMSR (Logarithmic Market Scoring Rule) used by prediction markets such as Consensus Point (where Hanson is Chief Scientist), and has conducted research on signaling.



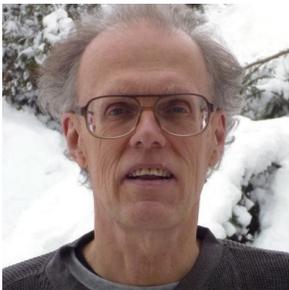
**Demis Hassabis** was the co-founder and CEO of DeepMind, a neuroscience-inspired AI company, bought by Google in Jan 2014 in their largest European acquisition to date. He is now Vice President of Engineering at Google DeepMind and leads Google's general AI efforts. Demis is a former child chess prodigy, who finished his A-levels two years early before coding the multi-million selling simulation game Theme Park aged 17. Following graduation from Cambridge University with a Double First in Computer Science he founded the pioneering videogames company Elixir Studios producing award-winning games for Microsoft and Universal. After a decade of experience leading successful technology startups, Demis returned to academia to complete a PhD in cognitive neuroscience at UCL. His research connecting memory with imagination was listed in the top ten scientific breakthroughs of 2007 by the journal Science. Demis is a 5-times World Games Champion, a Fellow of the Royal Society of Arts, and the recipient of the Royal Society's Mullard Award.

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**Nicholas J. Hay** is a PhD student of Prof. Stuart Russell working on metareasoning: the problem of designing systems that reason about their own reasoning, or more generally spend time computing what they should next compute. He has a longstanding interest in the future of AI, especially understanding how to create artificially intelligent systems that robustly learn to share our values.



**Bill Hibbard** is a scientist at the University of Wisconsin-Madison Space Science and Engineering Center working on visualization and machine intelligence. He is principal author of the Vis5D, Cave5D and VisAD open source visualization systems. He is also author of Ethical Artificial Intelligence, available at: [arxiv.org/abs/1411.1373](https://arxiv.org/abs/1411.1373)



**Neil Jacobstein** co-chairs the Artificial Intelligence and Robotics Track at Singularity University on the NASA Research Park campus in Mountain View California. He served as President of Singularity University from October 2010 to October 2011. Jacobstein is a Distinguished Visiting Scholar in the Stanford University Media X Program, where his research focuses on augmented decision systems. Jacobstein was CEO of Teknowledge Corp, an early AI company that sold its commercial division to Intuit in 2006. He Chaired AAAI's 17th Innovative Applications of Artificial Intelligence Conference, and continues to review technical papers on the IAAI Technical Program Committee. Neil was recently appointed for a three year term to the National Research Council's (NRC) Division on Earth and Life Studies (DELS) Committee.



**Christof Koch** has done pioneering work on the neural basis of consciousness, and spent 25 years as a professor at the California Institute of Technology. His interdisciplinary interests integrate theoretical, computational and experimental neuroscience, and he has published both popular books (Consciousness: Confessions of a Romantic Reductionist and The Quest for Consciousness: A Neurobiological Approach) and technical books (Biophysics of Computation: Information Processing in Single Neurons and Methods in Neuronal Modeling: From Ions to Networks).



**Viktoriya Krakovna** is a doctoral student in statistics at Harvard University. Her work focuses on Bayesian models and Markov chain Monte Carlo methods. She has gained numerous distinctions for her accomplishments in math competitions, including a silver medal at the International Mathematical Olympiad and the Elizabeth Lowell Putnam prize. She is a co-founder of the Future of Life Institute.

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**János Kramár's** background runs in math and computing, where he earned medals in national and international olympiads. He earned a BSc in math from UToronto and a Masters in Statistics from Harvard; in between he was briefly a Visiting Fellow at the forerunner of the Machine Intelligence Research Institute (MIRI) in summer of 2010, working to understand foundational questions related to projections of superintelligent AI. After working a year in algorithmic trading at KCG, he organized 2 MIRIx workshops in Boston in 2014, and joined the Future of Life Institute as a researcher and event organizer.



