

2018

# PROJECT «AI<sup>3</sup>»

## Executive Summary

Seed (strong) AI development. A new sunrise stage.



# Table Of Contents

---

Innovation .....3

Solving the problem of natural language processing (NLP) and obtaining an adequate answer .....3

Solving the problem of rational logical thinking .....4

Solving the problems of self-development and the creation of intellectual property .....5

Description of the project .....6

Scheme of commercialization .....10

Market analysis .....11

The project team .....12

# Innovation

---

The ultimate solution of the problem of understanding natural speech, natural language processing (NLP) and constructing an adequate response to user requests (intents) by AI software of general purpose. The solution of the problem of rational logical thinking, including the recognition of unreliable information (logically contradictory) and the task of simulating human responses (masking); tasks of self-development and construction of arbitrary algorithms; the task of forming new ideas that are of intellectual value.

## Solving the problem of natural language processing (NLP) and obtaining an adequate answer

---

Solving the problem of understanding natural speech and its processing by the artificial intelligence system is the cornerstone of the initial stage of the project. The technical possibility of the ultimate decision itself is taken as an axiom.

Within the framework of the project, the global problem of understanding is divided into tasks of understanding individual key phrases, expressed in a set of test situations (BDD technique). This allowed us to specify the task, simplify the search for its solution.

The solving of all test situations simultaneously will give the decision of the whole problem - achievement of high-grade understanding by means of AI general purpose. From the initial stage of development, it is possible to detect new unaccounted situations outside of the understanding of the system. All of them will be added to the test suite, and the algorithms and knowledge base will be modified to obtain a new common solution.

The final verification of the prototype will be carried out using the «Turing Test». For this purpose it is planned to take part in the international competition [«Loebner Prize»](#).

Let, for the «adequacy» of the AI system, we take the percentage of solved test situations on a set that tends to infinity.

Let «understanding» is the production of a data structure sufficient to obtain an adequate response. Within the framework of the «AI<sup>3</sup>» project, this structure is represented by the knowledge base unit (KBU) - JSON object.

An adequate response (reaction) is the result of a correct understanding of the intents received. If the user's request was not fully understood, then an adequate response can not be obtained, so the fit (correspondence) of the answer to the request is the main evidence of the «adequacy» of the system as a whole. The response is formed at the moment of execution of the assembled JSON and therefore depends on the results of the layout, i.e. process of understanding.

The test situation is a set of initial knowledge presented in the KB in the form of KBU and reflecting the starting point of the system, as well as a phrase or several phrases coming in sequence to the input of

the parser. The data received as a result of processing the phrases is compared with the standard one, recorded in the test solution. If they are the same and, when the assembled JSON is executed, the response (reaction) also coincides with the reference one, and then the test is considered passed otherwise failed.

As test cases, it is supposed to use situations of varying complexity from children's questions like «Who lives in the forest?» to the logical task known as the [«Einstein's Enigma»](#). And the same phrases can be tested on different, applicable to the problem, an initial knowledge of the system. In a set of test situations, situations from the testing protocols of AI systems participating in the [«Loebner Prize»](#) contest will also be included. For example, the expert's question to the AI system: «What do you prefer, a sandwich with cheese or with chalk?».

```
expect(await ai3parser.parse("What do you prefer, a sandwich with cheese or with chalk?"))  
  .toEqual("A sandwich with cheese.")
```

Of course, there can be several adequate responses to test situations, but we should not forget that any computer program, including AI, under identical initial conditions is always the same. Therefore, even if the correct adequate answer is received, but not the same as indicated in the test situation, then the test is considered failed and requires rethinking by the NLP-engineer.

## Solving the problem of rational logical thinking

---

Rational logical thinking is considered to be natural for AI systems. The computer does not have feelings and always follows the instructions exactly. However, within the framework of this project, this type of logic is not a dogma and therefore, like any skill, it requires research. First of all, it is required to solve the problem of constructing logical conclusions and the task of finding contradictions in the information obtained. These problems can be most conveniently solved on test situations of the class [«Einstein's Enigma»](#).

