



2018 Top 10 Emerging Technology Predictions

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By Hemi Ventures

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INTRODUCTION

This report will cover our predictions for top 10 emerging trends in 2018. Our team at Hemi Ventures has been fortunate to partner with world class technology leaders to identify these trends in the forward thinking areas of Artificial Intelligence, Autonomous Driving, and Biotech. Being aware of how the future technologies will shape our industry, humanity, and the greater good is only one part of having this foresight. The second part is nurturing and empowering the companies to progress the technology to maturity. These trends matter significantly because they are emerging technologies that have not yet hit mass scale or the mainstream.

This report was produced from the inputs of a special research committee of experts from top academic researchers at Stanford, and government leadership at DARPA and the most innovative startups (including some of our portfolio companies). Many of these leaders spoke at our recent XYZ Conference in San Francisco last December. Our extensive research on the growing market size along with the trajectory of the technology needs meeting the adoption; assists to justify these trends. These early trend signals will provide an impactful increase of influence to the general public in the coming years. Hemi Ventures' perspective on these emerging trends will be to continue to foster mentorship and support to the world class entrepreneurs that have the responsibility to positively transform the ecosystem.

About Hemi Ventures

Hemi Ventures is a Silicon Valley-based venture capital firm that invests in early stage companies. Hemi has backed frontier technology companies in the Artificial Intelligence, Autonomous Vehicle, Robotics and Biotech sectors. Hemi's mission is to invest in the technologies that solve the big problems. As the other half to founders, Hemi works hand in hand with entrepreneurs, empowering them to dream big and develop new ideas that can make the world better.

Peaking Inside the A.I. Black Box

With artificial intelligence, we are only scratching the surface with the training of models from datasets. Models can be trained to build context and learn from past data. As we get more quality data inputs, the outputs that the model produces becomes more richer. However, making more sense of it to understand the WHY is still needed to uncover the reasoning behind the model's decisions, recommendations, and how they will soon trigger automated actions.

The Defense Advanced Research Projects Agency (DARPA), part of the Department of Defense, is responsible for the development of emerging technologies for use by the military. It created a new program last year called The Explainable AI (XAI) program aiming to create a suite of machine learning techniques that:

- Produce more explainable models, while maintaining a high level of learning performance(prediction accuracy); and
- Enable human users to understand, appropriately trust, and effectively manage the emerging generation of artificially intelligent partners.

For a long time, artificial intelligence has been considered a black box where no justification was made on how algorithms made decisions and provided recommendations. This concept opens up a brand new level of evaluation and trust for the black box of artificial intelligence. Previously, entities and individuals had to trust that algos and artificial intelligence would be the system of record and truth. As a result, artificial intelligence now has accountability and is transparent in sharing its decision making process.



“Explainable AI will be essential if users are to understand, appropriately trust, and effectively manage this incoming generation of artificially intelligent partners.”

David Gunning
Program Manager, DARPA

Humans will Adapt to A Seamless Relationship with Autonomous Vehicles

In a world where autonomous vehicles are safe and their deployment will practically happen sooner than later, the question of how these autonomous vehicles interact with humans is at the forefront. Humans will utilize this technology, its relationship with it and how behavior will change in the process. For example, it is important to understand, predict, and design new ways of communicating between pedestrians with autonomous vehicles at pedestrian crosswalks, how these driverless cars communicate with other human driven vehicles at 4-way intersections, etc. Much of human interaction with mobility includes social interaction. For vehicles to be deployed at scale, a seamless experience between autonomous vehicles with passengers, pedestrians, other drivers, and other stakeholders have to be achieved.

People tend to interact with technology socially, whether they are pedestrians looking to establish eye contact at an interaction, or drivers hoping to share, control without complete disengaging autonomy. People's reactions were interesting to understand their comfort level with the car and various forms of communication. With the increased attention to the autonomous vehicle, human will make progress to adapt to a driverless future.



“The key for researchers is to create elegant ways for cars to behave and communicate, in order to maintain awareness and trust and to encourage people to consider them as partners.”

David Sirkin
Research Associate, Stanford University

A Universal Safety Standard will be Developed for Self-driving Cars

It is widely expected that autonomous vehicles will generate trillions of economic benefits in the next decades. This massive R&D project driven by carmakers, suppliers, tech giants and startups has started to pay dividends. Trials are started in major cities in U.S, Europe and Asia with optimists hoping for a driverless futures.

As with the current platforms and machines in general, customers expect it to work all the time and continuously. When there is any deviation from this expectation, consumer's are not satisfied with the result. With autonomous vehicles, hundreds of billions of miles need to be driven in order to ensure safety. To bridge this testing divide, companies are utilizing new simulation technology to augment real-miles driven, investing in new sensor systems as well as adopting ISO standards in order to deploy vehicles in mass.

