IJCSN - International Journal of Computer Science and Network, Volume 8, Issue 1, February 2019
ISSN (Online) : 2277-5420
www.IJCSN.org
Impact Factor: 1.5

Brain Intelligence: Another Aspect of Artificial Intelligence

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Abstract - Artificial intelligence has captured all the activities of our daily life, it not only solve our social problems but also helps in the development of a country. From agriculture to Robot Technology (RT), AI is the key for development. AI basically works on patterns, learning from past experiences and then implementing them, which sometimes add as a constraint. So, in this paper we will see the different aspect of AI, that is Brain intelligence, where without the past experience also machine will be able to take logical decision.

Keywords - *Artificial Intelligence, Brain Intelligence, Robot Technology, Patterns*

1. Introduction

Theories and concepts related to AI is existing from last 60 years. Simulation of the activities of brain has always been a subject of interest to scientists, philosophers and artists.Indian businesses, the government and individuals have, in recent years, also seen multiple use cases of AI in various facets of life. Digital assistants, cab aggregators, biometric recognition, targeted advertisements and online recommendation engines are among the more common AI applications used today. Organisations have started realising the efficiencies and growth opportunities that come with the automation of back-end processes, chatbots for customer services, machine learning for predictive maintenance in manufacturing , etc . Government bodies have employed AI-powered applications such as machine leaning, image and speech recognition, robotics and more to bolster defence equipment and techniques. But through some research, I have found that AI has some constraints also. Let's discuss them here.

2. Constraints of Artificial Intelligence

Increase processing capacity of computers and the impact of big data have acted as a booster for the development of AI. But these are limited to some areas like speech recognition, image recognition etc. we use techniques like Deep Residual learning for visual recognition, deep Neural Network for speech recognition and Represent Learning for Dialogue understanding. All these techniques are not enough to perform complete function of human brain like, self-control, self motivation, consciousness, decision making(without past experiences) etc. Let's discuss these constraints in detail:-

2.1 Frame Problem

When we talk about AI, it is always restricted to single type of problem. Like, if we develop an algorithm to pay badminton, only restricted results can be expected. But in real life we need to cope up with infinite number of phenomena. Like me to look also, listen music, surf on net at the same time. This capability need to be developed through AI.

2.2 Association Function Problem

When we talk about AI, it basically deals with large amount of data and the result obtained is numerical values. What is missed is the association function. No doubt, AI is excellent in extracting patterns correlation between patterns is also required. That is, a single part of the brain cannot be as intelligent as the whole brain.

2.3 Symbol Grounding Problem

As a human being we are blessed to interlink symbols with their appropriate meanings. Like we refer to 64 squares in a board, we can recognise that it will be a chess board or getting the indication that we have green, red and orange lights which make us think about traffic life but this is not done in AI. In simple terms we can say that AI does not have the capacity to make a logical connection with some ideas or symbols as done by human brain.

2.4 Mental and Physical Problem

What is the relationship between the mind and body? That is, if the mind is generally thought of as non-material, how

can the physical body be affected by it? Whether or not this is possible has not been elucidated.Because of these constraints we will discuss about Brain Intelligence(BI) that will overcome these limitations.

3. Artificial Intelligence

The market and business investment for AI has increased tremendously. From 2015 to 2019 this percentage has increased from 33% to 67% and investment has grown more than 300%. In 2015 AI was making a business of $ 6 billion which will grow to $ 47 billion in 2020 according to IDC estimates.
Current artificial intelligence includes a variety of technologies and tools, some time-tested and others that are relatively new. To help understand what is hot and what is not, Forrester has just released a TechRadar report on artificial intelligence(application developers), detailing the technologies for which companies should consider using artificial intelligence to support decisions.

3.1 Natural Language Generation

Natural-language generation (NLG) is the natural - langua ge processing task of generating natural language from a machine-representation system such as a knowledge base or a logical form.
It could be said an NLG system is like a translator that converts data into a natural-language representation. However, the methods to produce the final language are different from those of a compiler due to the inherent expressivity of natural languages. NLG has existed for a long time but commercial NLG technology has only recently become widely available.
Deep neural networks (DNN) are undoubtedly one of the most popular research areas in the current NLG field. DNN are designed to learn representations at increasing layers of abstraction by adopting backpropagation, feedforwards, log-bilinear models, and recurrent neural networks (RNN). Their advantage over traditional models is that DNN models represent voice sequences of varying lengths, so similar histories have related representations .
They over come the disadvantage of traditional models, which have data sparseness and a recorder for remembering the parameters.