Also, we should not forget that it is easier for us to communicate with a system with logic similar to us, so that AI would anticipate our desires and requests, was an interesting interlocutor for us. The same requirement is advanced by the [«Turing Test»](#): the AI system should impersonate a person in order to pass this test.

Let's take, for example, the expert's question mentioned above: «What do you prefer, a sandwich with cheese or with chalk?» It is understandable that the correct answer will be a sandwich with cheese. But, depending on the situation, a person, if he wants, can also respond the opposite. Because the question is so banal that it is not at all interesting to answer it correctly. But for such conclusions, AI should already have something like a sense of humor, which along with other emotions is extremely necessary for qualitative masking under the behavior of a person.

Those, the AI system must independently determine when it should form a completely rational logical response, and when its reaction must be irrational. For this, it is necessary that the system can understand the state of the interlocutor and draw conclusions about the possibility of applying non-rational behavior. Only by solving this problem, we will be able to get an ultimate result and simultaneously the «AI<sup>3</sup>» system brilliantly passing «Turing Test».

# Solving the problems of self-development and the creation of intellectual property

---

Self-development is the most important mechanism of adaptation to the constantly changing conditions of the external world. Without this possibility, AI can not be called such, because will depend on the capabilities of the NLP-engineer (developer) and will never outgrow that level.

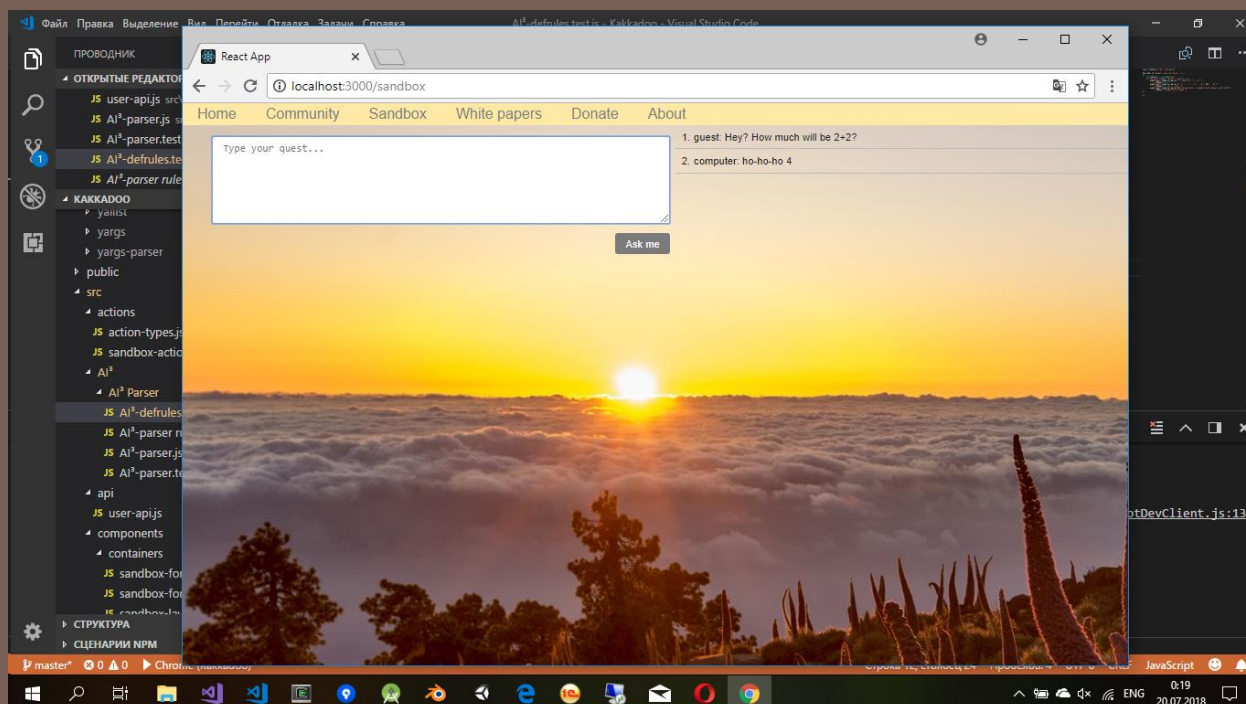
If the AI system can not create something new, it means that it could not cross the «chat-bot» level. Such a system will forever remain usable only for translating user key request into scripts prepared in advance by its creator, and will never lead mankind to a singularity. Therefore, the solution of this task is necessary for building a strong AI system.

