IBM Watson
"The Game Changer Technology Innovation"

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Abstract: On 2007, IBM (International Business Machine) Research took itself the biggest summon that could take on the game of Jeopardy!. On 2011, QA (Question Answering) system named "Watson" defeated the two highest ranked players in the game and eventually Watson triumph. Watson not only performs calculations but also keep tracks of day–to-day data that helps to capture various events that occur in the lifecycle of a data asset or model allowing you to discover what happened to the forte since it was created. Cognitive computing is the basis of Watson that uses computerized models to simulate the human thought process in miscellaneous situations. The alternative of Artificial Intelligence, the Augmented Intelligence is used in Watson that focuses and keep tracks on AI's generous role, emphasizing the fact that cognitive technology is intended primarily to enhance human intelligence rather than replacing it. For the above reasons IBM Watson is celebrated as "Cognitive Computer". The main section of this paper gives a tale of DeepQA processing pipeline. Hence shortly describing our results, based on the algorithmic techniques performed.

Keywords: IBM Watson, AI, Cognitive systems, QA, ML

I. INTRODUCTION

IBM Watson introduced in the year 2010 works based on Cognitive Computing. It is different from the Tabulating Machine (1891), Electronic Accounting Machine (1932), Selective Sequence Electronic Calculator (1948) and System360(1964) which are based on rigid based tree approach and only consider calculations. Big data is more complex evidence-based decision. IBM Watson find answers in size locked away in volumes of data. Examples include doctor diagnosing a patient, wealth manager advising a client on retirement portfolio, chef creating a new recipe.

New approach to put into context the volume of information they deal with on a daily basis in order to drive the value from it. The main advantage is that it serves human expertise, reasons to problems like a human does. Watson is extremely advanced machine learning that results in reasoning. This could aid in finance, scientific research, healthcare, provide business solutions, revolutionize the food industry. It can be stated as it is no longer a game man versus machine but it is man and machine reasoning together. Mainly Watson follows four criteria: -

1. Physical or visible phenomenon and bodies of evidence.
2. Interpret what we are seeing.
3. Evaluate what is right or wrong.
4. Decision making with regard to evaluation.

II. START TO USE

Question Answering (QA) computing system "Watson" was created by IBM to apply very advanced neural language processing, retrieval of information & ML (Machine Learning) technologies to the field of open domain QA. A simple document search takes a keyword and returns a set of results based on that whereas QA technology uses a question represented in natural language then tries to understand it with greater intensity and only then returns an accurate answer. Initially, many different techniques where used to analyse natural language, find origins, generate hypotheses, increment evidences and also merge and evaluate hypotheses. In these recent times, Watson's capabilities have been extended greatly. The working of Watson has changed drastically to take advantage of these new capabilities and evolved ML hardware and software. Watson's can no longer be tied down by the threads of QA alone but can now 'see', 'hear', 'read', 'talk', 'taste', 'interpret', 'learn' and 'recommend'.

Watson is broken down into a set of cognitive capabilities split into four key areas vision, speech, data and language. Watson allows developers to incorporate cognitive and machine learning into their applications without having to code in the actual intelligence. Cognitive systems learn that they are not programmed yet and are more than machine learning systems. They understand unstructured data and natural language. They do more than natural language

