BLUELIFE
LEVERAGE THE POWER OF AI

Deep Learning

Executive Briefing

WHAT IS DEEP LEARNING?

Welcome to the course!

As you'll discover, robotic process automation (RPA) is a powerful and emerging field that has already demonstrated a variety of real-world applications. The potential for improved quality, increased savings and more efficient workflows mean that this is a vital growth area for businesses.

The following study notes supplement the course's videos. We'll revise and explore the **nuts and bolts** of this resource, the **risks and benefits** of introducing RPA to your company. We will round off our analysis with **ten success stories** from companies that apply RPA.

With these informational tools, this video course will show you just how easy it is to implement robotic process automation into your business.

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Introduction to the course

Welcome to this Executive Briefing course on

Deep Learning

Your time is your most valuable asset, which is why this course will only cover the ultimate essentials for you to get up-to-speed with Deep Learning and see tangible examples of how this technology can add substantial value to your business.

Here's how this course is structured :

First,

we will talk about what Deep Learning is, its history, and why it can add value to virtually any business and any industry.

Then

we will discuss how a Deep Learning Network is built, setting up a framework for the algorithm to work in.

Afterwards

we will dive into how to combine Deep Learning with other areas of AI such as Reinforcement Learning or Computer Vision.

Finally,

we will look at 10 case studies of Deep Learning already being applied in different companies and industries. Here we are after the real results, the numbers – so we can get a feel for what Deep Learning can do for our businesses.

I hope you're as excited as I am,

let's get started!

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What is Deep Learning?

Deep Learning (DL) is a family of **machine learning** methods based on **artificial neural** networks.

There are two parts to this definition:

Machine learning is defined as a discipline within AI that teaches computers how to make predictions based on data.

The human brain is the most sophisticated system for data analysis known to us, it is therefore understandable that we wanted to create something similar inside our computers.

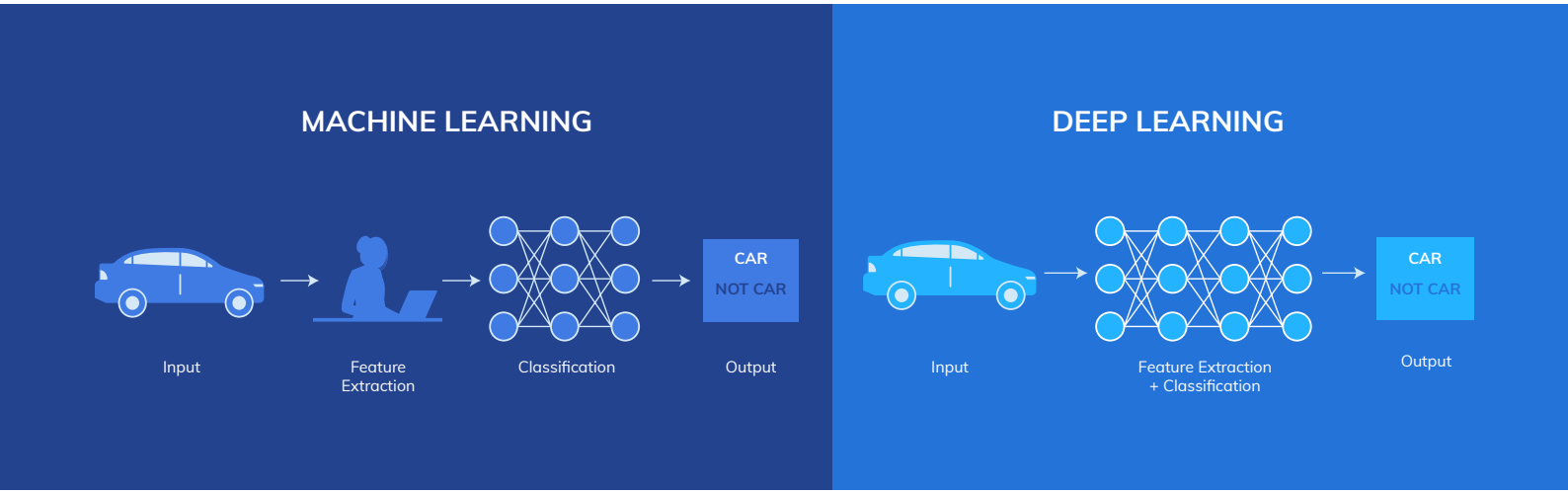
Computer scientists have found a way to mimic the human brain inside machines: **Artificial neural networks**. The goal of using these neural networks is to approach and solve general and complex problems in a similar way to how a human brain does.

