# ARTIFICIAL INTELLIGENCE IN SMART PHONES:

# **A BOON or BANE**

Pradeep Kumar U\*

Assistant Professor, Department of Commerce, Krupanidhi Degree College, Bangalore

#### Kiran J

Assistant Professor Department of Management, Krupanidhi Degree College, Bangalore

#### Abstract

The world today is depending upon the smart choices, smart perspectives, smart ideas and also looking forward to lead their lives smart using smart devices in the current scenario. With the help of AI we are driving our lives more in the easier form of the tasks we take up. Smart Phones are one among them which stimulates of human intelligence processes by machines, with the help of smart phones and the usage of the various AI Interfaces by various brands in the markets.

The era of AI has begun in Education, Finance, Law, Manufacturing, Health care to provide better role in providing solutions to their queries. All these AI applications can be a BOON to the end users but at the same time can also be an BANE raising many Security and Ethical Concerns like abuse of AI tools, sophisticated machine learning tools, complications in the issues of security, Self Driven cars (Hackers) and Smartphones Usage and Applications.

AI in smart phones can be as a medium of help to reduce the work/tasks but at the same time it can create lot of issues that could actually damage the Automation Systems due to many ethical concerns.

**Keywords:** Artificial Intelligence, Automation Systems, Machine Learning ,Human Intelligence , AI ,AI Tools ,AI Applications

#### Introduction

It is significant with the first comprehend what Artificial Intelligence (AI) really is. As indicated by the meaning of AI in Oxford word reference - Artificial Intelligence will be knowledge displayed by machines.

As machines become progressively competent, assignments considered to require "knowledge" are regularly expelled from the meaning of AI, a marvel known as the AI effect. A jest in Tesler's Theorem says "computer based intelligence is anything that hasn't been done yet. Modern machine capacities for the most part delegated AI incorporate effectively understanding human speech, contending at the most significant level in key game frameworks, (for example, chess and Go), independently working autos, wise steering in content conveyance systems, and military reproductions.

The advancement in AI is additionally bringing relentless outcomes for example destroying employments by the methods for work computerization, one such situation can be found in the Industry 4.0 system, which is these days being used in the car business. Industry 4.0 makes what has been known as a 'brilliant production line' wherein enormous number of robots take forward the entire assembling process with the assistance of digital physical frameworks, IoT and distributed computing.

#### Problems

AI in smartphones are developing in an incredible speed, sometimes seems to be magic. Researchers and developers possess a strong perspective that speed of AI growth could affect the humans themselves in future.

Humans can be threatened because of AI by few problems like – Threat to privacy, threat to human dignity, threat to safety, human laziness, abuse of AI tools, issues of security, hacking and smartphone applications.

#### Facts pertaining to the problems

In the year 2018 there were many breath taking innovations in the emerging of new technology that could surprise the humans. At the same time we saw them witnessing many controversies and shutdowns of popular consumer based and enterprise products like Google's Allo, Google +, the US based AI startup Lighthouse, Klout, Facebook's M and many more .

The above mentioned AI projects were shutdown due to privacy issues, security and safety, failures in commercial success , massive data leaks , misaligned expectations , incomplete data sets , wrong algorithms etc.,

### **Purpose of the Study**

This study not only helps us to know about the new advancements of AI in smart phone but also highlights the issues overall for the researchers, developers ,humans .AI can reach up to an unexpected level of making our lives more beneficial in terms of replacing the human efforts with surprising technology. Humans never say NO to new technology and fail to understand the threats as they are excited with the new world of technologies .AI is just booming up in all sectors to render inexperienced services to humans and seeing the future.

#### **Review of Literature**

Artificial Intelligence in Mobiles helped in finding the forecasts of smartphones worldwide from 2017-2021. The reason being advancement in technology– AI techniques in smartphones. It also highlights about how AI on smartphone's can remodel people's life loads.

Consumer Choice and Autonomy in the Age of Artificial Intelligence and Big Data explains about the consumer made choices and Autonomous choices in the era of AI having data as a resource. It also focuses on helping the researchers, practitioners, consumers and policy makers to the significance of perceived autonomy in consumer based choice in era of AI.

A Qualitative Research on marketing and sales in the Artificial Intelligence Age speaks about AI revolutionizing marketing and sales. It enables to know the impact of AI in marketing and sales as AI is replacing the sales jobs.

Impact of Artificial Intelligence in Marketing: - A perspective of marketing professionals of Pakistan. The research implies on understanding the AI in marketing and its impact on professionals of Pakistan to improve the performance of business by achieving profitability and competitive advantage.

Understanding the role of Artificial Intelligence in personalized engagement marketing where the role of social media, with the help of smartphone's can help the organization, business to get an personalized engagement with consumers to understand their needs/wants that could satisfies the consumers. This is possible only with AI by observed activities.