processing and are in aspect of Artificial Intelligence that is more correct to say Augmented Intelligence than artificial that's because Watson enhances scales and accelerate human expertise.
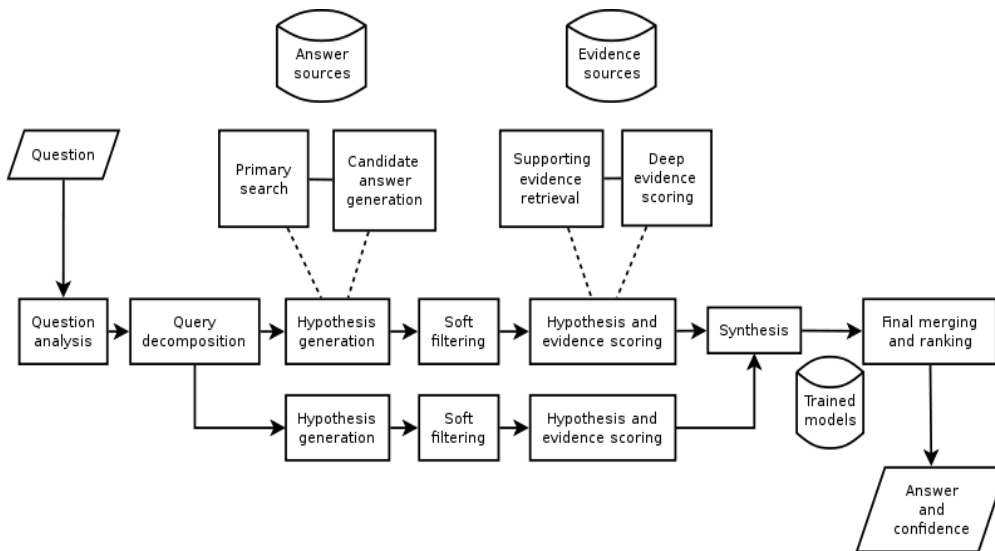

Fig. 1 The high-level architecture of IBM's DeepQA used in Watson [1]

III. YOUR DATA AND WATSON

The main working rule of Watson is to examine watchwords in a clue while simultaneously searching for related terms as responses, this does have its own advantages & disadvantages compared with human Jeopardy! players. Understanding the contexts of the clues is difficult for Watson. The result being human players generating responses faster than Watson particularly to short clues. Watson is programmed in such a way that only when its sure that the answer is correct will it produce the result hence responding with a slow reaction time. The human players were able to take advantage of this slower response time of average six to seven seconds. But in terms of pure response time Watson was faster due to its highly complicated circuitry, the human players tried to counter this with their anticipation& experience. Watson responds with an electronic voice synthesized from recording of actor Jeff Woodman.
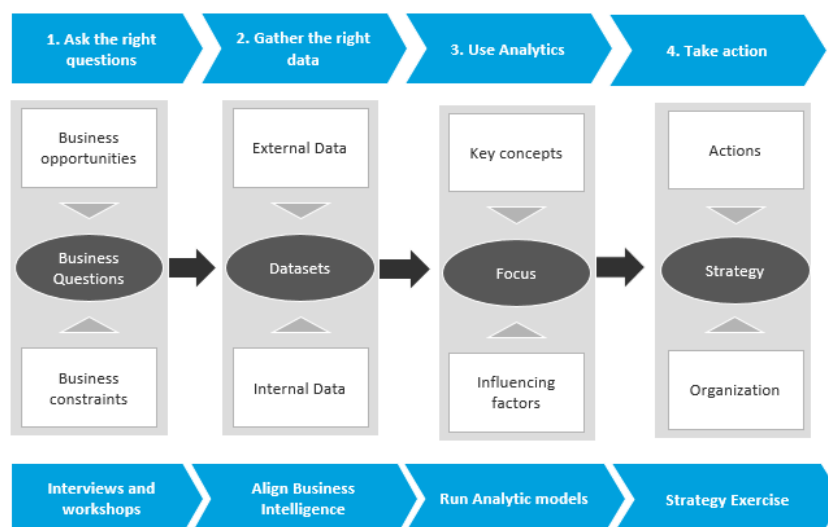

Fig. 2 How Watson derives a response to a question [2]

Transfer learning is learning what to learn. It enables Watson to learn more from less so it doesn't need to be trained from scratch, it can be fed prior knowledge to speed things up.
You can connect your data to Watson whenever it is whether it's inside your enterprise or in the cloud with no disruption to your work flow. The advantage is that you can protect your data from cyber threats comply with litigation old and new and always maintain full transparency as business start to rely more on Artificial Intelligence, they need transparency to confirm that the recommendations given can be trusted.