3.2 Speech Recognition

Speech recognition is the ability of a machine or program to identify words and phrases in spoken language and convert them to a machine-readable format. Hidden Markov models (HMM) are useful tools for speech recognition. In recent years, deep feedforward networks (DFN) have gained attention for solving issues of recognition. It seems that HMM combines with RNN as a better solution.

3.3 Virtual/Augmented Reality

As the word augmented means Augmented reality (AR) is an interactive experience of a real-world environment where the objects that reside in the real-world are "augmented" by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual ,auditory, and olfactory.
It is currently used in customer service and support and as a smart home manager.Sample vendors include Amazon, Apple, Artificial Solutions, Assist AI, Creative Virtual,Google, IBM, IPsoft, Microsoft, and Satisfi.

3.4 AI-optimized Hardware

In AI, we deal with large amount of data to learn patterns. Large data means large computation power which can be accelerated by better hardware.Graphics processing units (GPU) , general purpose processors (GPGPU)and field programmable gate arrays (FPGA) are required to efficiently run AI-oriented computational tasks.GPU has orders of magnitude more computational cores than traditional general purpose processors(GPP) and allows a greater ability to perform parallel computations. In particular, GPGPU is usually used. Unlike GPUs, FPGA has a flexible hardware configuration, and provides better performance per Watt than GPUs. However, it is difficult to program FPGA devices because of the special architecture.Sample vendors include Alluviate, Cray, Google, IBM, Intel, and Nvidia.

3.5 Decision Management

Decision-making plays a critical role in achieving sustainable development during turbulent financial markets. With the improvement of information communication technology (ICT), AI-based techniques, such as decision tree (DT), support vector machine(SVM), neural network (NN), and deep learning, have been used for decision making . Engines that insert rules and logic into AI systems are used for initial setup/training and ongoing maintenance and tuning. A mature technology, which is used in a wide variety of enterprise applications, assisting in or performing automated decision making. Sample vendors include Advanced Systems Concepts, Informatica, Maana, Pegasystems, and UiPath.

3.6 Robotic Process Automation

Robotic process automation (RPA) uses software and algorithms to automate human action to support efficient

business processes. A software robot is used instead of humans for typing and clicking and even analyzing data in different applications. RPA is currently used where it is too expensive or inefficient for humans to execute a task or a process. Researchers are promoting the adoption of RPA in the financial area. RPA has also been applied to trading in treasuries, affecting accounting staff involved in the banking area. AI, as a solution for big data, provides a new possibility for accurate prediction of RPA. Sample vendors include Advanced Systems Concepts, Automation Anywhere,Blue Prism, UiPath, and WorkFusion.

3.7 Text Analytics and NLP

Natural Language processing is the method to understand and analyse human language in an efficient way. It understands the meaning of human language with its intent also.We introduce the following AI methods applied to NLP.

Recurrent neural networks (RNN) make full use of sequential information. As we all know, the inputs and outputs of traditional neural networks are independent. In practice, it must predict the words before a sentence. The so-called RNN is a recurrent network because it performs the same task for every element of a sequence, with the output being dependent on the previous computations. There are many types of improved RNN models that have been proposed to solve some of the shortcomings of the original RNN model. Bidirectional RNN is based on the principle that the output may not depend only on the previous elements in the sequence but also on the future elements. Deep bidirectional RNN is similar to Bidirectional RNN but improved by adding multiple layers per time step. Long short-term memory (LSTM) uses the same mechanism to decide what to keep in and what to erase from memory that is used in RNNs.

Recursive neural network is another deep neural network created by applying the same set of weights recursively over a structure in order to produce a structured prediction over the input by transferring a given structure in topological order. Dependency neural network (DCNN) is a method proposed to capture long-distance dependencies . DCNN consists of a convolutional layer built on top of an LSTM model. Dynamic k-max pooling neural network is another type of network that uses a non-linear max pooling subsampling operator to return the maximum of a set of values.

3.8 Visual Recognition

Deep learning has been shown to be one of the best solutions for computer vision. A large number of methods have been developed to improve the performance of traditional deep-learning algorithms.In general, these methods can be divided into three categories: convolutional neural networks,autoencoders, and sparse and restricted Boltzmann machines. In this paper, we focus on searching convolutional neural network models.The pipeline of the traditional convolutional neural network architecture consists of three main setsof layers: convolutional, pooling, and fully connected layers.

