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A Contemporary Overview and Applications of Artificial Intelligence

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ABSTRACT

The Artificial Intelligence has been the subject of considerable emphasis in the field of computer science in recent times. Nowadays, many current real applications are being based upon Artificial Intelligence. It is being used in all fields of science and industry such as Automotive, Electronics, IT and Software, Telecommunications, Aerospace, Engineering, oil gas and geo sciences. In the following article, we focus our activities on the basic concept of Artificial Intelligence and vision by its creators, state of the art research, and standard implementation. The article also describes the running experiments and applications. Particular attention has also been paid on industrial case study of Artificial Intelligence. We survey some of the most relevant results obtained during recent years. The role of media (such as newspapers, articles, books and movies) has also presented many theories and predictions upon the future of AI, which would also affect the general view of Artificial Intelligence

1. INTRODUCTION

Concept

According to the dictionary the meaning of Artificial Intelligence is an area of study concerned with making computers copy intelligent human behaviour. The term was first introduced back in 1955 by Jhon Mccarthy, a scientist. He defines Artificial Intelligence as “science and engineering of making intelligent machines, especially computer programs”. The basic concept is of course, as the title suggests an intelligence manufactured by human beings to assist them in their own works. With the rise of mechanical age in 20th century, there was also rise in competition among scientists and manufacturers to develop better technology so artificial intelligence was introduced as part of the competition. A machine that could actually work like an individual may be even better. Robots are good examples of artificial intelligence. Now there are different types of these machines working in industrial sector and soon they will be working inside homes as well. Alan Turing was the first to explore a test called Turing’s Test which serves as the base history of Artificial Intelligence. Turing’s test is a type of game in which an interrogator tries to determine which of the two contestants is a machine and which is human. The test has inspired several programs whose goal is to simulate human conversation ability. Norbert Wiener is well known in the field of Artificial Intelligence as the first person to create a theory of communication and control with enough complexity to allow for intelligent behaviour, while Simon and Newell were some of the first people to write Artificial Intelligence programs. This research was carried out primarily by means of the Internet, the reason for this being the convenience of the technology. However, the Internet was mainly used for general knowledge and as a way of attaining information about important literature.

2. Braches of AI

Following is purposed list of Branches of Artificial Intelligence classified by its creator John McCarthy hence he has not finished the topic but kept an open space for future explorers to discover more of them.

2.1. Genetic programming

Genetic programming is a technique for getting programs to solve a task by mating random Lisp programs and selecting fittest in millions of generations. It is being developed by John Koza's group.

2.2. Heuristics

A heuristic is a way of trying to discover something or an idea imbedded in a program. The term is used variously in AI. *Heuristic functions* are used in some approaches to search to measure how far a node in a search tree seems to be from a goal. *Heuristic predicates* that compare two nodes in a search tree to see if one is better than the other, i.e. constitutes an advance toward the goal, may be more useful.

2.3. Ontology

Ontology is the study of the kinds of things that exist. In AI, the programs and sentences deal with various kinds of objects, and we study what these kinds are and what their basic properties are. Emphasis on ontology begins in the 1990s.

2.4. Epistemology

This is a study of the kinds of knowledge that are required for solving problems in the world.

2.5. Planning

Planning programs start with general facts about the world (especially facts about the effects of actions), facts about the particular situation and a statement of a goal. From these, they generate a strategy for achieving the goal. In the most common cases, the strategy is just a sequence of actions.

2.6. Learning from experience

Programs do that. The approaches to AI based on *connectionism* and *neural nets* specialize in that. There is also learning of laws expressed in logic. [Mit97] is a comprehensive undergraduate text on machine learning. Programs can only learn what facts or behaviors their formalisms can represent, and unfortunately learning systems are almost all based on very limited abilities to represent information.

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2.7. Common sense knowledge and reasoning

This is the area in which AI is farthest from human-level, in spite of the fact that it has been an active research area since the 1950s. While there has been considerable progress, e.g. in developing systems of *non-monotonic reasoning* and theories of action, yet more new ideas are needed. The Cyc system contains a large but spotty collection of common sense facts.