**Sean Legassick** was a lead developer at Demon Internet and led the design, development and deployment of a multi-billion-pound web trading platform for Winterflood Securities. He is a recognised expert on web and network software development, having received accolades for his work with the Apache Foundation and as technical editor for 'The Definitive Guide to Django'. Sean also created the core of the Chisimba web development framework.



**Shane Legg** got into research working for the WEKA machine learning project at the University of Waikato. For his MSc he moved to the University of Auckland where he worked on universal prediction algorithms and mathematical provability with the complexity theorist Prof. Cris Calude. After a number of years of commercial work he took up a PhD student position working on theoretical models of super intelligent machines with Prof. Marcus Hutter at IDSIA in Switzerland. His PhD research was published in international conferences and journals, as well as being reported in popular science magazines.



**Howie Lempel** graduated from Wesleyan University with a BA in Social Studies and Mathematical Economics. He has worked at the Brookings Institution and the Manhattan District Attorney's white collar crime bureau. He is on leave from Yale Law School, where he served as a law clerk at the ACLU National Prison Project and the Orleans Public Defenders. He joined GiveWell in August 2013 where he advises Good Ventures and works on the Open Philanthropy Project's investigation into global catastrophic risk.

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**Richard Mallah** heads research in AI, including knowledge representation, computational linguistics, and ragged multistructured machine learning, at knowledge integration platform firm Cambridge Semantics, used in dozens of enterprise applications ranging from drug discovery to fraud detection to cognitive computing. He has fifteen years of AI algorithms development, product team management, and CTO-level experience in finance, healthcare, and tech, including leading enterprise risk management systems at BlackRock during the global financial crisis. Richard is a board member at MarketMuse, a web marketing analytics firm, and is an advisor to other startups and nonprofits where he advises on AI, knowledge management, and sustainability. As a member of FLI, Richard's research interests include dynamic knowledge representation, ethical ensembles, and computational respect. Richard holds a degree in computer science and intelligent systems from Columbia University and is well-read in natural philosophy.



**Dr. James Manyika** is a director of the McKinsey Global Institute (MGI), McKinsey & Company's business and economics research arm, and one of its three global co-leaders. James is also a director (senior partner) at McKinsey, where he is one of the leaders of McKinsey's Global High Tech, Media and Telecom Practice. Based in Silicon Valley, for the past 18 years he has worked with many of the world's leading software, systems, Internet, media, and communications companies on a variety of issues, including strategy, innovation, and helped companies outside of the tech sector fully leverage technology for business transformation. James serves on the McKinsey's global committee that reviews and elects directors of the Firm.



**Betsy Masiello** is the Senior Manager for Global Public Policy at Google. Masiello heads up strategic planning and special projects for Google's public policy team. Prior to joining Google she was a consultant at McKinsey & Company, where she served global telecommunications companies on new business strategies around emerging technology. Masiello holds a BA in Computer Science from Wellesley College, a MSc in Economics from Oxford where she was a Rhodes Scholar, and an SM from MIT's Technology & Policy Program.



**Andrew McAfee**, a principal research scientist at MIT, studies how digital technologies are changing business, the economy, and society. His 2014 book on these topics, *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies* (co-authored with Erik Brynjolfsson) was a New York Times bestseller and was nominated by the Financial Times as one of the best business books of the year. He writes two blogs, academic papers, and articles for publications including Harvard Business Review, The Economist, The Wall St. Journal, and The New York Times. He's talked about his work on The Charlie Rose Show and 60 Minutes, at TED, Davos, the Aspen Ideas Festival, and in front of many other audiences.

He was educated at Harvard and MIT, where he is the co-founder of the Institute's Initiative on the Digital Economy.