Hello marketing, what can Artificial Intelligence help you with? Most of the human jobs are replaced with AI to quick up the speed but at the same time some work to the expectations and some fail. Data Scientists can help formulate predictive models, machine learning approaches that could help them in marketing.

The Augmenting effects of Artificial Intelligence on Marketing Performance where the effects of AI on marketing performance can actually benefit the marketers in providing the solutions to the marketing problems. It's believed that AI could actually provide great value for marketing decision makers.

AI Benchmark: Running Deep Neural Networks on Android Smartphones. The latest achievements in machine learning and AI are highlighted under Android smartphone's. It also analyses the current mobile chipsets which can be potentially used for accelerating the execution of neural networks on smartphone's. This paper also presents the AI Benchmark that compares the performance associated with neural networks on smartphones.

Human Activity recognition with smartphone sensors using deep learning networks highlights the neural networks for human activity using smartphone sensors. The AI/ ML features to the Smartphones hello the humans to know the activities performed with the help of sensors embedded in the smart devices. These smart features can help the humans to record their activity and also can keep track on their fitness, health, sports etc., with the help of powerful sensors in the smart devices.

The promise of Artificial Intelligence driving innovation in the public and private sectors is discussed with its facts and uses. How transformation happens in one individuals life seeking various services like education, energy, environment, Health care, Industrial Operations, Consumer Convenience, Disaster Prevention and Response, Social Good, Public Safety and tell how AI is foreseen in coming days.

# Health Care and Social Services

Public Sectors can become more smarter by developing an image analysis algorithm for preventing vision loss in diabetes patients, a machine learning system capable of predicting schizophrenia by analyzing speech, AI analyze large amounts of oncological data figuring out how to prevent pancreatic cancer, Anti scopes using AI neural network to diagnose malaria etc., and various social services.

# Justice and Policing

AI is having the potentiality to be applied in public justice and policing. AI is being researched as a public safety resource with the help of AI application – facial recognition which is now accessible in both public and private sectors which could help in the individual identity recognition.

#### Border Services

AI is following the leap forward innovation for the border services.AI technologies are helping to advance more from their former roles of backend systems to prime position in digital enterprises and doing the same in digital public services. The new data systems can help the border agencies to react faster to the challenging behaviors at the borders.

#### Agriculture

AI in agriculture can revolutionize in the methods of agriculture which could help the countries to be called as agrarian economy. Autonomous indoor farming system using network sensors and machine learning with the help of AI and ML algorithm monitoring crops and also warns farmers using networked cameras as soon as a plant gets sick, forecasting of crop yields from spaces through deep learning image analysis software to analyze satellite photos of farmland to forecast the crop yields ,identifying weeds using computer vision algorithms in the crops , sorting of vegetables made easy by the farmers trained systems computer vision algorithms etc.,,

#### **Business Operations**

Most of the private sectors are in the verge of of using better AI and ML technologies in their business operations. Few examples of how AI can be used are- IBM has created ML tool called Deep Thunder for the weather analysis, learning hours to keep customers happy with the help of a tool called Satisfaction Prediction to know whether there customers are happy by the customer service interactions, reduction of gender bias in the workforce using natural language processing and machine learning. AI is also used in automating office assistants, AI and ML making customer support multilingual with the help of language transaction tools et.,

#### **Consumer Convenience**

AI has already started its actual job by detecting the location of an individual with the help of smartphones used and tells you the nearest convenient different types of services available in that location.

Consumer Convenience can happen through deep learning for finding the right restaurant, AI developed smartphones applications can help the users to specify financial goals and can help with efficient spending patterns to have enough money for upcoming payments. Machine Learning features can help the users to record the most visited or searched pathways and helping the consumers by their choices.

#### Education

The area of education has its own recognition for using AI and ML access to education today which wouldn't be so easy if there wasn't a feature called AI. Personalizing the math classes through teacher advisor applications, predictions the student dropouts on the on the basis of students evaluated fats, automated teacher assistants Solving the doubts of the Students through online courses – chat box etc., Learning new languages is now easy with the help of language learning software featuring AI and ML, helping students to give an feedback in real time with the help of a tool called Revision Assistant which uses ML.

#### Smart Mobility and Transportation

In today's scenario smart mobility and transportation are the backbones of the modern economy for both domestic, international trades and also for the public mobility and transport services. With the help of AI the public transportation can now be Autonomous.

Smartphone Applications can help to access the services of these self-driving public shuttles, self-driving Taxi's by Uber in Pittsburgh helping the passengers to drive around the city pick and drop off autonomously, Autonomous trucks, Automated parking using computer vision systems to analyze they truck parking lots etc.