Different layers play different roles in the classification. Convolutional layers are used to convolve the image to generate feature maps. The main advantages of convolutional layers are that the weight-sharing mechanism reduces the number of parameters and local connectivity learns the relationships between the neighbor pixels. In addition,it is invariant to the location of the objects in the image.The pooling layers are usually used after the convolutional layers to reduce the dimensions of the feature maps and to adjust the parameters. Average pooling and max pooling are used in most cases.Following the last pooling layers, the fully connected layers are used to convert the two-dimensional feature maps into one-dimensional feature vectors. Several state-of-the-art convolutional neural network models are reviewed below.

Convolutional neural networks (CNN) are similar to traditional neural networks (NN). They are made up of neurons that have learnable weights and biases. The main difference between CNN and NN is the number of layers. CNN use several layers of convolutions with nonlinear activation functions applied to the results.AlexNet contains eight layers. The first five layers are the convolutional layers, and the following three layers are the fully connected layers. Compared to CNN, AlexNet has advantages such as data augmentation, dropout,ReLU, local response normalization, and overlapping pooling.

The main contribution of VGGNet is to increase the network depth using very small convolution filters. The total number of layers in VGGNet is 16–19. However, the use of max-pooling layers results in a loss of accurate spatial information.The GoogLeNet method increases the width and depth of the network while keeping the computational budget constant. One of the main advantages of GoogLeNet is that it allows the number of layers at each stage to be increased without an uncontrolled blow-up in the computational complexity. Another benefit is that this network is 2–3 times faster than similarly performing networks. However, it is complex to configure the design of this network. There is a trend for deeper layers to result in better network performance. However, with increasing network depth, the training accuracy becomes saturated and then rapidly degrades.

4. Brain Intelligence (BI)

There are many approaches proposed to solve the limitations of recent AI. However, these models are simply extended from the current AI models. This paper introduces the following items for explaining the concept of BI,

which is different from artificial intelligence, but extends upon current artificial intelligence.The BI intelligent learning model fuses the benefits of artificial life (AL) and AI. Currently, the mainstream research on deep learning is a method of learning expressions extracted from essential information of observational data by a deep neural network with a large number of layers. However, research on multitask learning that learns multiple tasks at the same time and transition studies that divert learning results for a certain task to other tasks is still insufficient. For this reason, AI models based on unsupervised learning and shallow neural networks will become trends in future. In this paper, we will combine various regional AI methods using a particular rule, especially unsupervised learning methods. It is essential to develop a new intelligent learning model with a small database and the ability to understand concepts. Therefore, we propose a Brain Intelligence model with memory and idea function. The BI model network combines artificial life technology and artificial intelligence technology with memory function. The concept of the BI model network. Different neural networks are connected by artificial life-based network, which can share the parameters, trained results, and structures to parents and sons. Research on current AI mainly focuses on individual areas such as dialogue comprehension, visual recognition, and auditory discrimination and so on. Research on whole-brain functions is still insufficient. For example, there are few studies on perceptual understanding models and self thinking models. Therefore, in this research, we will clarify the function and mechanisms of the whole brain and make efforts to realize it as artificial intelligence. BI network is consisted by many simple subnetworks. The parameters of each sub-networks is updated by S-system, which can modify the sub-networks by reproduction, selection, and mutation.Different from Neuro Evolution of Augmenting Topologies (NEAT), the proposed BI mode network does not just use the neural network structure and parameter optimization mechanism, it improves the structure of current AI models using S-system. hyperNEAT, a type of A-life based NN, which uses the Compositional Pattern Producing Network (CPPN) for pattern generation and uses NEAT for parameters optimization. hyperNEAT cannot overcome the drawbacks of the NEAT network. Other gene-based models, such as Gene Regulatory Network (GRN) and Evolving Reaction Network (ERN), are also studied by some researchers. These methods are inspired by biological characteristics, which do not take into account the usage of all the brain's function. Cognitive Computing (CC) is proposed a new model from the view of human cognitive functions. The BI model network is investigated from an engineering point of view, in the future, we will develop a super-intelligent brain function model that intends to discover problems itself and autonomously enhance its abilities.

5. Conclusion

In this paper, I have presented state-of-the-art artificial intelligence tools for individual application areas, such as natural language processing and visual recognition. The main contributions of this work are as follows. First, this is an overview of current deep learning methods. We have summarized the nine potential applications in detail. Second, this paper puts together all the problems of recent AI models, which will direct future work for researchers. Third, in this paper, we first proposed the brain intelligence model, which is a model fusing artificial intelligence and artificial life. AL models, such as the S- system, have the benefits of an association function, which is different from generative adversarial networks (GAN), for building big data within a life evolution process. It is foreseeable that the BI model can solve the issues of the frame problem, the association function problem, the symbol grounding problem, and the mental/ physical problem.

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