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**Tom M. Mitchell** is an American computer scientist and E. Fredkin University Professor at the Carnegie Mellon University (CMU). He is the founding Chair of the Machine Learning Department at CMU. Mitchell is known for his contributions to the advancement of machine learning, artificial intelligence, and cognitive neuroscience and is the author of the textbook *Machine Learning*. He is a member of the United States National Academy of Engineering, a Fellow of the American Association for the Advancement of Science and a Fellow and Past President of the Association for the Advancement of Artificial Intelligence. Mitchell is a member of the standing committee for Stanford's new 100 Year Study of Artificial Intelligence.



**James H. Moor** is the Daniel P. Stone Professor of Intellectual and Moral Philosophy at Dartmouth College. He earned his Ph.D. in 1972 from Indiana University. Moor's 1985 paper entitled "What is Computer Ethics?" established him as one of the pioneering theoreticians in the field of computer ethics. He has also written extensively on the Turing Test. His research includes study in philosophy of artificial intelligence, philosophy of mind, philosophy of science, and logic. Moor was from 2002-2010 the editor-in-chief of *Minds and Machines*, a peer-reviewed academic journal covering artificial intelligence, philosophy, and cognitive science.



**Luke Muehlhauser** is MIRI's Executive Director. Since joining MIRI he has organized many research workshops, grown collaborations with Oxford University, Cambridge University, and MIT, and published articles in *Communications of the ACM*, *Slate*, *Quartz*, and other venues. Previously he was a team leader for deploying mission-critical enterprise-wide IT solutions in Los Angeles.



**Elon Musk** is the founder, CEO and CTO of SpaceX and co-founder and CEO of Tesla Motors. In recent years, Musk has focused on developing competitive renewable energy and technologies (Tesla, Solar City), and on taking steps towards making affordable space flight and colonization a future reality (SpaceX). He has spoken about the responsibility of technology leaders to solve global problems and tackle global risks, and has also highlighted the potential risks from advanced AI.



**Luke Nosek** is a co-founder of PayPal and served as the company's VP of Marketing and Strategy. While at PayPal, Luke oversaw the company's marketing efforts at launch, growing the user base to 1 million customers in the first six months. Luke also created "Instant Transfer," PayPal's most profitable product. Prior to PayPal, Luke was an evangelist at Netscape. Luke has also co-founded two other consumer Internet companies, including the Web's first advertising network, and was an active venture capitalist in his personal capacity before launching Founders Fund. Luke received a BS in Computer Science from the University of Illinois, Urbana-Champaign.

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**Seán Ó hÉigeartaigh** is the Executive Director of the Centre for the Study of Existential Risk. Previously, he was Senior Academic Manager at the Future of Humanity Institute, where he managed the Oxford Martin Programme on the Impacts of Future Technology, and helped establish the FHI-Amlin Collaboration on Systemic Risk. His research interests are in the impacts of emerging technologies, including near- and longer-term impacts of AI and robotics, biotechnology including synthetic biology and genomics, and geoengineering as well as in general methodologies such as horizon-scanning and foresight. Sean has a PhD in genome evolution, and a degree in human genetics.



**Toby Ord** is a Research Fellow on the Population Ethics project. He studies both the theoretical and practical questions of how we should make decisions when these would change the population. For example, some things governments or NGOs do to help people potentially have a large impact on the number of lives that will be brought into existence. Saving a young person's life will typically lead to them being able to have children who will have children and so forth. Saving an older person's life will not have this effect. This is a major difference, but how should we take this into account (if at all)? Other questions relate to whether the world is overpopulated, what the correct theory of population ethics is, how to account for our moral uncertainty surrounding the issue, and what this all means for the future of humanity.



**Laurent Orseau** is an associate professor (maître de conférences) since 2007 at AgroParisTech, Paris, France. In 2003, he graduated from a professional master in computer science at the National Institute of Applied Sciences in Rennes and from a research master in artificial intelligence at University of Rennes 1. He obtained his PhD in 2007. His goal is to build a practical theory of artificial general intelligence. With his co-author Mark Ring, they have been awarded the Solomonoff AGI Theory Prize at AGI'2011 and the Kurzweil Award for Best Idea at AGI'2012. Laurent has been a research scientist at Google DeepMind since September 2014.