As the industry develops, and government regulators better understand the safety standards and processes, there will be a universal safety standard developed within each region. Only with strict verification and validation of software, hardware and development processes will the public feel confident that autonomous vehicles are safe.



“For true deployment of autonomous vehicles, companies need to solve both the behavioral safety issues and the functional safety issues.”

Josh Hartung
Chief Executive Officer, PolySync

From Hype to Practice - Companies Learn How to Use Artificial Intelligence

For the enterprise, the principles of artificial intelligence and deep learning have changed. In the past, it was initially assumed that a sophisticated model that was trained with historical data could potentially replace an employee, persona, or a manual process. However, thinking further and more realistically, artificial intelligence is becoming more of a commodity that is difficult to monetize, and more of an expectation. However, the trends of expectations have changed.

What can be inferred from this is that artificial intelligence is not ready to completely replace the entire workforce. The technology is not optimized for this yet. However, there are some tasks that are great candidates for automation. These are the tasks that are closely tied to assisting in improving the bottom line for most companies. The full solution of artificial intelligence to be referred to as “pure ai” which comprises of a combination of various techniques such as computer vision, natural language recognition, and speech/sensory recognition. Today, it is the augmentation of workflows that are the most impactful to the enterprises. Augmenting the workforce enhances the throughput of a talented organization. With human capital becoming a finite resource, the challenge quickly became about helping companies leverage existing resources to play in the world of deep learning. Large tech companies have poured billions of dollars into developing their own open-source technologies, while a handful of specialized startups are capturing the opportunities to serve the enterprise customers.



“Economic, societal, and technology change make AI both possible and necessary. We’re in the midst of a global corporate arms race for AI.”

Chris Nicholson
Chief Executive Officer, Skymind

Multi-scale Data for Modeling Complex Diseases

Patients will be more interested and aware of their health. Helping to demystify both the meaning of the data and how to personalize treatment will be crucial so that the treatment can be tailored to address the unique healthcare needs. However, just one modality of data is not sufficient to provide the big picture of making sense of a patient's medical picture.

Patients are empowered by making use of their medical records to build models. Data fusion work using Bayesian and kernel methods are now studied to identify and predict breast and ovarian cancer. Furthermore, computational algorithms are developed for the identification of driver genes using multi-omics data. It becomes possible to study a patient from multiple angles and scales with multi-modal, multi-scale, high dimensional, and high throughput biomedical data. Whether analyzed to impact the patient or doctor, these techniques will provide the additional dimensions to assist either the patient or doctor when it comes to the right type of tailored treatment.



“In the future of tailored medicine, we will need to develop flexible framework that can be tuned towards different applications, solutions for unlabeled data, and work on the explanation of models.”

Olivier Gevaert
Assistant Professor, Stanford University

Regenerating Human Organs Without Stem Cells

Regenerative medicine is an emerging field of research that focuses on the repair, replacement or regeneration of cells, tissues or organs to restore impaired function. The study of regenerative medicine has the potential to help scientists and clinicians devise early-intervention treatments for traumatic injury or degenerative diseases, by regrowth or replacement of cells or tissues. Regenerative medicine's original focus concentrate on the field of tissue engineering, and aiming to replace damage tissues and organs using stem cells. This method not only faces technical challenges as researchers struggles to control the behaviors of stem cells, but also any treatment as such must perform a lengthy and complete set of preclinical and clinical studies for Food and Drug Administration (FDA) regulatory approval as a biologic.

Currently, regenerative medicine has now expanded to encompass the use of stem cells for modeling disease as well as autologous transplant and therapeutic delivery of functional molecules, the production of tissues and organs in a dish, the role of immune function in tissue repair, and the burgeoning area of biomedical engineering. New approaches to regenerative medicines has also been developed as demonstrated by BioAesthetics team. The team invented a new way to utilize existing tissues from donors for the good of patients. Its proprietary method decellularizes existing tissues from patients and can be re introduced to patient bodies without evoking severe immune response. We believes that in the future, similar method can be adopted to regenerate more complex organs including human lungs.



“Our technology is not only essential to breast cancer patients, it also has significant implication in the regenerative medicine world as we see this technology being used in regenerating many other sophisticated human organs in the future.”

Nicholas Pashos
Chief Executive Officer, BioAesthetics

Augmenting Humans to Automate the Workforce

One of the core societal impacts being discussed around the adoption of Autonomous Vehicles is its potential to displace the millions of professional drivers that are on the roads. Similar concerns exist with all forms of automation. Machines are developing increased capabilities while their costs are being reduced. How will humans compete?

