



# DEEPLARNING 101

Making Deep Learning Accessible

Deep learning can seem enigmatic to the uninitiated, but knowing what it is and how it can help you prepare your business for the future is important. The concept of deep learning is inextricably linked to machine learning and artificial learning, and having a basic knowledge of these two concepts is important to understanding what deep learning is.

To keep it simple, deep learning is a kind of machine learning, that is based on a system which automatically recognizes representations required to detect features and classify information from raw data. This automatic learning mimics how humans learn, and is more autonomous than other types of machine learning.

Deep learning is vaguely based on how the human nervous system works, but there are obvious differences between the human brain and how deep learning takes place in a system designed for learning from data representations.

In this white paper, we make a case for business application of deep learning, and help you take action towards implementing it in small but measurable steps. At the end of the document, you will learn

- **What deep learning is**
- **Different kinds of deep learning**
- **How other businesses are using deep learning to improve their bottomline**
- **What you can expect in the near future**
- **How you can implement it quickly**



01

**WHAT IS  
DEEP LEARNING?**



Deep Learning lies at the intersection of Data Science and Machine Learning, which lies under the broader Artificial Intelligence field of study. True Artificial Intelligence is theoretically similar to human intelligence, but in real life, AI is not quite capable of what humans can do. Thus, much of alarm associated with AI is unfounded, and resisting implementing AI or its various sub-fields may hurt your business prospects.

Machine learning derives from Artificial Intelligence, and consists of a set of algorithms and techniques and that enables a computer to learn things on its own, without humans having to program it. The more a machine learning model learns, the better it shall perform thanks to its “experience”, which is akin to human learning and performance. Deep Learning is a kind of machine learning in which applications can solve problems on their own, without someone having to program them.

Deep Learning models are based on artificial neural networks (ANN) and deep belief networks, where a system learns in multiple levels. Artificial neural networks are computational systems and frameworks that are vaguely inspired by the biological nervous system, and learning takes place in a similar fashion. In fact, the “deep” in deep learning refers to the complex structure of learning levels in which data is transformed, understood, and “learned” by a machine learning algorithm.

Deep Learning models are used to enable computers and systems to solve tasks on their own, with minimal or no human intervention, resulting in far-reaching business implications in terms of automation. In short, computers navigate from one layer to another and learn in progression through a hierarchy of concepts similar to neural networks.

02

**WHAT ARE  
THE TYPES OF  
DEEP LEARNING?**

Deep learning models consist of many architectures made of neural networks. Neural networks mimic the biological nervous system to an extent. There are far too many neural networks each with specific purposes.

In most use cases, combinations of neural networks are stacked or layered together to achieve unique deep learning effects and business goals. Some of the common neural networks are artificial neural networks, deep neural networks, recurrent neural networks, deep convolutional networks, deep belief networks, autoencoders, and recursive networks.

The most common areas of deep learning that are currently in use among digitally savvy businesses include speech recognition, computer vision, and natural language processing. Each of these is built with stacks of neural networks that are appropriate for the stated business goals.



**Speech recognition:** Large-scale automatic speech recognition is currently being used by a growing number of businesses to achieve automation in fields of customer service, sales, and marketing. Automatic speech recognition can compete with traditional speech at an astonishingly impressive level.



**Computer vision:** Deep learning networks are currently used to teach computers to interpret 360 degree camera views, and image recognition is currently at superhuman levels. Deep learning networks have surpassed human abilities of image recognition and are used in health, marketing, customer service, security, and other areas.



**Natural language processing:** Currently, deep learning networks use natural language processing (NLP) to recognize human speech, understand how language is used and constructed naturally, and generate language-based content. Its applications are far-reaching, and hold the key to automating much of business requirements.

03

**DEEP LEARNING  
IN ACTION**

Currently, deep learning is revolutionizing the way businesses are adopting technology. It has influenced creators of technology and their users equally. It wouldn't be an exaggeration to say that deep learning will continue to evolve rapidly in 2019, and more businesses will scampers to implement some form of deep learning frameworks into their business strategy. To help make a case for implementing deep learning quickly, we listed 7 use cases in which neural networks are finding themselves deeply embedded.



**Marketing:** Traditionally, marketing has been limited to identifying the right target audience, and communicating with them at the right time. However, deep learning helps you draft the right message too, and Brandon Purcell, an analyst at Forrester feels the same way as well. Video and image analytics, natural language processing-enabled text analytics, speech and face-recognition architectures will help businesses to draft content specific to the audience that will convert. Deep learning makes hyper-targeting a reality that most marketers could only dream of.

Google acquired DeepMind Technologies last year, a clear indication that internet marketing and SEO will depend on machine learning and deep learning.



**Design:** Design is a field that has been particularly influenced by deep learning networks. Algorithms and neural networks can be layered and stacked to achieve and predict user-friendliness of products, interfaces, and applications. Currently, deep learning networks are used by designers to personalize experiences, identify anomalies, develop novel ways of communication with users, and access deep insights. Both computer vision and natural language processing are used to create better interfaces that feel more realistic to users. Apple uses deep learning to help its users compile albums in Photos, interact with Siri better, and make music recommendations on its Music application.