# Implications of AI

A new era has begun for AI and it's applications in various areas/fields. AI is rapidly advancing in all areas to deliver the new experience. The two sectors of the market categorizing them into Public Sector and Private Sectors have started to imply AI.

Few countries have already implied AI successfully in their administration but face lots of issues in terms of collaboration with universities, efficient policy making, public decisions, and private companies. Public Sectors can make use of AI technology in a wider sense. With the help of chat box ,sensors, Data Analytics , Drones etc., Let us understand more how AI is helping the different sectors in creating a new world of technological experience.

## Conclusion

AI is getting a remarkable change in the private and public sectors driving many new innovations year by year. AI and ML have created a positive benchmark in all areas and its applications and to see much more.

This study helps to understand the smartness of phones with AI, ML features and tools benefiting the activities/ performance of an individual. Smartphones are ahead with AI technology in transformation and influence together for greater new experience. The smartphones having AI technology can boost up the sales in turn the economy will also boost up to an greater extent leading many developmental changes in many areas.AI influence can reach up-to be a greater mile stone as AI will be creating 58 Million net new jobs by 2022 accelerating the development and adoption of AI in smartphones and many other areas is a good thing to make lives more simpler.

#### Acknowledgement

The authors express their sincere gratitude to The Management, Krupanidhi Group of Institutions for supporting the work through Krupanidhi Research Incubator Centre (K-RIC) under Krupanidhi Degree College and the Research Mentors, Accendere, CL Educate Ltd.

#### References

"Grand Challenge '05," DARPA, accessed September 29, 2016, http://archive.darpa.mil/grandchallenge05/.

"Dave Ferrucci at Computer History Museum: How It All Began and What's Next," IBM Research Blog, December 1, 2011, https:// www.ibm.com/

blogs/research/2011/12/dave-ferrucci-at-computer-history-museum-how-it-all-began-and-whats-next/.

Sam Byford, "Google's AlphaGo AI Beats Lee Se-dol Again to Win Go Series 4-1," The Verge, March 15, 2016, http://www.theverge.com/2016/3/15/11213518/alphago-deepmind-go-match-5-result.

Olivia Solon, "Karim the AI Delivers Psychological Support to Syrian Refugees," The Guardian, March 22, 2016, https://www.theguardian.com/technol- ogy/2016/mar/22/karim-the-ai-delivers-psychological-support-to-syrianrefugees; Dina Bass, "Microsoft Develops AI to Help Cancer Doctors Find the Right Treatments," Bloomberg, September 20, 2016, http://www.bloomberg.com/news/articles/2016-09-20/microsoft-develops-ai-to-help-cancer-doctors-find- theright-treatments.

Robert D. Atkinson, "'It's Going to Kill Us!' and Other Myths About the Future of Artificial Intelligence," (Information Technology and Innovation Foun- dation, June 2016), http://www2.itif.org/2016-myths-machine-learning.pdf.

"AI Overview: Broad Discussions of Artificial Intelligence," AITopics, accessed September 29, 2016, http://aitopics.org/topic/ai-overview.

Herbert A. Simon, The Shape of Automation for Men and Management (New York: Harper & Row, 1965).

Calum Chase, Surviving AI: The Promise and Peril of Artificial Intelligence (Three C's, 2015), 104.

John Markoff, Machines of Loving Grace: The Quest for Common Ground Between Humans and Robots (New York: Ecco, 2015), 114.

Pedro Domingos, The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World (New York: Basic Books, 2015).

Amit Karp, "Deep Learning Will Be Huge—and Here's Who Will Dominate It," Venture Beat, April 2, 2016, http://venturebeat.com/2016/04/02/deep-learning-will-be-huge-and-heres-who-will-dominate-it/.

Irving Wladawksy-Berger, "Soft' Artificial Intelligence Is Suddenly Everywhere," The Wall Street Journal, January 16, 2016, http://blogs.wsj.com/ cio/2015/01/16/soft-artificial-intelligence-is-suddenly-everywhere/.

Atkinson, "It's Going to Kill Us!' and Other Myths About the Future of Artificial Intelligence."

"Cognitive Systems Accelerate Competitive Advantage," IDC, accessed September 29, 2016, http://www.idc.com/promo/thirdplatform/innovationac- celerators/cognitive. "Artificial Intelligence Explodes: New Deal Activity Record for AI Startups," CB Insights, June 20, 2016, https://www.cbinsights.com/blog/artificial-in- telligence-funding-trends/.

James Manyika et al., "Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy," (McKinsey Global Institute, May 2013), http://www.mckinsey.com/business-functions/business-technology/our-insights/disruptive-technologies.