Human workers will find ways to adapt. This trend is already being seen where worker's workflows are being augmented to be more productive and efficient. This augmentation of the worker will offset the investment return of automation in specific areas and roles where humans are better equipped to fulfill. Technology innovations in exoskeletons, augmented reality, robotics and artificial intelligence are all serving workers to perform better at their jobs. Furthermore, companies are beginning to respond by investing in these technologies. Augmented reality is not only a form for entertainment, but becoming a useful way to assist people in their work, reduce injury and fatigue, increase productivity, all of which will lead to a better working environment.



“With increasing demands for human labor, there is an immediate demand globally on human augmentation to increase safety, speed up productivity, and reduce mistakes/errors.”

Angelo Stracquatano
Chief Executive Officer, Apprentice

A New Era of Cyber Risks for Small Business

Whether its computers, smartphones, autonomous vehicles or augmented reality glasses of the future, society's dependence on machines is creating vulnerabilities in both the performance of these devices and the data that is stored on them. As risks are quickly evolving, the ability to protect data and assets must also evolve. This has been applied to consumers and large companies in various ways, but there is a strong trend innovation in cybersecurity in small businesses.

In 2016, there were 28.8 million small businesses, which accounted for 99.7% of US businesses. This made up more than 66% of all jobs since 1970. In order to be successful, small businesses have to leverage technology to distribute their product globally, better serve customers who are changing purchasing behaviors, and gain analytic insights into their customers. Small businesses have aggressively adopted cloud based software services in order to maintain flexibility in data needs for a monthly fee. This dependence on cloud services combined with the proliferation of mobile phones has created a new environment for cyber risks - where small business vulnerabilities are continuously changing. A new generation of cyber protection solutions are rising to help small business to be more secure.



“70% of all attacks target small businesses and of those companies hacked, 60% go out of business after 6 months. This is a big problem.”

Han Wang
Chief Executive Officer, Paladin Cyber

Understanding Drug Behavior from 2D to 3D Environment

Pharmaceutical companies are facing a dwindling return from their investment on drug research and development, and the number of blockbuster drugs have been on the decline. In addition, they are facing public and regulatory pressures to lower prices. Drugs are facing an increasing percentage of failure rates because they were often tested on outdated 2D platforms and slow, immune-deficient mouse studies before clinical trials.

The increasing failure rates for new drug approvals have costed pharmaceutical companies lots of money to develop new programs. Studies have shown that in the past fifteen years, pharma's spend on R&D has been skyrocketing. To-date, the average cost for developing one drug is over \$2.5 billion. Faced with such burden of cost in developing new drugs, pharmaceutical companies are getting serious about accessing new technologies that will enable them to make better drugs at lower costs.

There are multiple ways to lower the cost of drug development. Pharmaceutical companies are increasing relying on innovative companies to come up with new ways to improve development efficiencies. During the vitro stage testings, companies like Cypre are figuring out disruptive ways to make the micro environment closer to that of humans, so drugs at this stage have a higher chance of success rate after entering human tests. At the clinical stage of testing, utilizing data to better recruit patients for trials have been proven crucial to the success of drugs.



“Our goal is to transform pharmaceutical research with our unique platform technology and drive better drugs, faster to the market .”

Kolin Hribar
Chief Executive Officer, Cypre

A.I. vs. M.D.

Among the industries getting serious about data, the medical industry has been at the forefront of utilizing big data for the benefit of patients. There are very few companies that actually make data usable, and most of the digital data goes not to pharma companies, but to physicians. As a result, making the aggregated data relevant and meaningful is vital. For example, driven by the aging population, the number of scans have increased dramatically. As a result, radiologists and pathologists have been overworked which causes a larger risk of errors.

Spurred by the need to operate more efficiently and productively, medical imaging facilities will increasingly turn to artificial intelligence for help, and will actively seek out technologies to help automate their workflow. This phenomenon is even more obvious in developing countries like China and India, where both have the capability to purchase state of the art equipment but lack in available training for radiologists. Ever since the inception of neural networks, the accuracy of artificial intelligence in applications like medical imaging is high enough to be considered to integrate into medical systems. Artificial Intelligence will serve as the perfect tool to not only assist physicians with a second opinion, but also bring early diagnosis to patients at an affordable cost.

Adding AI software to the acquisition and interpretation phase can change the profession's future for the better. We believe a more immediate solution is to provide software solutions that will make image reading faster, more accurate, and provide a second set of eyes for triage when needed.



“Although at this point I don’t see the hope of AI replacing doctors in terms making medical decisions, I would agree that AI will be very useful in certain tasks that may traditionally take hours or even days for humans to complete.”

Lei Xing

Jacob Haimson Professor of Medical Physics & Director of Medical Physics Division of Radiation Oncology Department, Stanford University

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