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Neural networking: The next step in artificial intelligence

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Artificial intelligence (AI) is about more than chat bots and assembly automation. It is about machines that can learn, robots that can adapt, and man-made systems that emulate the human mind.

Yet while 'machine learning' technologies have grown in sophistication over the past few decades, it is the more recent advancements in deep learning and neural networks that are truly bringing us closer to unlocking AI's full potential.

What is a neural network?

According to Dr. Robert Hecht-Nielson, a pioneer of neurocomputing, an artificial neural network (ANN) is a "computing system made up of a number of simple, highly interconnected processing elements, which process information by their dynamic state response to external inputs[1]."

In non-neurocomputing vernacular, an Artificial Neural Network (ANN) is a term that describes a system through which data is collected, extrapolated, and fed through advanced pattern recognition algorithms as a means to extract key insights, predict outcomes, or optimize functions. You can also think of ANNs like a human brain whereby neural networks are designed to emulate the way brains absorb information from their environment, process that information through an exceedingly complex system of neural pathways, and use it along with historical data and past 'learnings' to help us make contextual, intuitive decisions.

What can neural networks do?

The evolution of neural networking over recent years has given rise to some extremely interesting applications. Here are some examples:

- **Lifetime value modeling:** Neural networks can help companies identify their most valuable customers, both in terms of dollar value and intangible benefits (e.g., brand loyalty). These insights can be used to create targeted marketing campaigns for loyal customers while allowing attrition to occur among customers that contribute less to the bottom line. In addition, machine learning algorithms can analyze loyal customers to find key patterns that can be used to attract new customers who exhibit similar characteristics.
- **Customer attrition:** Beyond finding which customers are most valuable to a company, machine learning algorithms can also be used to determine which customers are most likely to disengage with their business and the reasons why. Here again, that information can help marketing teams fine-tune their retention strategies through targeted campaigns. Cell phone or internet service providers, for example, can use deep learning tools to determine when a customer (or region of customers) is most likely to update, modify, or purchase new plans and products, thereby allowing them to align their business strategy to reduce the risk of customer attrition or lost sales.
- **Declining or flat revenues:** Deep learning algorithms can process large groups of customer-related inputs such as geography, age, buying habits, and lifestyle preferences to gauge the highest price that customer subsets are willing to pay for a product.
- **Customer segmentation:** By identifying your customer segments through a machine learning algorithm, patterns between customers that were once only intuited by decision makers can be identified and verified based on historical data.
- **Inventory management:** Predictive analytics, fueled by ANNs, can give retail chains the ability to analyze and correlate inventory positions on storefront shelves to better understand when a customer is most likely to make the maximum purchase in their store.

[1] Neural Network Primer: Part I" by Maureen Caudill, AI Expert, Feb. 1989

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- **Employee acquisition and retention:** Through deep learning, Human Resources departments can predict when employees are most likely to quit and plan their hiring initiatives during that time period in order to mitigate the impact of employee attrition to their business.
- **Self-driving vehicles:** Image recognition systems help self-driving vehicles 'read' the road ahead by identifying object types and their behaviours based on historical data. It is this type of deep learning that gives automated vehicles the 'brains' to assess their environment and respond accordingly.
- **Energy saving:** Organizations can reduce cooling and energy costs by applying deep learning algorithms over their historical data to learn when it makes the most sense to use or conserve energy. For example, this capability can help maximize energy use when it comes to cooling a warehouse.

Savings and rewards just for you

Safeway, a Canadian supermarket chain in Western Canada, has put lifetime value modelling into practice with its savings and rewards program. By offering discounts, promotions and Air Miles rewards to customers based on the products they buy and ones Safeway thinks they will enjoy, the company is analyzing consumer habits and decision making to optimize promotional programs and reward customer loyalty.

Source: https://www.safeway.ca/

Deep Learning in Silicon Valley

In 2014, Google tasked its $500 million DeepMind AI neural network with finding the most efficient ways to cool Google's data centers by using historical data (e.g., temperatures, power, pump speeds, set points, etc.) that had already been collected by thousands of sensors within the data center to train an ensemble of deep neural networks. As a result, Google's machine learning system was able to consistently achieve a 40 percent reduction in the amount of energy used for cooling. This is one of a growing number of case studies that showcases the impact deep learning can have on an organization's bottom line and environmental footprint.

Source: https://deepmind.com/blog/deepmind-ai-reduces-google-data-centre-cooling-bill-40/)

Great examples, but what's the catch?

As with any game-changing technology, there are obstacles to adoption. Consider the following before you make an investment:

- **How clean is your data?** ANNs require accurate, actionable data – a resource which is not always readily available. If you have dirty data, or your systems for storing data are not secure or efficient, then you won't have the main ingredient required for deep learning capabilities.
- **Can you afford it?** Good data is essential to deep learning capabilities, yet the cost of collecting, cleaning, and storing that data can be intimidating. The good news is those costs are coming down and technology companies are coming to market with more affordable, pre-made neural network engines with the ultimate goal to make deep learning more affordable and accessible to organizations regardless of size or level of tech-savviness.
- **Do you have the right talent?** Maintaining a neural network requires specialized skills, and data scientists are few and far between (or already working for the top technology players). Fortunately, the field is expanding.

Where do I start?

ANNs have much to offer, but their uses will differ for each organization. Therefore, it's important to first conduct a SWOT analysis (strengths, weaknesses, opportunities, threats / risks) within your organization to help determine how deep learning capabilities can optimize business risks and maximize your opportunities.

After all, there's no doubt that neural networking is rapidly changing the field of AI, and there's no doubt that the return on investment potential is worthy of investigation. Once you know how your organization can benefit from ANNs, you can align your people, processes, and business transformation strategies to take part in this promising AI revolution.

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