Mark Purdy and Paul Daugherty, "Why Artificial Intelligence Is the Future of Growth," (Accenture, September 28, 2016), https://www.accenture.com/ us-en/\_acnmedia/PDF-33/Accenture-Why-AI-is-the-Future-of-Growth.pdf.

Will Knight, "Could AI Solve the World's Biggest Problems," MIT Technology Review, https://www.technologyreview.com/s/545416/could-ai-solve-the-

#### worlds-biggest-problems/.

Larry Greenemeier, "Human Traffickers Caught on Hidden Internet," Scientific American, February 8, 2015, http://www.scientificamerican.com/ article/human-traffickers-caught-on-hidden-internet/; Davey Alba, "Weeding Out Online Bullying Is Tough, So Let Machines Do It," Wired, July 10, 2015, https://www.wired.com/2015/07/weeding-online-bullying-tough-let-machines/; Michelle Horton, "Stanford Scientists Combine Satellite Data, Machine Learning to Map Poverty," Stanford News, August 18, 2016 http://news.stanford.edu/2016/08/18/combining-satellite-data-machine-learning-to-map-pov- erty/; Sean Captain, "How Artificial Intelligence is Finding Gender Bias at Work," Fast Company, October 10, 2015, https://www.fastcompany. com/3052053/elasticity/how-artificial-intelligence-is-finding-gender-bias-at-work.

Lindsey Kratochwill, "IBM Watson Can Now Help You With Your Christmas Shopping," Popular Science, November 17, 2015, http://www.popsci.com/ ibm-watson-can-now-help-you-with-your-christmas-shopping; Glen Martin, "This Company Uses AI to Accelerate Drug Discovery," O'Reilly, July 13, 2016, https://www.oreilly.com/ideas/this-company-uses-ai-to-accelerate-drug-discovery.

"Artificial Intelligence Expedites Breast Cancer Risk Prediction," ScienceDaily, August 29, 2016, https://www.sciencedaily.com/releas- es/2016/08/160829122106.htm.

Nelson Sizwe et al., "Integrating Artificial Intelligence Into Data Warehousing and Data Mining," Proceedings of the World Congress on Engineering and Computer Science 2015 2 (October 2015), pp. 819-823, http://www.iaeng.org/publication/WCECS2015/WCECS2015\_pp819-823.pdf.

Ben Popper, "How Netflix Completely Revamped Recommendations for Its New Global Audience," The Verge, February 17, 2016, http://www.thev- erge.com/2016/2/17/11030200/netflix-new-recommendation-system-global-regional.

Jared Newman, "Everything You Need to Know About AI Assistants, From Siri to Ozlo," Fast Company, May 17, 2016, https://www.fastcompany. com/3059719/handicapping-the-ai-assistants-from-siri-to-ozlo; Klint Finley, "Robot Radiologists Will Soon Analyze Your X-Rays," Wired, October 27, 2015, https://www.wired.com/2015/10/robot-radiologists-are-going-to-start-analyzing-x-rays/; Chris Weller, "The World's First Artificially Intelligent Lawyer Was Just Hired At A Law Firm," Tech Insider, May 16, 2016, http://www.techinsider.io/the-worlds-first-artificially-intelligent-lawyer-gets-hired-2016-5.

Joshua Hill, "Google's DeepMind AI reduces Data Center Cooling by 40%," Clean Technica, July 22, 2016, https://cleantechnica.com/2016/07/22/ googles-deepmind-ai-reduces-data-center-cooling-bill-40/.

Eric Limer, "A Fleet of Self-Driving Trucks Just Completed a 1,000-Mile Trip Across Europe," Popular Mechanics, April 7, 2016, http://www.popular- mechanics.com/cars/trucks/a20310/european-platooning-challenge-self-driving-trucks-1000-miles/; Alexis Madrigal, "Autonomous Robots Invade Retail Warehouses," Wired, January 27, 2009, https://www.wired.com/2009/01/retailrobots/.

Casey Newton, "Facebook Begins Using Artificial Intelligence to Describe Photos to Blind Users," The Verge, April 5, 2016, http://www.theverge.com/2016/4/5/11364914/facebook-automatic-alt-tags-blind-visually-impared.

Sarah Griffiths, "Automatic Sign Language Tool Can Translate Gestures into 'Readable Language," Daily Mail, June 23, 2014, http://www.dailymail.

co.uk/sciencetech/article-2666166/Automatic-sign-language-tool-translate-gestures-readable-language.html. 33. Ibid.

Weronika Jurkiewicz, "Machine Learning Can Help Kids With Autism Recognize Emotions," PSFK, March 23, 2016, http://www.psfk.com/2016/03/ machine-learning-help-kids-with-autism-microsoft-oxford-project.html.