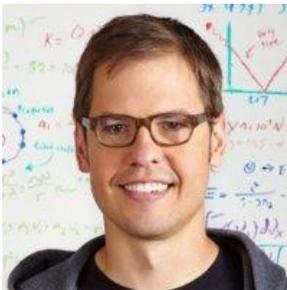
**Michael Osborne** is an Associate Professor in Machine Learning, Official Fellow of Exeter College and Faculty Member of the Oxford-Man Institute of Quantitative Finance, all at the University of Oxford. He co-leads the Machine Learning Research Group, a sub-group of the Robotics Research Group in the Department of Engineering Science.

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**David C. Parkes** is Harvard College Professor, George F. Colony Professor of Computer Science, and Area Dean for Computer Science at Harvard University, where he leads research at the interface between economics and computer science, with a focus on electronic commerce, artificial intelligence and machine learning, and where he founded the EconCS research group. He is a AAAI Fellow, and the recipient of the NSF Career Award, the Alfred P. Sloan Fellowship, the Thouron Scholarship and the Harvard University Roslyn Abramson Award for Teaching. Parkes received his Ph.D. in Computer and Information Science from the University of Pennsylvania in 2001, and an M. Eng. (First class) in Engineering and Computing Science from Oxford University in 1995. Parkes has served as Program Chair of ACM EC'07, AAMAS'08, and AAAI HCOMP'14, and General Chair of ACM EC'10 and WINE 2013. Parkes serves as the Chair of the ACM Special Interest Group on Electronic Commerce, an Editor of Games and Economic Behavior, and on the editorial boards of the Journal of Autonomous Agents and Multi-agent Systems, Journal of Artificial Intelligence Research (Special Track on Human Computation and AI), the ACM Transactions on Economics and Computation, and the INFORMS Journal of Computing.



**Scott Phoenix** is cofounder of Vicarious. Previously, Scott was Entrepreneur in Residence at the Founders Fund, Cofounder and CEO at Frogmetrics (Y Combinator S2008, Founders Fund, Felicis VC), CXO at OnlySecure (acquired by NetShops) and MarchingOrder (Ben Franklin Partners). His design work has been featured in 16 magazines and 3 museums, including the Institute for Contemporary Art in Philadelphia. Scott earned his BAS in Computer Science and Entrepreneurship from the University of Pennsylvania.



**Tomaso Armando Poggio** is the Eugene McDermott professor in the Department of Brain and Cognitive Sciences, an investigator at the McGovern Institute for Brain Research, a member of the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL) and the director of the NSF Center for Brains, Minds and Machines.



**Huw Price** is Bertrand Russell Professor of Philosophy and a Fellow of Trinity College at the University of Cambridge. He was previously ARC Federation Fellow and Challis Professor of Philosophy at the University of Sydney, where from 2002—2012 he was Founding Director of the Centre for Time. In Cambridge he is co-founder, with Martin Rees and Jaan Tallinn, of the Centre for the Study of Existential Risk.

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**Matthew Putman** is an American scientist, educator, musician and film/stage producer. He is best known for his work in nanotechnology, the science of working in dimensions smaller than 100 nanometers. Putman currently serves as the CEO of Nanotronics Imaging, which provides ultra high-resolution images for industry and science.



After working on the philosophy of mathematics at The Cooper Union, **Michele Reilly** lead a robotics team in the FIRST competition and advised hedge funds and major media outlets on topics from Bitcoin to global warming.

A geometric analyst with a strong interest in metaphysical and mathematical foundations, Michele has also worked on modern methods in geometric flows and applied them to machine learning for financial options trading. This involved using Navier–Stokes and Ricci flow techniques coupled with mathematical variational models. Recently, she has been interested in trying out similar methods on deep learning systems.