IV. UNSTRUCTURED TO STRUCTURED

As mentioned above, Watson uses unstructured text as its input and produces results based on that, but this unstructured text needs to be converted to a structured data in order for the system to understand. The technique of transforming unstructured text to structured data is called text analytics. This process produces metadata for the original content. This metadata is used to index unstructured text to prepare the search & discovery operations like - summarization, sentiment analysis, explication, investigation, classification etc. Watson can understand unstructured data that includes literature, articles, research reports, blogs, posts and tweets.

Watson can realize natural language grammar, context and culture. It is implicit, ambiguous and challenging process. When Watson is employed in a particular field it learns language, jargon (technical terms related to that particular field) and mode of thought.

Watson began to get major recognition after defeating two champions of the 'Games of Jeopardy'.

Watson uses statistical, linguistic, rule-based and ML techniques for natural language processing (NLP). Also, some results allow the users to develop and insert in the processing pipeline with their own set of rules and so on specific to the user.

Major contribution to Medical field on the treatment of Oncology related to cancer and leukemia related to tumours. As per reports 'Hope, Hype, and Harm at the dawn of Medicine's Computer Age' was reported. Watson still continues to get back its hope.

The basic motive of Watson is to learn adapt and get smarter. Watson gains value with age by learning interaction with as and from its own success and failures.

Fig. 3 Conversion of unstructured text to structured data

V. MOVING ON FROM LANGUAGE

Cognoscible systems maybe defined as implementing human-like characters to convey and manipulate ideas. This when combined with the advancements of digital computing, these systems are able to solve problems with higher accuracy, flexibility and over a massive scale of information. High order cognitive processes can make use of fundamental behaviors to attain a certain level of understanding. To be able to comprehend something, we will be needed to tear it down into finer elements. Likewise, these cognitive systems were designed to do work at human levels but over a large scale of information.

After we have established a certain degree of understanding, decomposition of the problem, these cognitive systems are able to recompose these finer elements in different ways, which may or may not express new concepts. Hence leading to new findings and insight, so that answers can be found for question that never existed. These findings could be used to solve problems that fit common patterns. Thus, to support sound decisions or for the very least help people with their decisions. As these cognoscible systems advances, we expect them to gain the ability to perceive, that is to do much more than to just read and have a minimum awareness of their surroundings. These systems should be able to perceive information, identify shapes, varying conditions, reason etc. This will be the start of a new age in which computers go beyond doing their routines efficiently and attain a human-like cognition to help people smarter.

The above image depicts a cognitive system as having many key elements in order to properly execute its normal functioning. The medium colored boxes indicate the current capabilities whereas the lighter shaded boxes indicate future capabilities.
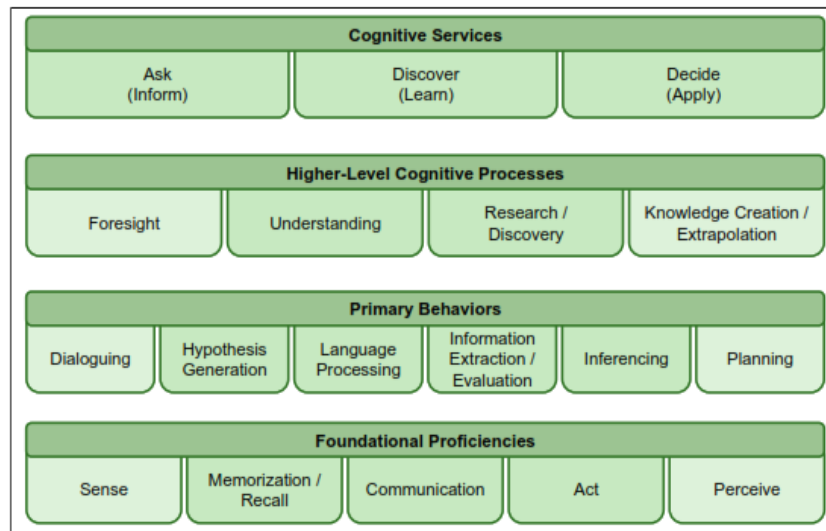
Fig. 4 Elements of a cognitive system [3]

Like humans, these systems have a method of collecting information as well as retrieving these data similar to humans recollecting information from their memories. These systems have a basic ability to communicate and take action accordingly to the situation to which they are put into which on the other hand are controlled by behavioral conditions already preprogrammed into to their systems such as - create and test hypotheses, generate inferences about the language, extract and assess useful information. All the above-mentioned skills are fundamentals of these cognitive systems without which humans nor the systems can identify correct association between questions and answers.