Ian Steadman, "Applying Lessons From Self-Driving Cars to Self-Driving Wheelchairs," NewStatesman, November 25, 2013, http://www.newstates-man.com/future-proof/2013/11/applying-lessons-self-driving-cars-self-driving-wheelchairs.
37. Ibid

Rachel Metz, "App Listens for Danger When You're Not Paying Attention," MIT Technology Review, February 26, 2014, https://www.technologyreview.com/s/524971/app-listens-for-danger-when-youre-not-paying-attention/.

"How Motorleaf is Helping Automate Indoor Farming," AgFunderNews, July 20, 2016, https://agfundernews.com/motorleaf-helping-automate-in-

door-farming.html.

Leanna Garfield, "This Robot Has 'Eyes' That Can See Dying Plants Before Farmers Can," Tech Insider, July 8, 2016, http://www.techinsider.io/pros- pera-robot-can-see-dying-plants-before-farmers-2016-7.

Robinson Meyer, "The Start-Up That Watches Cord Grow, From Orbit," The Atlantic, August 10, 2016, http://www.theatlantic.com/technology/ar-chive/2016/08/seeing-corn-with-satellites/495149/.

Joshua New, "5 Q's for Mark Johnson, Founder of Descartes Labs," Center for Data Innovation, September 2, 2016, https://www.datainnovation.org/2016/09/5-qs-for-mark-johnson-founder-of-descartes-labs/.

Matt Simon, "The Future of Humanity's Food Supply Is in the Hands of AI," Wired, May 25, 2016, https://www.wired.com/2016/05/future-humani- tys-food-supply-hands-ai/.

Dave Gershgorn, "The Ultimate Promise of Artificial Intelligence Lies in Sorting Cucumbers," Quartz, September 1, 2016, http://qz.com/771921/the-ultimate-promise-of-artificial-intelligence-lies-in-sorting-cucumbers/.

Roland Moore-Colyer, "IBM Launches Deep Thunder to Use Machine Learning and Big Data for Local Weather Forecasts," V3, June 16, 2016, http:// www.v3.co.uk/v3-uk/news/2461798/ibm-launches-deep-thunder-to-use-machine-learning-and-big-data-for-local-weather-forecasts.

"Zendesk's Satisfaction Prediction Brings Machine Learning to the Customer Experience," news release, March 15, 2016, https://www.zendesk.com/company/press/zendesks-satisfaction-prediction-brings-machine-learning-customer-experience/.

Vivian Giang, "The Growing Business of Detecting Unconscious Bias," Fast Company, May 5, 2015, https://www.fastcompany.com/3045899/hit-the-ground-running/the-growing-business-of-detecting-unconscious-bias.

Ben Popper, "The Smart Bots Are Coming and This One is Brilliant," The Verge, April 7 2016, http://www.theverge.com/2016/4/7/11380470/ amy-personal-digital-assistant-bot-ai-conversational.

Rip Empson, "Unlabel Launches a Human-Edited Machine Translation Service to Help Businesses Go Global, Localize Customer Support," TechCrunch, March 23, 2014, https://techcrunch.com/2014/03/23/unbabel-launches-a-human-edited-machine-translation-service-to-help-businesses-go- global-and-localize-customer-support/.

Ainsley O'Connell, "Your Photo of a Burrito is Now Worth a Thousand Words," Fast Company, July 17, 2016, https://www.fastcompany.com/3060884/your-photo-of-a-burrito-is-now-worth-a-thousand-words. 62. Ibid.

Preetam Kaushik, "Is Artificial Intelligence the Way Forward for Personal Finance?," Wired, February, 2014, https://www.wired.com/insights/2014/02/ artificial-intelligence-way-forward-personal-finance/.

April Glaser, "Pepper, the Emotional Robot, Learns How to Feel like an American," Wired, June 7, 2016, https://www.wired.com/2016/06/pep-per-emotional-robot-learns-feel-like-american/. 66. Ibid.

Tom Brant, "Pinterest Encourages Shopping Frenzy with New AI Features," PC Magazine, June 28, 2016, http://www.pcmag.com/news/345688/pin- terest-encourages-shopping-frenzy-with-new-ai-features.

Max Lewontin, "How Google Photos Uses Machine Learning to Create Customized Albums," Christian Science Monitor, March 24, 2016, http://www. csmonitor.com/Technology/2016/0324/How-Google-Photos-uses-machine-learning-to-create-customized-albums.

Chris Baraniuk, "Earthquake Artificial Intelligence Knows Where Damage is Worst," New Scientist, September 30, 2015, https://www.newscientist.com/article/mg22830412-800-earthquake-artificial-intelligence-knows-where-damage-is-worst/.