It's nowhere near as sophisticated and therefore cannot be classed as "general intelligence", however specific applications of DL from self-driving cars to cancer detection have seen tremendous success.

So, what sets DL apart from standard methods of analysis or even from ML?

The main difference is that in DL there is no pre-defined framework. In the case of non-DL methods there are certain frameworks that we tried to fit on the data to explain the patterns that we are seeing. If they work then great, if they don't – then we try something else, until we find something that fits the data well and helps us extract those insights.

In the case of DL, there is no such thing. All we have is a **Deep Neural Network with multiple layers**.



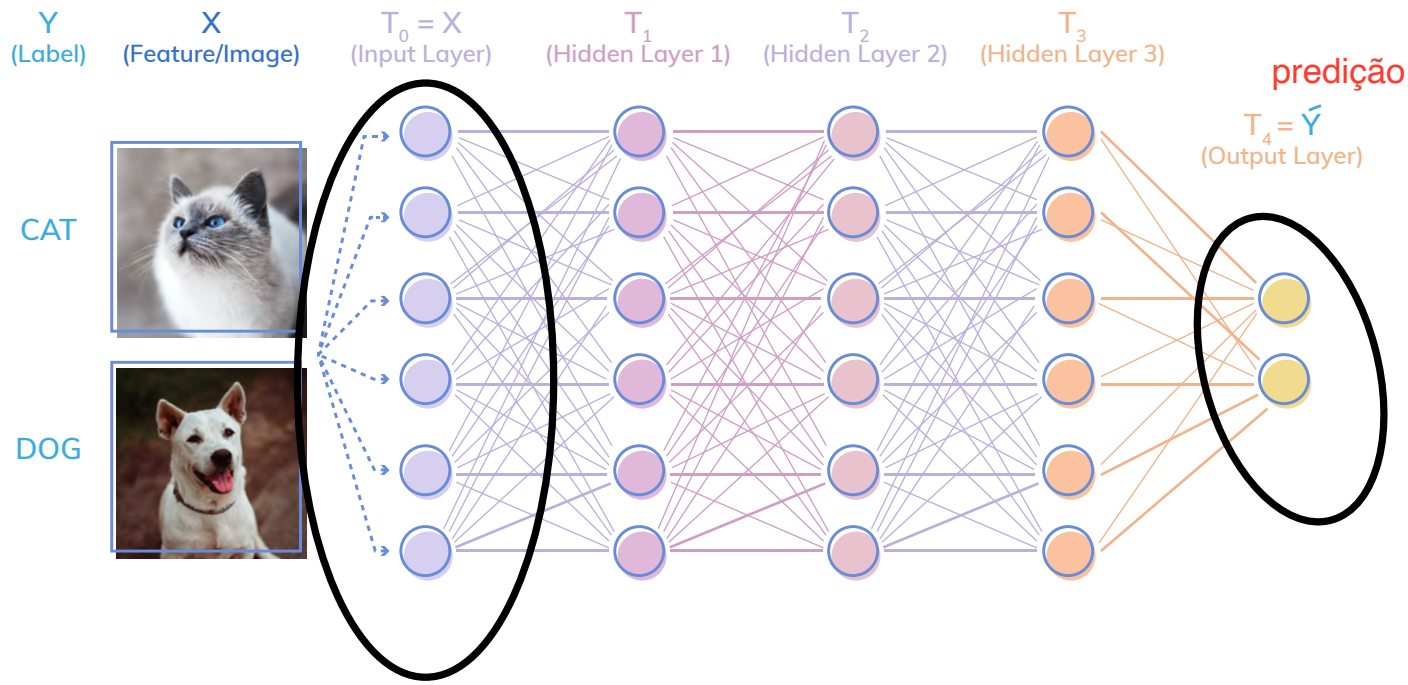
So, what is a Deep Neural Network (DNN)?