2.8. Inference

From some facts, others can be inferred. Mathematical logical deduction is adequate for some purposes, but new methods of *non-monotonic* inference have been added to logic since the 1970s. The simplest kind of non-monotonic reasoning is default reasoning in which a conclusion is to be inferred by default, but the conclusion can be withdrawn if there is evidence to the contrary. For example, when we hear of a bird, we can infer that it can fly, but this conclusion can be reversed when we hear that it is a penguin. It is the possibility that a conclusion may have to be withdrawn that constitutes the non-monotonic character of the reasoning. Ordinary logical reasoning is monotonic in that the set of conclusions that can the drawn from a set of premises is a monotonic increasing function of the premises. Circumscription is another form of non-monotonic reasoning.

2.9. Representation

Facts about the world have to be represented in some way. Usually languages of mathematical logic are used.

2.10. Pattern recognition

When a program makes observations of some kind, it is often programmed to compare what it sees with a pattern. For example, a vision program may try to match a pattern of eyes and a nose in a scene in order to find a face. More complex patterns, e.g. in a natural language text, in a chess position, or in the history of some event are also studied. These more complex patterns require quite different methods than do the simple patterns that have been studied the most.

2.11. Logical AI

What a program knows about the world in general the facts of the specific situation in which it must act, and its goals are all represented by sentences of some mathematical logical language. The program decides what to do by inferring that certain actions are appropriate for achieving its goals. The first article proposing this was [McC59]. [McC89] is a more recent summary. [McC96b] lists some of the concepts involved in logical aI. [Sha97] is an important text.

2.12. Search

AI programs often examine large numbers of possibilities, e.g. moves in a chess game or inferences by a theorem proving program. Discoveries are continually made about how to do this more efficiently in various domains.

3. Surveys

3.1. The 2014 Survey: **Impacts of AI and robotics by 2025**

Summary of Key Findings

The vast majority of respondents to the 2014 Future of the Internet canvassing anticipate that robotics and artificial intelligence will permeate wide segments of daily life by 2025, with huge implications for a range of industries such as health care, transport and logistics, customer service, and home maintenance. But even as they are largely consistent in their predictions for the evolution of technology itself, they are deeply divided on how advances in AI and robotics will impact the economic and employment picture over the next decade.

We call this a canvassing because it is not a representative, randomized survey. Its findings emerge from an "opt in" invitation to experts who have been identified by researching those who are widely quoted as technology builders and analysts and those who have made insightful predictions to our previous queries about the future of the Internet. (For more details, please see the section "About this Canvassing of Experts.")

Some 1,896 experts responded to the following question:

The economic impact of robotic advances and AI – Self-driving cars, intelligent digital agents that can act for you, and robots are advancing rapidly. Will networked, automated, artificial intelligence (AI) applications and robotic devices have displaced more jobs than they have created by 2025?

Half of these experts (48%) envision a future in which robots and digital agents have displaced significant numbers of both blue and white-collar workers—with many expressing concern that this will lead to vast increases in income inequality, masses of people who are effectively unemployable, and breakdowns in the social order.

The other half of the experts who responded to this survey (52%) expect that technology will not displace more jobs than it creates by 2025. To be sure, this group anticipates that many jobs currently performed by humans will be substantially taken over by robots or digital agents by 2025. But they have faith that human ingenuity will create new jobs, industries, and ways to make a living, just as it has been doing since the dawn of the Industrial Revolution.

These two groups also share certain hopes and concerns about the impact of technology on employment. For instance, many are concerned that our existing social structures—and especially our educational institutions—are not adequately preparing people for the skills that will be needed in the job market of the future. Conversely, others have hope that the coming changes will be an opportunity to reassess our society's relationship to employment itself—by returning to a focus on small-scale or artisanal modes of production, or by giving people more time to spend on leisure, self-improvement, or time with loved ones.