Andrew Good, "A.I. Could be a Firefighter's 'Guardian Angel,' "NASA Jet Propulsion Laboratory, August 11, 2016, http://www.jpl.nasa.gov/news/news.php?feature=6590.

Larry Greenemeier, "Smart Machines Join Humans in Tracking Africa Ebola Outbreak," Scientific American, September 24, 2014, http://www.scien-tificamerican.com/article/smart-machines-join-humans-in-tracking-africa-ebola-outbreak/.

"HealthMap," HealthMap, accessed September 29, 2016, http://www.healthmap.org/en/.

Katie Collins, "How AI, Twitter and Digital Volunteers Are Transforming Humanitarian Disaster Response," Wired, September 30, 2013, http://www.wired.co.uk/article/digital-humanitarianism.

Rebecca Merrett, "Machine Learning Used to Predict Hazardous Solar Flares," CIO, January 16, 2015, http://www.cio.com.au/article/564056/ma-chine-learning-used-predict-hazardous-solar-flares/.

Elizabeth Harris, "Next Target for IBM's Watson? Third-Grade Math," New York Times, September 27, 2016, http://www.nytimes.com/2016/09/28/ nyregion/ibm-watson-common-core.html?\_r=0.

"ML Predicts School Dropout Risk & Boosts Graduation Rates," Microsoft, June 4, 2015, https://blogs.technet.microsoft.com/machinelearn-ing/2015/06/04/ml-predicts-school-dropout-risk-boosts-graduation-rates/.

Jason Maderer, "Artificial Intelligence Course Creates AI Teaching Assistant," Georgia Tech News Center, May 9, 2016, http://www.news.gatech.edu/2016/05/09/artificial-intelligence-course-creates-ai-teaching-assistant.

Parul Goliani, "Duolingo Looks to Dominate the Mobile Education Market With New Flashcard App TinyCards," Forbes, July 22, 2016, http://www. forbes.com/sites/parulguliani/2016/07/22/duolingo-looks-to-dominate-the-mobile-education-market-with-new-flashcard-app/.

Carl Straumsheim, "Detecting More Than Plagiarism," Inside Higher Ed, January 21, 2016, https://www.insidehighered.com/news/2016/01/21/turni-tin-expanding-beyond-plagiarism-detection-launches-revision-assistant.

Lucas Mearian, "IBM's Machine-Learning Crystal Ball Can Foresee Renewable Energy Availability," Computerworld, July 16, 2015, http://www.com- puterworld.com/article/2948987/sustainable-it/ibms-machine-learning-crystal-ball-can-foresee-renewable-energy-availability.html.

"ORNL Researchers Develop 'Autotune' Software to Make It Quicker, Easier, and Cheaper to Model Energy Use of Buildings," Department of Energy, October 15, 2014, http://energy.gov/eere/buildings/articles/ornl-researchers-develop-autotune-software-make-it-quicker-easier-and.

Jack Clark, "I'll Be Back: The Return of Artificial intelligence," Bloomberg, February 3, 2015, http://www.bloomberg.com/news/articles/2015-02-03/i- ll-be-back-the-return-of-artificial-intelligence.

"Programming Isn't Proven," Nest, accessed September 29, 2016, https://nest.com/thermostat/real-savings/; "An Introduction to Learning on the Nest Learning Thermostat," Nest, accessed September 29, 2016, https://nest.com/support/article/An-introduction-to-learning.

"An Introduction to Learning on the Nest Learning Thermostat," Nest.

Larry Hardesty, "Siting Wind Farms More Quickly, Cheaply," MIT News, July 17, 2015, http://news.mit.edu/2015/siting-wind-farms-quickly-cheap-ly-0717. 105. Ibid.

Adele Peters, "This AI Watches Satellite Photos and Says 'It Looks Like You're About to Cut Down a Forest. Could You Not?," Wired, May 11, 2015, https://www.fastcoexist.com/3046014/this-ai-watches-satellite-photos-and-says-it-looks-like-youre-about-to-cut-down-a-forest-cou.

Will Knight, "How Artificial Intelligence Can Fight Air Pollution in China," MIT Technology Review, August 31, 2015, https://www.technologyreview.com/s/540806/how-artificial-intelligence-can-fight-air-pollution-in-china/.

Jackie Snow, "Rangers Use Artificial Intelligence to Fight Poachers," National Geographic, June 12, 2016, http://news.nationalgeographic. com/2016/06/paws-artificial-intelligence-fights-poaching-ranger-patrols-wildlifeconservation/.

Jody Avirgan, "Big Data Is Saving This Little Bird," FiveThirtyEight, October 16, 2015, http://fivethirtyeight.com/datalab/big-data-is-saving-this-lit- tle-bird/.