It's an artificial construct designed to mimic how the human brain works. The way to think about it is that a DNN will learn about your data set just as a baby will learn a language or how to differentiate between objects.

It has a brain,

it has no predefined network that we put in there, and simply by walking around and interacting with humans, it automatically and slowly learns how to talk, how to walk, and how to do other things. So that's how a DNN works as well – we try to mimic the human brain. And that is the beauty of DL; without having to put any framework on our data, we allow it to learn on its own.

A classic example of this is distinguishing between a dog and a cat. By feeding it thousands upon thousands of photos of dogs and cats, we can teach the neural network, without any additional input, to distinguish between the two animals. For instance, it will find that cats have pointy ears, dogs have fluffy ears. Cats have a smaller variety of sizes, dogs have a larger variety of sizes and so on. And just by observing these things about the data and comparing the labels, it will eventually learn these features on its own.



The drawback with DL is that it requires a lot of data,

much more data than other algorithms. It might require thousands, hundreds of thousands, or even millions of examples before it can come up with those features and truly learn. On the flip side, the benefits that we get are incredible.

In some cases, such as in handwritten text recognition, **ML algorithms can only get accuracy of around 87%, and very rarely over 90%**.

> Whereas with DL, it is trivial to get a **99% accuracy rate**, simply because it is such a powerful tool – hence all the hype about DL.

Finally, DL isn't something new,

it has actually been around since the 1980s.
The theoretic concepts of DL are quite old and rigorously thought through. However, computing power back in the 1980s was not to the level it is now, and as such this whole notion of neural networks was lost and forgotten.

Recently, DL has started to rise again

Recently, DL has started to rise again because computing power has risen substantially.
Now, we can build neural networks and feed them hundreds of thousands of examples to get substantial and useful insights within days, hours, or sometimes even minutes, depending on the capabilities of your computer system.

So that, in a nutshell, is what DL is. We could talk much more about this topic but hopefully, this gives you a quick overview of how this branch of ML is different and why it is so powerful.

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Building Neural Networks

If DL algorithms learn on their own, then why do we need data scientists or ML engineers to build them? And why are experts in this space so expensive?

This is a great question and to answer it we need to take a little bit of a closer look at neural networks...

Here we see a basic input-output type of neural network:

It has one input layer with 4 neurons and one output layer with 1 neuron. Now what we can do is add another layer in-between the input and output layers.