In 2013, she founded Turing Inc., a one-stop-shop for machine learning in the medical and life sciences and in-silico simulation of biological computations.



**H.M. Roff's** research interests pertain to international ethics and the ethics of the Responsibility to Protect doctrine, as well as issues of cyber warfare, lethal autonomous weapons, unmanned vehicles and emerging military technologies. Dr. Roff's approach to international ethics is particularly Kantian, and she is also a recognized Kant scholar. Her research stays and affiliations include being a research fellow at the Lehrstuhl für Strafrecht, Strafprozessrecht und Rechtsphilosophie, Friedrich-Alexander-Universität, Erlangen-Nürnberg in Germany, and she continues to affiliate as a research fellow at the Eisenhower Center for Space and Defense Studies at the United States Air Force Academy. She is currently a Visiting Associate Professor at the Josef Korbel School of International Studies at the University of Denver.



**Francesca Rossi** is a professor of computer science at the University of Padova, Italy. Currently she is on sabbatical at Harvard University with a Radcliffe fellowship. Her research interests are within artificial intelligence, and include constraint reasoning, preferences, multi-agent systems, and computational social choice. She has been president of the international association for constraint programming (ACP) and she is now the president of International Joint Conference on Artificial Intelligence (IJCAI), as well as the associate editor in chief for JAIR (Journal of AI Research).

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**Stuart Russell** received his BA with first-class honours in Physics from Oxford in 1982, his PhD in Computer Science from Stanford in 1986, and then joined the faculty of the University of California at Berkeley. He is a Professor (and former Chair) of Electrical Engineering and Computer Sciences and holds the Smith--Zadeh Chair in Engineering. He is a fellow of AAAI, ACM, and AAAS; winner of the Computers and Thought Award and the ACM Karl Karlstrom Outstanding Educator Award; and holder from 2012 to 2014 of the Chaire Blaise Pascal and ANR senior Chaire d'excellence in Paris. His book "Artificial Intelligence: A Modern Approach" (with Peter Norvig) is the standard text in AI and has been translated into 13 languages. His research covers many areas of artificial intelligence, with a particular focus on machine learning, probabilistic modeling and inference, theoretical foundations of rationality, and planning under uncertainty. He also works for the United Nations, developing a new global seismic monitoring system for nuclear treaty verification.



**Anders Sandberg** holds a Ph.D. in computational neuroscience from Stockholm University, and is currently a James Martin Research Fellow at the Future of Humanity Institute at Oxford University. Sandberg's research centres on societal and ethical issues surrounding human enhancement and new technology, as well as on assessing the capabilities and underlying science of future technologies. He has worked on whole brain emulation, global catastrophic risks and reasoning under extreme uncertainty.



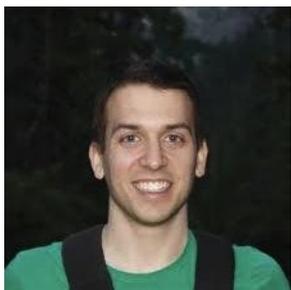
**Bart Selman** is a Professor of Computer Science at Cornell University. He previously was at AT&T Bell Laboratories. His research interests include computational sustainability, efficient reasoning procedures, planning, knowledge representation, and connections between computer science and statistical physics. He has (co-)authored over 100 publications, including six best paper awards. His papers have appeared in venues spanning Nature, Science, Proc. Natl. Acad. of Sci., and a variety of conferences and journals in AI and Computer Science. He has received the Cornell Stephen Miles Excellence in Teaching Award, the Cornell Outstanding Educator Award, an NSF Career Award, and an Alfred P. Sloan Research Fellowship. He is a Fellow of the American Association for Artificial Intelligence and a Fellow of the American Association for the Advancement of Science.