**Development:** Software development is getting easier and more efficient thanks to artificial intelligence and deep learning networks. In fact, deep coding helps generate codes that are complex and difficult for human developers. Deep learning networks are being used to fix bugs in applications and websites, optimize existing code, and to test software. Deep learning can increase the speed of software development and ensure that updates are released on an ongoing basis.

MIT Laboratory worked with Adobe to create the Helium software, which automates the process of fixing old code, and eliminating the need for original source.



**Mobile Advertising:** Deep learning has begun to change the way mobile advertising strategy is planned and implemented. Rich insights, predictive analytics, and artificial intelligence are helping advertising tools to learn and interpret how users react and respond to in-app ads, and other forms of mobile ads.

Bidalgo recently created an AI that uses both image and video recognition to identify how users interact with advertisements, and match them against ad performance. The tool can be used by marketers and advertisers to view all the insights related to their ads on a dashboard. Advertisers no longer have to indulge in guesswork while developing ad creative.



**Image Restoration:** Current methods of image restoration depend on machine learning techniques which are vulnerable to the weaknesses of conventional fixated models. Deep convolutional neural networks have succeeded in overcoming these weaknesses that are inherent to current restoration techniques. Deep learning improves image inpainting, image deblurring, denoising and pixel interpolation, all of which are crucial processes across industries. Image restoration is particularly important to medical professionals, marketers, product designers, and publishers.

The University of Texas has worked extensively on deep image restoration and the importance of on-demand learning. This paper elucidates their study.



**Financial Fraud Detection:** In deep learning terminology, identifying cases of financial fraud is known as a classification problem. Common classification problems include spam detection, predicting who will default loan payments, and making recommendations. Deep learning networks can learn to identify transactions and instances that are legit or fraudulent based on a number of criteria such as time, location, amount, and merchant. Deep Learning-enabled technologies can effectively power ecommerce and financial applications to detect fraud and safeguard privacy and security of users.

Convolutional Neural Networks, which are based on the visual cortex, detect and help in reducing fraudulent activity by understanding and predicting how people think.



**Customer Relationship Management:** Machine learning and deep learning in particular have begun to help companies to propel their CRMs into turning more intelligent than they ever were. CRMs that are integrated with deep learning networks identify how customers think, act, behave, and feel, and use this data to provide rich insight to businesses. Such insight can be used to make better recommendations, personalize communication, and render better services and make improvements to products.

Currently, deep learning is used to engage customers and detect new opportunities, make sales forecasts and resolve customer issues, and predict future outcomes. Going forward, deep learning will change the way CRMs behave.



**WHAT THE FUTURE  
HOLDS FOR  
DEEP LEARNING**

The future of deep learning is promising and it will continue to evolve technically. From a business perspective, 2019 will herald implementation of deep learning among even smaller businesses, and it will continue to become more accessible and affordable. From the perspective of research, here are three major areas of deep learning that will see growth:



### **Thought Vectors**

Word vectors are represented by numbers, with the help of which AI learns to process text. Each word maybe represented by close to 500 numbers, and the system uniquely “understands” each of these words. Thought vectors, on the other hand, represents a thought’s context in relation to other thoughts. Thought vectors are very complex and can provide AI-enabled machines with superior text processing skills.

Google and other search engines currently employ thought vectors to make searches more context-specific and relevant. Businesses can use thought vectors to process customer interactions, and to communicate with them more effectively. However, thought vectors are still in the process of evolution, and will continue to develop throughout 2019.



### **Deep Reinforcements**

The concept of reinforcements is rooted in psychology, which points to the fact that humans learn to behave in a certain way if there are rewards or punishments associated with that particular behavior. Desired behavior is rewarded, while undesirable behavior is punished, leading to reinforcing of different behaviors. Deep reinforcements help neural networks and systems to “learn” similarly.

Goal oriented behaviors can be taught to algorithms, so that they learn to “behave” in a manner that the developer of the application wants them to. Deep reinforcements will propel deep learning into uncharted territories and will help algorithms to learn new concepts similar to humans. Deep reinforcements are being studied closely by developers and will likely shape how deep learning is applied in various business fields.

## Video recognition

While image recognition is relatively easy for systems to recognize and process, action recognition is not that simple. Action involves a number of processes, and to place them in context and make meaningful interpretations is difficult for algorithms at this stage. However, video recognition is evolving rapidly, and is expected to become more pliable to business use in the coming years.

Currently, video recognition is expensive and standard benchmarks do not exist. Video recognition has huge implications in the areas of medicine, marketing, customer service, and even product testing. In 2019, 3D recognition research will focus on kinetic recognition and meaning creation.



05

**IMPLEMENT  
DEEP LEARNING  
NOW**

Implementing deep learning in your business need not be an intimidating task or endeavor. As with any new technology, start small and plan to scale up quickly as you grow. As most businesses have already warmed up to other aspects of AI such as chatbots and virtual assistants, the next step would be to integrate deep learning networks into existing systems and applications. You can begin with investing in automated recruitment, intelligent conversational interfaces, smart security systems, and deep learning-based marketing and customer service.

Depending on your unique pain points that hurt your bottom line, you can identify core areas which would benefit from deep learning implementation. Speak to us today to learn how deep learning can solve your most pressing issues and find new opportunities to grow and scale.