Arion McNicoll and Stefanie Blendis, "Green Machine: Intelligent Robot System Recycles Waste," CNN, June 10, 2013, http://www.cnn.com/2013/06/07/tech/zenrobotics-recycling-robot/.

"Now There's an App for That: Computers Can Recognise a Complication of Diabetes That Can Lead to Blindness," The Economist, September 19, 2015, http://www.economist.com/news/science-and-technology/21664943-computers-can-recognise-complication-diabetes-can-lead-blindness-now.

Adrienne Lafrance, "Computers Can Predict Schizophrenia Based on How a Person Talks," The Atlantic, August 26, 2015, http://www.theatlantic.com/technology/archive/2015/08/speech-analysis-schizophrenia-algorithm/402265/.

Laura Lorenzetti, "This Company Wants to Cure Pancreatic Cancer Using AI," Fortune, April 22, 2016, http://fortune.com/2016/04/22/berg-pacreat-

ic-cancer-artificial-intelligence/.

Anna Nowogrodzki, "Artificial Intelligence Offers a Better Way to Diagnose Malaria," MIT Technology Review, February 10, 2016, https://www.tech- nologyreview.com/s/600779/artificial-intelligence-offers-a-better-way-to-diagnose-malaria/#/set/id/600798/.

"How Machine Learning Can Help with Voice Disorders," ScienceDaily, August 29, 2016, https://www.sciencedaily.com/releas- es/2016/08/160829140438.htm.

Lean A. Santos, "Using Artificial Intelligence to Revolutionize Diabetes Treatment," Devex, April 8, 2016, https://www.devex.com/news/using-artifi-cial-intelligence-to-revolutionize-diabetes-treatment-87989.

Chris Wood, "Machine-Learning Robot Could Streamline Drug Development," New Atlas, February 10, 2016, http://newatlas.com/machine-learn- ing-drug-development/41759/.

Eliza Strickland, "Autonomous Robot Surgeon Bests Humans in World First," IEEE Spectrum, May 4, 2016, http://spectrum.ieee.org/the-human-os robotics/medical-robots/autonomous-robot-surgeon-bests-human-surgeons-inworld-first.

Alex Hern, "Google DeepMind and UCLH Collaborate on AI-Based Radiotherapy Treatment," The Guardian, August 30, 2016, https://www.theguard- ian.com/technology/2016/aug/30/google-deepmind-ucl-ai-radiotherapy-treatment-.

"Scientists Teaching Machines to Make Clinical Trials More Successful," Science Daily, April 27, 2016, https://www.sciencedaily.com/releas-es/2016/04/160427095057.htm.

"Offerings," DataRPM, accessed September 29, 2016, http://www.datarpm.com/offerings.php.

Christopher Alessi and Chase Gummer, "Germany Bets on 'Smart Factories' to Keep Its Manufacturing Edge," The Wall Street Journal, October 26, 2014, http://www.wsj.com/articles/germany-bets-on-smart-factories-to-keep-its-manufacturing-edge-1414355745.

Tomas Kellner, "Deep Machine Learning: GE and BP Will Connect Thousands of Subsea Oil Wells to the Industrial Internet," GE Reports, July 8, 2015, http://www.gereports.com/post/123572457345/deep-machine-learning-ge-and-bp-will-connect/.

"GE's Industrial Software to Boost Efficiency across BP's Global Operations," news release, July 8 2015, https://www.ge.com/digital/press-releases/ ge-industrial-software-to-boost-efficiency-across-bp-global-operations; "GE Oil & Gas Partners with BP, Paradigm," Offshore, January 28, 2016, http:// www.offshore-mag.com/articles/2016/01/ge-oil-gas-partners-with-bp-paradigm.html.

"In the World of Perishables, Forecast Accuracy is Key," SupplyChainBrain, August 6, 2014, http://www.supplychainbrain.com/content/industry-ver- ticals/food-beverage/single-article-page/article/in-the-world-of-perishables-forecast-accuracy-is-key/.

"Project Dreamcatcher," Autodesk, accessed October 3, 2016, https://autodeskresearch.com/projects/Dreamcatcher.

"Shot in the Dark: New Surveillance Tool Called ShotSpotter Traces and Records Incidents of Gunfire," ScienceDaily, April 16, 2016, https://www.sciencedaily.com/releases/2016/04/160416130850.htm.

Maud Rozee, "The NYPD Can Now Pinpoint the Exact Location of a Gunshot," Gothamist, March 17, 2015, http://gothamist.com/2015/03/17/ nypd\_pinpointing\_gunshots.php.

Sean Captain, "Hitachi Says It Can Predict Crimes Before They Happen," Fast Company, September 28, 2015, https://www.fastcompany.com/3051578/elasticity/hitachi-says-it-can-predict-crimes-before-they-happen.