**Murray Shanahan** is Professor of Cognitive Robotics in the Dept. of Computing at Imperial College London, where he heads the Neurodynamics Group. He gained his PhD in computer science from Cambridge University in 1988. He took up a lectureship at Imperial College in 1998, where he became full professor in 2006. His publications span artificial intelligence, robotics, logic, dynamical systems, computational neuroscience, and philosophy of mind. His work up to 2000 was in the tradition of classical, symbolic AI, but since then has concerned brain-inspired cognitive architectures, neurodynamics, and consciousness. His book "Embodiment and the Inner Life" was published by OUP in 2010, and his recently completed book "The Technological Singularity" will be published by MIT Press in 2015.

# The Future of AI: Opportunities and Challenges

*Puerto Rico, January 2-5, 2015*



**Nate Soares** is a research fellow of the Machine Intelligence Research Institute, where he studies technical obstacles to aligning smarter-than-human systems with human interests. He is particularly interested in understanding how to design agents that could be aligned with human interests in theory, through research on topics such as corrigibility, value learning, and decision theory. Nate has bachelor's degrees in computer science and economics, and previously worked for Google.



**Marin Soljačić** received a BsE degree in physics and a BsE degree in electrical engineering from MIT in 1996. He earned his PhD in physics at Princeton University in 2000. In September 2000, he was named an MIT Pappalardo Fellow in Physics, and in 2003 was appointed a Principal Research Scientist in the Research Laboratory of Electronics at MIT. In September 2005, Soljačić became an Assistant Professor of Physics at MIT; in July 2010 an Associate Professor; and in July 2011 a Full Professor. Soljačić is also one of the founders of WiTricity Corporation (2007). Soljačić's main research interests are in electromagnetic phenomena, focusing on nanophotonics, non-linear optics, and wireless power transfer. He is the recipient of the Adolph Lomb medal from the Optical Society of America (2005), and the TR35 award of Technology Review magazine (2006). In 2008, he was named a MacArthur Fellow. Soljačić has been a correspondent member of the Croatian Academy of Engineering since 2009. In 2011, he became a Young Global Leader (YGL) of the World Economic Forum. In 2014, he was awarded Blavatnik National Award, as well as *Invented Here!* (Boston Patent Law Association).



**Jacob Steinhardt** is a graduate student in machine learning at Stanford University. He has previously done research in mathematics, robotics, and cognitive science, and is currently interested in combining tools from probability theory and program analysis to develop a framework for talking about “abstract beliefs”. He received a silver medal at the International Olympiad in Informatics and has been a coach for the USA Computing Olympiad since 2009. In his free time he likes to play Ultimate Frisbee and Bridge.



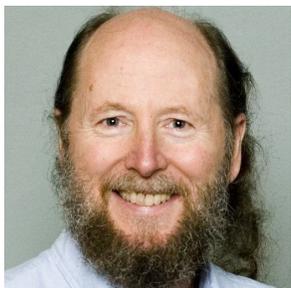
**Mustafa Suleyman** is co-founder of DeepMind Technologies. He is also co-founder of Reos Partners, a global conflict resolution firm specialising in addressing complex social challenges.

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**Ilya Sutskever** is a research scientist at Google, focusing on neural networks and machine learning. He received his PhD in the University of Toronto under the supervision of Geoffrey Hinton and was a co-founder of DNNResearch.



**Richard S. Sutton** is professor of computer science and iCORE chair at the University of Alberta. Professor Sutton is known for his significant contributions in the field of reinforcement learning. He is the author of the original paper on temporal difference learning. He is a fellow of the Association for the Advancement of Artificial Intelligence and co-author of the textbook Reinforcement Learning: An Introduction from MIT Press.



**Jaan Tallinn** is a founding engineer of Skype and Kazaa as well as co-founder of MetaMed, a personalized medical research company. He is a co-founder of the Cambridge Center for Existential Risk and the Future of Life Institute, and philanthropically supports other existential risk research organizations such as the Future of Humanity Institute, the Global Catastrophic Risk Institute and the Machine Intelligence Research Institute. He has also served on the Estonian President's Academic Advisory Board.