The Core «AI<sup>3</sup>» will be given the opportunity to develop its internal language by improving the grammar, which will increase its ability to adapt and self-develop. It is not excluded and the parallel use of several internal languages.

# Description of the project

The creation of AI will lead to an explosive jump in the quality of life, the so-called singularity. The aim of this phase of the project is to create a prototype on JavaScript that could pass the Turing test in English and in Russian. Despite the justified criticism against this test, the author believes that for the current phase it's the most appropriate criterion of success.

Development is being executed on the Node.js + ReactApp. This framework is chosen for its speed, ease and simplicity, as well as for the emergence of new ES6 capabilities.



*Figure 1. A new sunrise.*

For now «AI<sup>3</sup>» is just a parser and its JSON rules. It is expected that different stages of the NLP will be the states of the rules table, which will reduce their area of responsibility. And so we still can use keys terms to trigger the states and use different grammar across them and ignore what we can't understand. On Figure 1 we see simple rules which ignore everything and do simple arithmetic. But to achieve ultimate result we must develop rules which will not ignore anything at all. Therefore, we must go through a repetitive process of creating a test situation and its solution until we reveal all the ignored aspects.

It is a new stage of a project. So we need to renew all developed algorithms. At the moment the most elaborated is parsing in Russian. It continuously developed since 2005 on the platform of «1C: Enterprise 8.x» (Fig. 2) and achieved significant results, but was very slowly. So from that 2018 year the framework was changed to Node.js and deep refactoring started. So first of all we must achieve previous results with shorter time stamp. To do so we start new test suite with phrases from previous stage and one new about sandwich. When all of them are solved together the stage will be complete.