Dan Moren, "Autonomous Robots to Help Remove Car Bomb Threats," Popular Science, April 29, 2015, http://www.popsci.com/autonomous-robots-help-remove-car-bomb-threats.

Michael Madaio et al., "Firebird: Predicting Fire Risk and Prioritizing Fire Inspections in Atlanta," (KDD 2016, San Francisco, California, August 13-17, 2016), http://www.kdd.org/kdd2016/subtopic/view/firebird-predicting-fire-risk-and-prioritizing-fire-inspections-in-atlanta.

Alex Davies, "The Brilliant Machine That Could Finally Fix Airport Security," Wired, July 7, 2014, https://www.wired.com/2014/07/qylur-securi-ty-world-cup/.

Sarah Emerson, "Artificial Intelligence is Predicting Human Poverty from Space," Motherboard, August 18, 2016, http://motherboard.vice.com/en\_ca/read/artificial-intelligence-is-predicting-human-poverty-from-space.

"Mobile Phone Data Reveals Literacy Rates in Developing Countries," MIT Technology Review, July 13, 2016, <u>https://www.technologyreview</u>.com/s/601895/mobile-phone-data-reveals-literacy-rates-in-developing-countries/.

Larry Greenemeier, "Human Traffickers Caught on Hidden Internet," Scientific American, February 8, 2015, http://www.scientificamerican.com/ article/human-traffickers-caught-on-hidden-internet/.

Andy Greenberg, "Inside Google's Internet Justice League and Its AI-Powered War on Trolls," Wired, September 19, 2016, https://www.wired.com/2016/09/inside-googles-internet-justice-league-ai-powered-war-trolls/.

Olivia Solon, "Karim the AI Delivers Psychological Support to Syrian Refugees," The Guardian, March 22, 2016, https://www.theguardian.com/tech-nology/2016/mar/22/karim-the-ai-delivers-psychological-support-to-syrianrefugees.

Matt Hamblen, "Self-Driving Olli Shuttle With IBM Watson Debuts in Washington Area," Computerworld, June 17, 2016, http://www.computerworld. com/article/3085454/internet-of-things/self-driving-olli-shuttle-with-ibm-watson-debuts-in-washington-area.html.

Eric Limer, "A Fleet of Self-Driving Trucks Just Completed a 1,000-Mile Trip Across Europe," Popular Mechanics, April 7, 2016, http://www.popular-mechanics.com/cars/trucks/a20310/european-platooning-challenge-self-driving-trucks-1000-miles/.

Max Chafkin, "Uber's First Self-Driving Fleet Arrives in Pittsburgh This Month," Bloomberg, August 18, 2016, http://www.bloomberg.com/news/fea- tures/2016-08-18/uber-s-first-self-driving-fleet-arrives-in-pittsburgh-this-month-is06r7on.

Peter Ker, "Rio Tinto Pushes Ahead with Driverless Trains in Pilbara," The Sydney Morning Herald, March 10, 2015, http://www.smh.com.au/busi-ness/mining-and-resources/rio-tinto-pushes-ahead-with-driverless-trains-in-pilbara-20150309-13z28v.html.

Aarian Marshall, "Parking a Truck Is a Pain in the Butt. Tech to the Rescue!" Wired, June 6, 2016, https://www.wired.com/2016/06/parking-truck- pain-butt-tech-rescue/.

"What Is Machine Learning," TechTarget, accessed September 29, 2016, http://whatis.techtarget.com/definition/machine-learning.

"A Basic Introduction to Neural Networks," University of Wisconsin Department of Computer Sciences, accessed September 29, 2016, http://pages.cs.wisc.edu/~bolo/shipyard/neural/local.html.

Amit Karp, "Deep Learning Will Be Huge—and Here's Who Will Dominate It," Venture Beat, April 2, 2016, http://venturebeat.com/2016/04/02/ deep-learning-will-be-huge-and-heres-who-will-dominate-it/.

Matt Kiser, "Introduction to Natural Language Processing," Algorithmia, August 11, 2016, http://blog.algorithmia.com/introduction-natural-lan- guage-processing-nlp/.

T.S. Huang, "Computer Vision: Evolution and Promise," CERN School of Computing, no. 19 (1996): 21-25, http://cds.cern.ch/record/400313/files/ p21.pdf.

Bernard Marr, "What Everyone Should Know About Cognitive Computing," Forbes, March 23, 2016, http://www.forbes.com/sites/bernard- marr/2016/03/23/what-everyone-should-know-about-cognitivecomputing/#a64bc145d6e7; John E. Kelly III, "Computing, Cognition, and the Future of Knowing," (IBM, October 2015), http://www.research.ibm.com/software/IBMResearch/multimedia/Computing\_Cognition\_WhitePaper.pdf.