Known as "Mad Max" for his unorthodox ideas and passion for adventure, **Max Tegmark's** scientific interests range from precision cosmology to neuroscience and the ultimate nature of reality, all explored in his new popular book "Our Mathematical Universe". He is an MIT physics professor with more than two hundred technical papers and has featured in dozens of science documentaries. His work with the SDSS collaboration on galaxy clustering shared the first prize in Science magazine's "Breakthrough of the Year: 2003." He is a co-founder of the Foundational Questions Institute and the Future of Life Institute.



**Cecilia Tilli** is an Academic Project Manager at the Future of Humanity Institute, currently managing the Programme on the Impacts of Future Technology. Her research interests cut across core areas of the Institute, including the benefits and risks of future technology, the nature and future of computational systems, the relationship between natural and artificial cognitive systems, and the development and enhancement of natural cognition. Prior to joining the institute, Cecilia finished her Ph.D. in philosophy and neuroscience at Princeton University.

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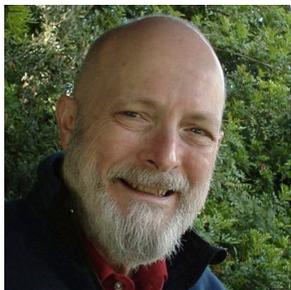


**Aaron VanDevender** is the Chief Scientist and a Principal at Founders Fund. He monitors the scientific impact of the portfolio, works with portfolio companies, assesses new technologies, and conducts his own research.

Prior to Founders Fund, Aaron was CTO of enterprise war games firm The Prosperity Institute. Aaron has designed single-photon and single-atom quantum computers in academia and government (NIST), advanced the quantum-mechanical theory for microscopic black holes, patented the fastest transparent optical switch, and is a co-inventor of yoctotechnology (named after the smallest unit prefix on the SI scale). He then developed next-generation DNA sequencing technology at Halcyon Molecular. His broad scientific interests encompass energy, biotech, nanotech, and computing. Aaron received a SB from MIT and a PhD in physics from the University of Illinois at Urbana-Champaign. In addition to entrepreneurial science, Aaron is a professional skydiver.



**Michael Vassar** has worked in molecular biology, genetics and nanoscale physics, has founded multiple start-ups, and was executive director of the Singularity Institute. As their director, he worked with eminent scientists in all major fields and directed both research and large scale conferences. He was inspired to found MetaMed Research by his discovery, in that capacity, that most potentially revolutionary developments in medical science never reach the public. He has also worked as a Peace Corps volunteer and as an inner city school teacher in Cincinnati.



**Vernor Vinge** is an emeritus professor of Computer Science at San Diego State University (SDSU), and a science fiction author. He is best known for his Hugo Award-winning novels and novellas *A Fire Upon the Deep* (1992), *A Deepness in the Sky* (1999), *Rainbows End* (2006), *Fast Times at Fairmont High* (2002), and *The Cookie Monster* (2004), as well as for his 1984 novel *The Peace War* and his 1993 essay "The Coming Technological Singularity", in which he argues that the creation of superhuman artificial intelligence will mark the point at which "the human era will be ended", such that no current models of reality are sufficient to predict beyond it.



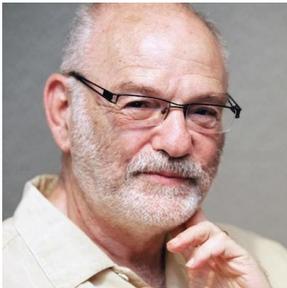
**Professor David Vladeck** teaches federal courts, civil procedure, administrative law, and seminars in First Amendment litigation, and co-directs the Institute for Public Representation, a clinical law program. Professor Vladeck recently returned to the Law Center after serving for nearly four years as the Director of the Federal Trade Commission's Bureau of Consumer Protection. At the FTC, he supervised the Bureau's more than 430 lawyers, investigators, paralegals and support staff in carrying out the Bureau's work to protect consumers from unfair, deceptive or fraudulent practices. Before joining the Law Center faculty full-time in 2002, Professor Vladeck spent over 25 years with Public Citizen Litigation Group, a nationally-prominent public interest law firm, handling and supervising complex litigation.