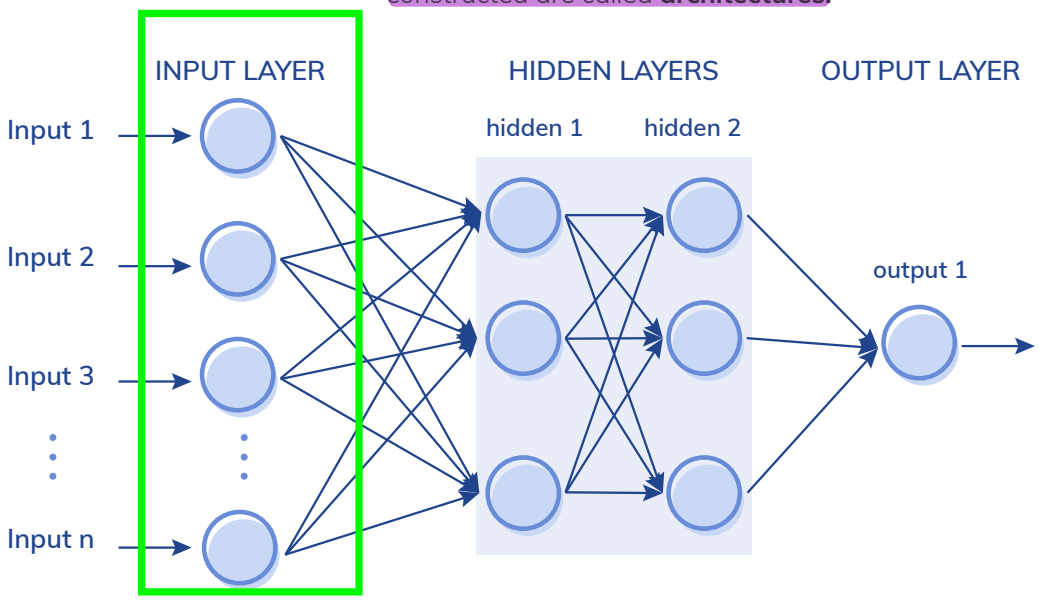
This layer is called a "hidden" layer and in this case it has 6 neurons. We can add another hidden layer, and another.

Each one of these neural networks

– whether it has zero hidden layers, or one, or two or 10 – is a valid neural network. Moreover, we can also change the number of neurons in each layer.

For example, the first hidden layer might have 8 neurons, while the 2nd hidden layer might have only 2 creating and then back to 6 in the 3rd hidden layer – forming a sort of a bottle-neck shape. That is also a valid neural network.

These different ways that neural networks can be constructed are called **architectures.**



Every purpose, every application, every challenge will have a different architecture that serves it best. Finding the right neural network architecture is actually a very creative process. And that's why expert ML engineers and data scientists who build DL algorithms are in such high demand and are so expensive to have on your team – because they are doing highly creative work which requires their unique touch and input.

And once a suitable architecture is set up, the algorithm will do the rest of the work itself.

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Deep Learning and other areas of AI

Other areas of AI such as Reinforcement Learning, Natural Language Processing and Computer Vision represent some of the most disruptive exponential technologies currently in existence.

What happens when we combine them with DL?

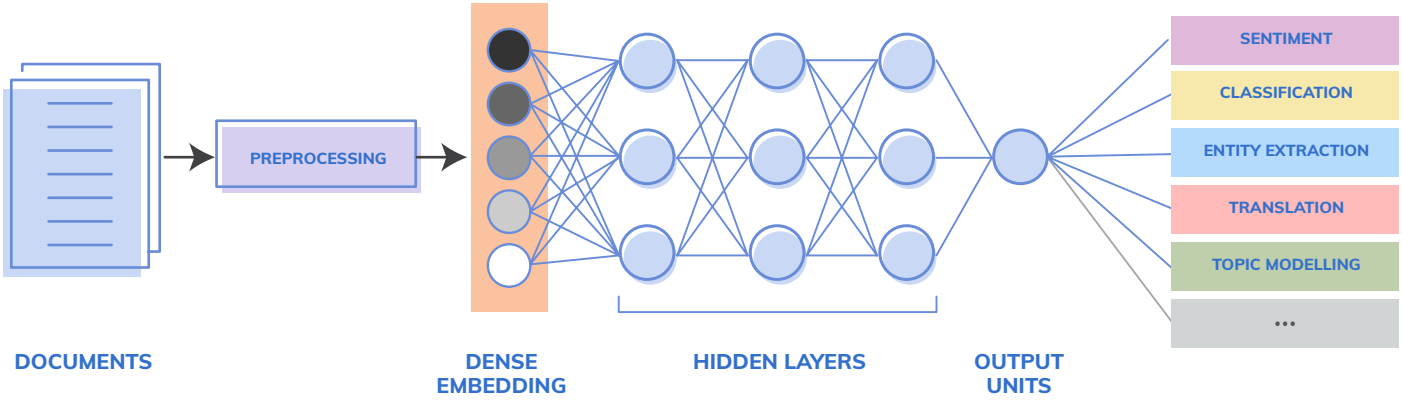
However, when we add DL to these technologies,, what that means is that we're essentially adding the power of deep neural networks to those technologies :