3.2. Predictions for Automation of Work by 2025

The sizeable majority of experts surveyed for this report envision major advances in robotics and artificial intelligence in the coming decade. In addition to asking them for their predictions about the job market of the future, we also asked them to weigh in on the following question:

To what degree will AI and robotics be parts of the ordinary landscape of the general population by 2025? Describe which parts of life will change the most as these tools advance and which parts of life will remain relatively unchanged.

Following are some themes that emerged from answers to this question.

AI and robotics will be integrated into nearly every aspect of most people's daily lives

Many respondents see advances in AI and robotics pervading nearly every aspect of daily life by the year 2025—from

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distant manufacturing processes to the most mundane household activities.

Jeff Jarvis, director of the Tow-Knight Center for Entrepreneurial Journalism at the City University of New York, wrote, "Think 'Intel Inside'. By 2025, artificial intelligence will be built into the algorithmic architecture of countless functions of business and communication, increasing relevance, reducing noise, increasing efficiency, and reducing risk across everything from finding information to making transactions. If robot cars are not yet driving on their own, robotic and intelligent functions will be taking over more of the work of manufacturing and moving."

Vint Cerf, vice president and chief Internet evangelist for Google, responded, "Self-driving cars seem very likely by 2025. Natural language processing will lead to conversational interactions with computer-based systems. Google search is likely to become a dialog rather than a client-server interaction. The Internet of Things will be well under way by this time and interaction with and among a wide range of appliances is predictable. Third party services to manage many of these devices will also be common."

Stowe Boyd, lead researcher for GigaOM Research, predicted, "Pizzas will not be delivered by teenagers hoping for a tip.

Food will be raised by robotic vehicles, even in small plot urban farms that will become the norm, since so many people will have lost their jobs to 'bots. Your X-rays will be reviewed by a battery of Watson-grade AIs, and humans will only be pulled in when the machines disagree. Robotic sex partners will be a commonplace, although the source of scorn and division, the way that critics today bemoan selfies as an indicator of all that's wrong with the world."

K.G. Schneider, a university librarian, wrote, "By 2025 AI, robotics, and ubiquitous computing will have snuck into parts of our lives without us understanding to what extent it has happened (much as I just went on a camping trip with a smartphone, laptop, and tablet)."

Lillie Coney, a legislative director specializing in technology policy in the US House of Representatives, replied, "It is not the large things that will make AI acceptable it will be the small things—portable devices that can aid a person or organization in accomplishing desired outcomes well. AI embedded into everyday technology that proves to save time, energy, and stress that will push consumer demand for it."

JP Rangaswami, chief scientist for Salesforce.com, wrote,

"Traditional agriculture and manufacturing will both be affected quite heavily, with AI and robotics having greater roles to play at scale, while high-touch 'retro' boutiques will exist for both sectors. Service sector impact will continue to be lower in relative terms; knowledge/information worker sector impact, on the other hand, will be transformational."

Marc Prensky, director of the Global Future Education Foundation and Institute, wrote, "The penetration of AI and robotics will be close to 100% in many areas. It will be similar to the penetration of cell phones today: over two-thirds of the world now have and use them daily."

Nilofer Merchant, author of a book on new forms of advantage, wrote, "Let me put it this way: my son, who is 10, doesn't think he needs to learn to drive or do grocery shopping because he says he'll just click something to arrive. All the fundamentals of life can and will be automated, from driving to grocery shopping. Chores effectively disappear in terms of time consumption."

A Syracuse University professor and associate dean for research wrote, "Robots and AI are moving beyond simple rules into framed judgment spaces. There will be several spectacular failures (to give voice to the dystopian seers) and so many subtle impacts. I see them in public transport, long-distance driving, traffic routing, and car-to-car interactions. I also see them moving into the built environment through post-market sensor networks reflecting energy monitoring, maintenance for household appliances, and supporting more distributed education. My expectation is that much of medicine will be in the midst of a transformation based on better sensors tied to more powerful analytics."

