Deep Learning Outside the Tech Industry

Technological companies such as Google, Facebook, Microsoft, and others have made heavy investments in deep learning infrastructure. Most of these companies were already familiar with machine learning systems, likely from past experiences with machine learning such as with ad prediction systems or search engines. As a result, shifting to deep learning from older machine learning systems took only a small conceptual shift. Also, the success of past machine learning applications has made tech management quite open to the argument that deep learning could be more widely applied within companies. For these reasons, software companies are likely to remain the most prominent users of deep learning for the near future. If you intend to find a job using deep learning within the next couple years, it's likely that you will end up at a tech company.

However, at the same time, there is a broader shift brewing in which deep learning is beginning to infiltrate industries that historically have not used much machine learning. Unlike simpler machine learning methods, deep learning reduces the need for sophisticated feature preprocessing and allows for direct input of perceptual, textual, and molecular data. As a result, a number of industries are taking note, and large-scale efforts to overhaul these industries have already begun in many innovative start-ups. We will now briefly discuss some of the changes happening in nearby industries and note that many new job opportunities for deep learning experts may become available in the near future.

Applications Are Synergistic

You will soon learn about a number of deep learning applications in different industries. The striking fact about these applications is that all of them use the same fundamental deep learning algorithms. Techniques you've seen such as fully connected networks, convolutional networks, recurrent networks, and reinforcement learning are broadly applicable to any of these fields. In particular, that means core improvements in convolutional network design will yield fruit in pharmaceutical, agricultural, and robotics applications. In reverse, deep learning innovations discovered by roboticists will filter back and strengthen the foundations of deep learning. This virtuous cycle of fundamentals driving application driving fundamentals means that deep learning is a force that's here to stay.

Deep Learning in the Pharmaceutical Industry

Deep learning is showing signs of taking off in a big way in drug discovery. Drug discovery is broken down into multiple phases. There's the preclinical discovery phase,

where the effects of potential drugs are tested indirectly in test tubes and in animals, followed by the clinical phase where therapeutics are tested directly in human volunteers. Medicine that passes both nonhuman and human testing is approved for sale to consumers.

Researchers have begun to construct models that optimize each part of the drug discovery process. For example, molecular deep learning has been applied to problems such as predicting the potential toxicity of putative medications and to chemical problems involved in the synthesis and design of drug-like molecules. Other researchers and companies are using deep convolutional networks to design new experiments that closely track cellular behavior on massive scales to obtain stronger understanding of novel biology. These applications have had some impact on the pharmaceutical world, but nothing dramatic yet since it isn't possible to build one drug discovery model that "designs" a novel drug. However, as more data gathering efforts continue and more biological and chemical deep learning models are designed, this state of affairs could change drastically in the next few years.

Deep Learning in Law

The legal industry relies heavily on precedent in the legal literature to make arguments about the legality or illegality of new cases. Traditionally, legions of paralegal researchers have been employed by large law firms to perform the needed lookups into the legal literature. In more recent years, legal search engines have become standard fare for most sophisticated firms.

Such search algorithms are still relatively immature, and it's likely that deep learning systems for neurolinguistic processing (NLP) can offer significant improvements. For example, a number of startups are working on building deep NLP systems that offer better querying of legal precedent. Other startups are working on predictive methods that use machine learning to predict the outcome of litigation, while a few are even experimenting with methods for automated generation of legal arguments.

In general, these sophisticated applications of deep models will take time to mature, but the groundswell of legal AI innovation likely heralds a dramatic shift in the legal profession.

Deep Learning for Robotics

The robotics industry has traditionally avoided deploying machine learning since it's not easy to prove that machine-learned systems are safe to deploy. This lack of safety guarantees can become a major liability when building systems that need to be safe for deployment around human operators.

In recent years, though, it's become clear that deep reinforcement learning systems, combined with low data learning techniques, can offer dramatic improvements in