1. Reinforcement Learning becomes Deep Reinforcement Learning.
2. Computer Vision becomes Deep Computer Vision.
3. Natural Language Processing becomes Deep Natural Language Processing.

As usual with neural networks, this approach has the drawback of more costly computation.
However, if the computing power is available, then more often than not, adding a deep neural network can substantially improve accuracy of the algorithm.
Simply because now it has additional room to think and experiment with different neural pathways.

> *It's important to note that this is not a silver bullet to solve all problems, however it does tend to work in the majority of cases. Therefore, it can be useful to keep in mind that you can often add DL to another exponential technology to enhance it.*

Deep Natural Language Processing.



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Real world use cases

When attempting to develop an understanding of new technologies and systems, it is imperative that we look beyond the hypothetical and examine some real-world examples. The cases highlighted below give examples of how various industries have incorporated DL into their corporate life. You will gauge how global companies have used DL in practice to increase productivity, profit, compliance and security across diverse sectors.

GoldSpot Discoveries, mineral exploration

The Earth's non-renewable natural resources are getting harder and harder to find. Companies looking for profitable operations need to dig deeper and cover more area, both of which are costly and time-consuming. Major gold discoveries have dropped from around 15 per year in the 1990s to just 1 or 2 per year in recent years, despite exploration spending doubling or even tripling during that same period.

Utilising DL to analyse existing geological data, GoldSpot Discoveries developed a predictive method for finding gold deposits. They were able to correctly identify 86% of existing gold deposits in the Quebec Abitibi, despite working off data from just 4% of the total surface area.

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Google AI, cancer detection

With almost 10 million deaths per year, cancer is the second most common cause of death in the world. In addition to the trauma and suffering, it also causes over a trillion dollars of economic damage worldwide. The biggest contributor to successful treatment is early and correct diagnosis, but even after years of study and specialisation, pathologists disagree on the diagnosis in over 50% of cases of breast and prostate cancer.

Google AI worked on a large data set to develop a DL algorithm that can properly identify metastasis with 89% accuracy, compared to 73% for a trained pathologist with unlimited time. Although unlikely to replace them at any time soon, this system can significantly help pathologists improve their diagnoses.

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Amazon, recommendation engine

The global online retail revenue is already past 3 trillion dollars and expected to keep growing 15-20% every year, just as it has during the last few years. Retailers have stopped relying solely on organic searches long ago and recommendations based on previous purchases are a classic way of increasing revenue.

Amazon's DL recommendation engine is incredibly powerful, suggesting items based not only on what you just bought, but also on your previous purchases and your demographic, which it compares to other customers. It is estimated that more than 35% of all Amazon sales are generated by these product recommendations.

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Ayasdi, anti-money laundering

Money laundering transactions are estimated to total $1-2 trillion annually, an incredible 2-5% of the global GDP. Preventing money laundering also helps stop terrorism, human trafficking and the distribution of narcotics.

An unnamed financial institution, one of the largest in the world, worked with Ayasdi to integrate a DL solution and prevent money laundering. The goal was to increase operational efficiency by 3%. The bank achieved a reduction in investigative volume of over 20%, as well as lowered their regulatory exposure by discovering new risk segments.

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Deep Instinct, cyber security

Cybercrime costs the global economy $600 billion every year. Hackers are already using completely autonomous AI bots to try and find ways into systems in minutes, rather than hours, and traditional security measures simply aren't keeping up.