David Clark, a senior research scientist at MIT's Computer Science and Artificial Intelligence Laboratory, noted that AI is already a part of daily life for many users: "AI methods and techniques are already part of the ordinary landscape. The problem with the term 'AI' is that it is constantly redefined to describe things we don't yet know how to do well with computers. Things like speech recognition (like Siri), image recognition (face recognition in consumer cameras), and the like used to be hard AI problems. As they become practical commercial offerings, they spin off as their own disciplines."

However, some experts sounded a note of concern that the gains from these new advances risk being limited only to those with the financial resources to afford the latest technologies, which may reinforce economic inequality.

The CEO of a professional not-for-profit society responded,

"We will have more and more robots and AI in our lives, although I fear the benefits will accrue to the top 1-2% who can afford the gadgets." And an information science professional and leader for a national association wrote, "In terms of day-to-day living, AI and robotics could easily be something that only the 1% can afford or have access to. In fields like medicine, though, advances have the potential to help everyone."

A journalist, editor, and leader of an online news organization wrote, "Typically, this will depend on socioeconomics. The rich will spend almost no time doing things that can be automated; the poor will continue as is, more or less, although with superior communication abilities."

Bill Woodcock, executive director for the Packet Clearing House, responded, "The degree of integration of AI into daily life will depend very much, as it does now, on wealth. The people whose personal digital devices are day-trading for them, and doing the grocery shopping, and sending greeting cards on their behalf, are people who are living a different life than those who are worried about missing a day at one of their three jobs due to being sick, and losing the job, and being unable to feed their children."

Here are some of the key respondents in this report:

Rob Atkinson, president of the Information Technology and Innovation Foundation; Fred Baker, Cisco Systems Fellow; danah boyd, a social scientist for Microsoft; Stowe Boyd, lead at GigaOM Research; Bob Briscoe, chief researcher for British Telecom; Robert Cannon, Internet law and policy expert; Vint Cerf, vice president and chief Internet evangelist at Google; David Clark, senior scientist at MIT's Computer Science and Artificial Intelligence

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Laboratory; Glenn Edens, research scientist at PARC and IETF area chair; Jeremy Epstein, a senior computer scientist at SRI International; Bob Frankston, Internet pioneer and technology innovator; Jonathan Grudin, principal researcher for Microsoft; Joel Halpern a distinguished engineer at Ericsson; Jim Hendler, Semantic Web scientist and professor at Rensselaer Polytechnic Institute; Jeff Jarvis, director of the Tow-Knight Center at the City University of New York; Michael Kende, professional economist; Mike Liebhold, distinguished fellow at the Institute for the Future; Geoff Livingston, author and president of Tenacity5 Media; John Markoff, senior writer for the Science section of the *New York Times*; Raymond Plzak, former CEO of the American Registry for Internet Numbers, now a member of the board of ICANN; Jason Pontin, editor in chief and publisher of MIT Technology Review; JP Rangaswami, chief scientist for Salesforce.com; Howard Rheingold, pioneering Internet sociologist and self-employed writer, consultant, and educator; Mike Roberts, Internet Hall of Famer and longtime leader with ICANN; Marc Rotenberg, president of the Electronic Privacy Information Center; Paul Saffo, managing director of Discern Analytics and consulting associate professor at Stanford; Henning Schulzrinne, a member of the Internet Hall of Fame, IETF leader, and professor at Columbia University Doc Searls, director of ProjectVRM at Harvard's Berkman Center; Hal Varian, chief economist for Google; and Amy Webb, CEO of strategy firm Webbmedia Group. Here is a selection of other institutions at which respondents work or have affiliations:

Yahoo; Intel; IBM; Hewlett-Packard; Nokia; Amazon; Netflix; Verizon; PayPal; BBN; Comcast; US Congress; EFF; W3C; The Web Foundation; PIRG: NASA; Association of Internet Researchers; Bloomberg News; World Future Society; ACM; the Aspen Institute; Magid; GigaOm; the Markle Foundation; The Altimeter Group; FactCheck.org; key offices of US and European Union governments; the Internet Engineering Task Force; the Internet Hall of Fame; ARIN; Nominet; Oxford Internet Institute; Princeton, Yale, Brown, Georgetown, Carnegie-Mellon, Duke, Purdue, Florida State and Columbia universities; the universities of Pennsylvania, California-Berkeley, Southern California, North Carolina-Chapel Hill, Kentucky, Maryland, Kansas, Texas-Austin, Illinois-Urbana-Champaign, the Georgia Institute of Technology, and Boston College.