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**Mr. Kent Walker** has been Senior Vice President and General Counsel of Google Inc. since 2006. Mr. Walker is responsible for managing Google's global legal team and advising its board and management on legal affairs. Mr. Walker previously worked for eBay, AOL, Netscape, Liberate Technologies, and AirTouch Communications. Prior to his work in the technology sector, Mr. Walker served as an Assistant U.S. Attorney with the U.S. Department of Justice, where he specialized in the prosecution of technology crimes and advised the Attorney General on management and technology issues. He attended Harvard College and Stanford Law School.



**Wendell Wallach** is a consultant, ethicist, and scholar at Yale University's Interdisciplinary Center for Bioethics. He chairs the Center's working research group on Technology and Ethics and is a member of other research groups on Animal Ethics, Neuroethics, and End of Life Issues. He is also a Senior Scholar at The Hastings Center, a fellow at The Lincoln Center (ASU), and a fellow at the Institute for Ethics and Emerging Technologies (IEET). Wendell co-authored (with Colin Allen) *Moral Machines: Teaching Robots Right From Wrong* (Oxford University Press 2009), which maps the new field of enquiry variously called machine ethics, machine morality, computational morality, or friendly AI. *A Dangerous Master: How to Keep Technology from Slipping Beyond Our Control* (Wendell's forthcoming book) will be published by BASIC Books on June 2nd. Formerly, he was a founder and the President of two computer consulting companies, Farpoint Solutions and Omnia Consulting Inc. Among the clients served by his companies were PepsiCo International, United Aircraft, and the State of Connecticut.



**Adrian Weller** is a researcher in the Computational and Biological Learning Lab at Cambridge, after completing a PhD in machine learning at Columbia focusing on methods for inference in graphical models. He previously held senior positions in fixed income at Goldman Sachs, Salomon Brothers and Citadel Investment Group. He is an active angel investor and an advisor to several charities.

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**Dr. Alexander D. Wissner-Gross** is an award-winning scientist, inventor, and entrepreneur. He serves as an Institute Fellow at the Harvard University Institute for Applied Computational Science and as a Research Affiliate at the MIT Media Laboratory. He has received 114 major distinctions, authored 16 publications, been granted 22 issued, pending, and provisional patents, and founded, managed, and advised 4 technology companies, 1 of which has been acquired. In 1998 and 1999, respectively, he won the U.S.A. Computer Olympiad and the Intel Science Talent Search. In 2003, he became the last person in MIT history to receive a triple major, with bachelors in Physics, Electrical Science and Engineering, and Mathematics, while graduating first in his class from the MIT School of Engineering. In 2007, he completed his Ph.D. in Physics at Harvard, where his research on programmable matter, ubiquitous computing, and machine learning was awarded the Hertz Doctoral Thesis Prize. A popular TED speaker, his talks have been viewed more than 1.65 million times and translated into 26 languages. His work has also been featured in more than 150 press outlets worldwide including The New York Times, CNN, USA Today, the Wall Street Journal, and BusinessWeek.



**Eliezer Yudkowsky** is internationally recognized by the academic community for his role in developing the foundations of Friendly AI research. His ideas and technical research have become a focal point for research workshops held around the world and attended by researchers from Stanford, Harvard, Cambridge, MIT, UC Berkeley, Princeton, Google, and other leading institutions. He is also a promoter of “applied rationality” whose writings on psychology and philosophy of science have made the latest research in these fields accessible to thousands of teens and adults.