An unnamed Fortune 500 company installed Deep Instinct's DL-powered security platform. Within the first week of deployment, the algorithm found 12 infected endpoints and with time, found that almost 10% of their devices were infected, even though they had all been equipped with traditional security measures before. Despite requiring less than 1% CPU usage, it tested 99% successful at finding and preventing incoming malware, including 140 cases of ransomware.

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Digital Domain, visual effects

Visual effects are used in almost everything that hits our screens, from blockbuster movies to everyday commercials. For cinema, they can represent 20-50% of the entire film's budget, which can mean up to $100 million for the largest productions.

Digital Domain worked on the character Thanos in the 2019 release, Avengers: Endgame, using a DL algorithm trained on high-res scans of the actor's face to render the character in real-time. This provided the director with unprecedented insight into how the movie will look during the actual shooting, rather than days or weeks later. Critical acclaim and public opinion about how natural the visual effects are powered the movie to become the highest earning movie of all-time, earning almost $3 billion worldwide.

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Doxel, productivity tracking

Around 80% of construction projects are delivered over budget, with typical delivery times 20 months behind schedule. Part of the reason is that project managers lack a realistic, instant visibility of the project's progress. Most progress tracking is still done with physical measurement, visual inspection and clipboards. This is part of the reason why construction efficiency has only increased by around 1% during the last 20 years, whereas manufacturing efficiency almost doubled in the same period.

Doxel uses DL to analyse data collected from robots and drones that traverse a construction site. This can detect deviations from the planned schedule and prompt the project team to act before delays start to pile up. During one project, labour productivity was increased by 38% and the project was delivered 11% under budget.

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Zestimate, real estate prices

The real estate market is the largest sector of the US economy, surpassing 13% of the total GDP. Opportunities, as well as competition, are vast and real estate agencies are turning to AI to handle them. The current shortage of appraisers has increased the time and cost of accurately predicting the price of a property.

Zestimate uses a DL algorithm to analyse home characteristics, their unique features, and on- and off-market data to predict the price of almost 100 million homes in the US. Their median error for listed properties is only 1.9%, allowing real estate agencies who use their service to focus on customer acquisition and retention, rather than costly and time-consuming appraisals.

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Amazon Rekognition, facial recognition

Although facial recognition is currently under scrutiny due to allegations of bias and concerns over individual safety, the technology is still in its infancy, and experiencing fast development. It has numerous applications and, as a society, we will need to find out which of them are acceptable to us and which present human rights or privacy risks.

Washington County Jail management uploaded all 300,000 mugshots they had previously taken since 2001 into the system. Later, when a crime was captured on camera, rather than manually scan the vast set of mugshots in the hopes of finding a match, Rekognition was employed to find matches with 80%, 95% or even higher similarity. This has allowed law enforcement officers to quickly narrow their search and follow up on leads, often solving cases before any additional problems arose.

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ZestFinance, loan approval

7 million people in the US, around 5% of auto lenders, are currently at least 3 months behind their car payments. This is powered both by customers that don't account for their own financial capabilities and by companies taking greater risks to try and improve their revenue.

ZestFinance offers a DL algorithm that analyses a potential customer's credit score and determines their risk of defaulting. This allowed a top US auto lender to cut its losses by 23% annually.

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Recap

Here's a recap of what we discussed :

1. First, we defined DL and its principles.

2. Next, we discussed how a DL network is built, allowing the algorithm to do the rest of the work itself.

3. Then we looked at how combining DL with other areas of AI, such as natural language processing, creates exciting new options.

4. Finally, we considered 10 different companies that are applying DL to already gain huge advantages right now. We saw real, tangible results.

So, there we go, I hope you enjoyed this journey into the World of Deep Learning. If you would like to learn more about our work, you can find us at www.bluelife.ai – and I look forward to seeing you inside our other Executive Briefing courses where we deconstruct exponential technologies in under 30 minutes.

Hungry for **more**?

Find us at **www.bluelife.ai**,
where you can join us on our other courses
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