3.3. A survey of public opinions about Artificial Intelligence.

In terms of response, about 70 percent of the responders were male, 25 percent were female and 5 percent were unreported. Their results indicated that the majority of responders believe that Artificial Intelligence could be attained within this century and if not, it is at least theoretically possible. Surprisingly though, of the people quizzed only a little over 50 percent believed that machines could one day think by themselves. Concerning more social and ethical issues, the authors had asked about the result of robots replacing human beings. Most responded by saying that this may cause problems. A question was also asked about whether or not intelligent machines should be given rights: the overwhelming majority of responders answered in the negative. 5 In terms of interacting with Artificial Intelligence and sources of knowledge about the field, the answers were more varied. Some reported using Artificial Intelligence daily, others weakly, some monthly and yearly - a surprising number reporting never to have interacted with Artificial Intelligence at all (the numbers are 80, 38, 26, 11 and 34 people respectively).

3.4. Project Artificial Intelligence Through the Eyes of the Public BY Matthew Dodd, Alexander Grant and Latiff Seruwagi

Conduct a survey in order to gauge public opinion and link the findings. The major goal of this project was to analyse the extent to which public and expert opinion mirrors the reality of the Artificial Intelligence field. This goal was further divided into the study of two core relations, the relationships between the experts and the media; and between the media and the public. The most important part of a survey was the questions that it contains. The answers to these following questions provide the data for analysis, so it is important that the questions are easily understandable, unbiased, clear, and concise:

1) Do people understand what Artificial Intelligence actually is?

2) Is there a correlation between a person's intake of media (medium and frequency of consumption) and their understanding of Artificial Intelligence?

As stated above the goal was to analyse the extent to which public and expert opinion mirrors the reality of the Artificial Intelligence field. It was determined that this goal would be reached by studying two core relations, the relationships between the experts and the media; and between the media and the public. Based on research and survey data, the following conclusions about these two relationships:

• There is a lack of expert presence in the media.

• The media does affect the public's view of Artificial Intelligence.

Based on these two conclusions, following concluded about main goal, the extent to which public and expert opinion mirrors the reality of the Artificial Intelligence field:

• There is no connection between the experts' work in Artificial Intelligence and the public understands of the experts' research in Artificial Intelligence.

4. Research

After WWII, a number of people independently started to work on intelligent machines. The English mathematician Alan Turing may have been the first. He gave a lecture on it in 1947. He also may have been the first to decide that AI was best researched by programming computers rather than by building machines. By the late 1950s, there were many researchers on AI, and most of them were basing their work on programming computers.

AI research has both theoretical and experimental sides. The experimental side has both basic and applied aspects.

There are two main lines of research. One is biological, based on the idea that since humans are intelligent, AI should study humans and imitate their psychology or physiology. The other

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is phenomenal, based on studying and formalizing common sense facts about the world and the problems that the world presents to the achievement of goals. The two approaches interact to some extent, and both should eventually succeed. It is a race, but both racers seem to be walking.

Alan Turing's 1950 article *Computing Machinery and Intelligence* [Tur50] discussed conditions for considering a machine to be intelligent. He argued that if the machine could successfully pretend to be human to a knowledgeable observer then you certainly should consider it intelligent. This test would satisfy most people but not all philosophers. The observer could interact with the machine and a human by teletype (to avoid requiring that the machine imitate the appearance or voice of the person), and the human would try to persuade the observer that it was human and the machine would try to fool the observer.

The Turing test is a one-sided test. A machine that passes the test should certainly be considered intelligent, but a machine could still be considered intelligent without knowing enough about humans to imitate a human.

