

Udacity AI/ND: Planning

Google's Recent AI Developments

Rick W. Lentz, M.S., M.S.

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Company Introduction and Background

Google is a USD \$700B USD publically traded, global information services company. It was selected since the company has an ideal structure for exploiting big data value both for itself and for its clients. Under the company's current structure, innovations come from many groups and teams within the company and through hundreds of thousands of people in the online communities Google fosters.


This research review focuses on the group called DeepMind and covers their recently published, artificial intelligence advancement of a lifetime. DeepMind brands themselves as the world leader in artificial intelligence research and its application for positive impact. The team is working to push the boundaries and uses of big data, developing programs that can learn to solve any complex problem *without needing direct experience*.

Using different data with the same learning process is likely the most critical and widely beneficial scientific advancement ever made. It positions Google with the ability to increase our capacity to understand the mysteries of the universe and to tackle some of our most pressing real-world challenges. From climate change to the need for radically improved healthcare, too many problems suffer from painfully slow progress, their complexity of big data overwhelming our ability to find solutions. DeepMind's work acts as a multiplier for human ingenuity; those answers will come into reach.

AI Use - Task Automation

We know the gig, running a regression, writing a business intelligence summary for senior leadership, planning the resource allocation for \$5 trillion based on weekly news and forecasts. All of these tasks require specialized knowledge and experience to formulate and articulate expert level performance. What if I told you that DeepMind created a technology that is so powerful, it can use the same process to create a machine to learn to do all of these tasks? They did.

Task automation is viewed as disruptive to the workforce (Harari, 2017). It will require rethinking of work and the right to perform a job (Anthes, 2017). Task automation is the extension of



automation that uses a computer to perform a task that a person once did. Expert task automation is the ability for a machine to perform this work better than a team of experts.

DeepMind demonstrated expert level task automation in the game of Go (Sing, 2017). Infact, they updated their algorithm to achieve two breakthrough milestones: a 44x performance improvement and the ability to use simulation over historical data. I'll cover this in detail in the next section of this paper.

What does this mean? It means that characterizing a system's data can be good enough to generate a system that can be then used to train a machine for task automation and eventually expert level task automation. It also means that you don't need 100 specialty graphics card based compute clusters to do the work. It is a harder, smarter, better, faster approach that is widely viewed to displace many jobs (Anthes, 2017).

The What and How


Deep Mind used a database of millions of games to train a network on a \$400,000 computer over six months. At the 2017 Future of Go Summit, AlphaGo beat Ke Jie, the world No.1 ranked player at the time, in a three-game match.

Later that year, they applied two improvements referenced earlier that were limiting the training rate. The trained using generated data on a \$9,000 computer to the machine to expert level task automation that surpassed all previous performance in under two days (Sing, 2017). Yes, that is right. I'll repeat it again. A machine can be trained to produce expert level task automation (outperform any previous system or human) at the game of GO in less that two days using less than \$50 of compute resources.

This is where we take a step back and reflect at this timeline. For 50 years the problem is open as a grand challenge. We discover that deep learning is applicable to many different problems. We use many computers and get it to work in 2016. In 2017, we train it on Google's massive computer clusters and beat the world champion three games in a row. Someone comes along within a few months and tweaks the algorithm and finds a 3960x improvement factor.

Impact of Data + Algorithm on Business

Smart assistants are in our homes already. If Google applies this technology to their smart assistant, they can generate an extra \$30B a year in profit in the US and \$165B a year outside the



US. This increase factors out B2B, which is outside the scope of this assignment. In 2016, Google pulled in \$105B US over the course of the year and made \$25B before taxes. They should be able to generate 8x profit growth in under two years by rolling out this technology as a service to individuals, globally. This will improve most of GOOGL's key ratios, including Net Margin, Return on Assets, Return on Equity, Operating Margin, and Earning Per Share.

Data Collection For Decision Making

Google has several ways of collecting information. Initially web scraping was the dominant way Google gathered data for its search service. Now, with cloud storage, cloud databases, and cloud services, both structured and unstructured data are directly uploaded.

Machine learning services covered earlier are useful for decision makers if they are able to access and process the collected data. The services can be configured as analytical tools, highlighting actions to take or as stand alone, automated services. In either case the outcome is clear. Google has copies of the needed data and can produce derivative works that can generate massive gains for shareholders.

Future Developments for Decision Making

Future developments include ethical considerations as these developments are expected to be disruptive (Anthes, 2017) to the current work structure.

This research was focused on expansion of personal digital assistant services through expert level task automation. It is expected that B2B will be the largest growth area for Google since expert level task automation is more applicable to healthcare, finance, energy, education, technology, science, and entertainment.



AI Development Summary

Google has acquired and structured its position in the market to have access to both data and tools essential for capitalizing on smart assistant services. As pointed out by Sing, Harari, Anthese, and Silver these are expected to be disruptive advancements that mainly impact the B2B sector (which was outside the scope of this assignment). By having access to advanced, value adding services, Google has positioned itself to grow into the personal assistant space by using expert level task automation. These services are anticipated to generate a massive 8x profit expansion over the next two years.



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[GOOGL Balance Sheet](#) via MorningStar, Inc

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