VI. WATSON VS HUMANS

The main working rule of Watson is to examine watchwords in a clue while simultaneously searching for related terms as responses, this does have its own advantages & disadvantages compared with human Jeopardy! players. Understanding the contexts of the clues is difficult for Watson. The result being human players generating responses faster than Watson particularly to short clues. Watson is programmed in such a way that only when its sure that the answer is correct will it produce the result hence responding with a slow reaction time. The human players were able to take advantage of this slower response time of average six to seven seconds. But in terms of pure response time Watson was faster due to its highly complicated circuitry, the human players tried to counter this with their anticipation& experience. Watson responds with an electronic voice synthesized from recording of actor Jeff Woodman.

VII. PROBLEMS

As time goes on, we are finding new uses for IBM Watson. Watson has found its way into many fields such as - oncology diagnosis, research, utilization management, credit analysis etc. Watson provides assistance to people in making their decision, that is answer their questions. The answers provided by Watson helps you think in new ways providing you out of the box ideas. This gives you an idea about the competitive threats and chances out there. New discoveries are constantly being made in IBM Research and Software Development Labs, some of the recent discoveries helps to create deeper insight determining that 'this' will lead to 'that' which will result in something else. These inferences can be captured in an inference graph by which we can observe a wide spectrum of ensuing considerations.

Sometimes it is also possible to produce reverse inferences, that is we discover questions to answers that were never asked. Major improvements can be made to IBM Watson with increasing investments which can lead way to further breakthroughs in government, healthcare, industries, finance etc. For example, in healthcare Watson is being used to identify diseases from symptoms of the patients. Watson mainly utilizes traditional forms of computing which include - statistical analysis, collaboration, processing etc.

VIII. CURRENT AND FUTURE APPLICATIONS

With the help of Watson, IBM is breaking through its limits as the new aeon of cognoscible computing. IBM have invested over $1 billion to this project. This Watson ecosystem is to empower and promote startups and businesses those are building cognitive systems with Watson. This ecosystem will continue to grow and grow as the time goes on, and with the increasing amounts of investments flowing in.

According to IBM, "The goal is to have computers start to interact in natural human terms across a range of applications and processes, understanding the questions that humans ask and providing answers that humans can understand and justify." [4] Watson is based on IBM Power 750 servers. IBM is currently working with 3 companies to make apps embedded with Watson technology, also with the help of Watson's API helps them to build apps and services which are embedded in Watson's capabilities. Watson has integrated with many databases including Bon Appétit magazine in order to create a platform that generates recipes.

Watson is supposed to be integrated with music discovery services which uses supercomputers to provide music recommendations to its users. OmniEarth, Inc. will use Watson's vision services to study satellite & aerial imagery to improve water conservation efforts. Since the very day Watson beat Jeopardy! champions with the help of natural language recognition and machine learning the system has been used in a variety of industries. In the coming three to five years every single professional will want to consult Watson, in order to make the optimal decision. Watson will be used in ever industries in the future.

Ultimately the main goal of IBM is to reform businesses, industries, professions etc. With Watson helping people make better decisions this reformation will one day become possible, business will be able to achieve things that earlier generations deemed impossible with very little or absolutely no errors in their calculations.

IX. CONCLUSION

In spite of being designed prior to the dawn of deep learning, IBM Watson remains astonishingly relevant. Being a modular system rather than being a monolithic algorithm, this system can incorporate new data sources and algorithms which includes deep learning. IBM's many accomplishments have given the company a wide set of training data for Watson. Watson has what it takes to bring AI to healthcare, analytics, IOTs, services and more.

ACKNOWLEDGMENT

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