Daniel Dennett's book *Brainchildren* [Den98] has an excellent discussion of the Turing test and the various partial Turing tests that have been implemented, i.e. with restrictions on the observer's knowledge of AI and the subject matter of questioning. It turns out that some people are easily led into believing that a rather dumb program is intelligent.

The ultimate effort is to make computer programs that can solve problems and achieve goals in the world as well as humans. However, many people involved in particular research areas are much less ambitious.

A few people think that human-level intelligence can be achieved by writing large numbers of programs of the kind people are now writing and assembling vast knowledge bases of facts in the languages now used for expressing knowledge.

However, most AI researchers believe that new fundamental ideas are required, and therefore it cannot be predicted when human-level intelligence will be achieved.

The American Association for Artificial Intelligence (AAAI), the European Coordinating Committee for Artificial Intelligence (ECCAI) and the Society for Artificial Intelligence and Simulation of Behavior (AISB) are scientific societies concerned with AI research. The Association for Computing Machinery (ACM) has a special interest group on artificial intelligence SIGART.

The International Joint Conference on AI (IJCAI) is the main international conference. The AAAI runs a US National Conference on AI. *Electronic Transactions on Artificial Intelligence*, *Artificial Intelligence*, and *Journal of Artificial Intelligence Research*, and IEEE Transactions on Pattern Analysis and Machine Intelligenceare four of the main journals publishing AI research papers.

5. Implementations

AI has been playing a genuine and beneficial role in technology, ever since IBM's Deep Blue computer, the precursor to their Watson cognitive framework, defeated chess wizard Garry Kasparov. We're now seeing AI in day-to-day interactions with Siri, Apple's personal assistant, which provides information in response to voice commands. It's present in phone systems which listen for human input then route calls accordingly. Aviation relies on it for airport gate selection and simulation strategies. Financial organizations use it to maintain operations, investments and properties. Toy makers have released electronic pets and robots with simple AI capabilities. You can even find AI in space probes which go where humans cannot and make calculations as needed based on programming instructions.

6. Applications

There are applications of Artificial Intelligent in every part of Industry especially in Automotive, Electronics, IT & Software, Telecommunications, Aerospace, Oil, Gas & Geosciences and Engineering. There are further different applications of Artificial Intelligence. Some of these applications include use in the military, medical fields or for entertainment purposes. Another 4 application of Artificial Intelligence that mention is the use of Artificial Intelligence in creating realistic game characters. Artificial Intelligence in games evolved from simple characters to complex interactions and levels that depend greatly on context. They give examples of games such as Sims, and Petz and other games that react dynamically and realistically to the player

6.1 Game playing

You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation--looking at hundreds of thousands of positions. To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

6.2. Speech recognition

In the 1990s, computer speech recognition reached a practical level for limited purposes. Thus United Airlines has replaced its keyboard tree for flight information by a system using speech recognition of flight numbers and city names. It is quite convenient. On the other hand, while it is possible to instruct some computers using speech, most users have gone back to the keyboard and the mouse as still more convenient.

6.3. Understanding natural language

Just getting a sequence of words into a computer is not enough. Parsing sentences is not enough either. The computer has to be provided with an understanding of the domain the text is about, and this is presently possible only for very limited domains.

6.4. Computer vision

The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-

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dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

6.5. Expert systems

A ``knowledge engineer'' interviews experts in a certain domain and tries to embody their knowledge in a computer program for carrying out some task. How well this works depends on whether the intellectual mechanisms required for the task are within the present state of AI. When this turned out not to be so, there were many disappointing results. One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. Namely, its ontology included bacteria, symptoms, and treatments and did not include patients, doctors, hospitals, death, recovery, and events occurring in time. Its interactions depended on a single patient being considered. Since the experts consulted by the knowledge engineers knew about patients, doctors, death, recovery, etc., it is clear that the knowledge engineers forced what the experts told them into a predetermined framework. In the present state of AI, this has to be true. The usefulness of current expert systems depends on their users having common sense.

6.6. Heuristic classification

One of the most feasible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item he is buying and about the establishment from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment).

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