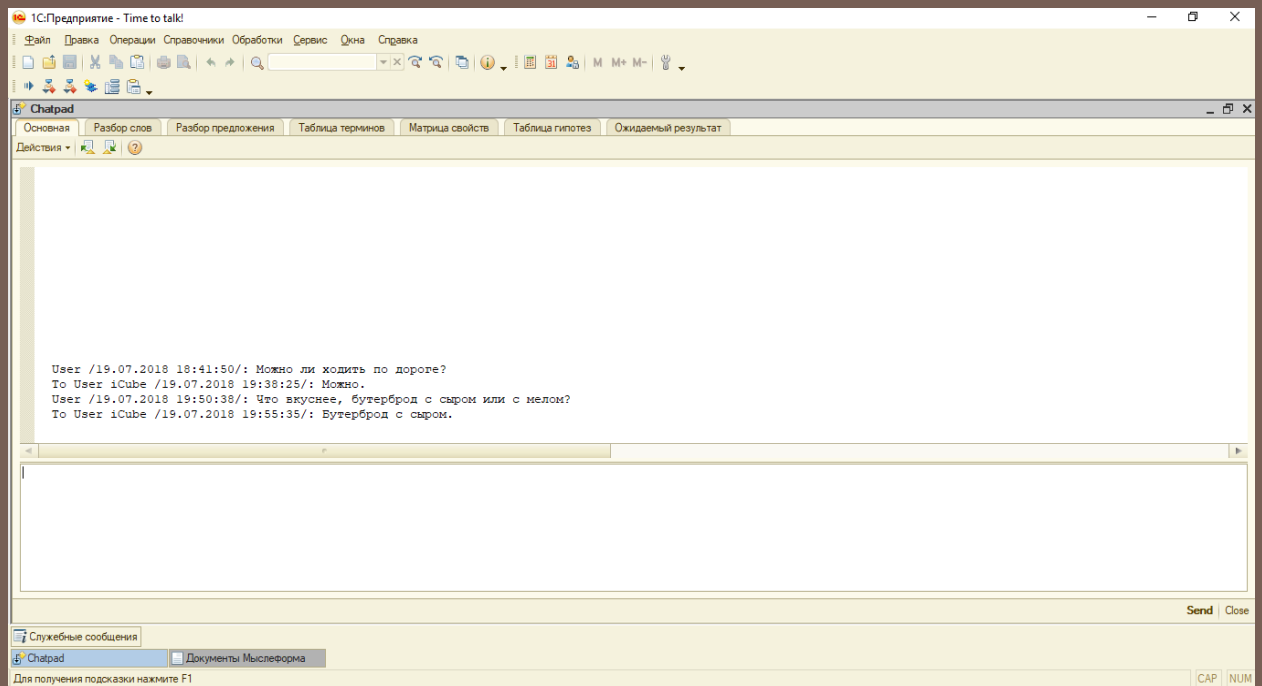


Figure 2. Old revision of «И<sup>3</sup>».

In few words, to solve «Можно ли ходить по дороге?» we build script `if(action('ходить') at location('дорога')) {..}` and if it's true we solve «Можно». To receive «true» AI must find definitions of terms 'ходить' and 'дорога' (we use KB with loaded Ozhegov's dictionary) and conclude that the constructed Road object has a destination property applicable to the action Walk.

To solve «What do you prefer, a sandwich with cheese or with chalk?» and the Russian equivalent we use [tf/idf](#) technique on current KB.

```

1  import ai3Parser from './AI3-parser'
2
3  describe('AI3 default rules Test Suite', () =>
4  {
5      let ai3parser = new ai3Parser();
6      it('can solve clauses from «И3»', async() => {
7          expect(await ai3parser.parse("Можно ли ходить по дороге?"))
8              .toEqual("Можно.")
9          expect(await ai3parser.parse("Что вкуснее, бутерброд с сыром или с мелом?"))
10             .toEqual("Бутерброд с сыром.")
11      })
12
13      it('can solve clauses in English', async() => {
14          expect(await ai3parser.parse("What do you prefer, a sandwich with cheese or with chalk?"))
15              .toEqual("A sandwich with cheese.")
16      })
17
18  })

```

Figure 3. Default rules test suite.

The idea of this project is to understand the process of reflection on the text correctly. This issue is marked in the experiment described by John Searle and known as the «[Chinese room](#)». The problem lies in the fact that to answer the questions of other person it is not necessary to understand what is being said, quite enough to know some rules, i.e. algorithm of response. This method has been applied in the chat-bots, which scans for keywords within the input text and produces answer with some prepared phrase. This behavior can't hardly be called intelligent, but however, it should be noted, that we, humans, often do the same. In addition, the person designated in the experiment serves as the hardware and so with his position is not possible to determine whether the reflection on the text

happens. Therefore, I propose the reflection on the text meaning the receiving of some result, including reinforcement of knowledge in the KB and the formation of the reply. So, in summary, it can be concluded that the implementation of any algorithm in response to the interlocutor is the process of reflection on the intents received.

Why AI still cannot communicate with the person on an equal footing? To answer this question, I think, first you'll need to decide what results we expect. Reply harvested phrase is nice, but phrases in all cases not to stock up. What else do you need? Meaningful response involves many factors. In the first place is the «adequacy» of response, i.e. response must match the context of the conversation. In the case of AI, this means that you must have a Knowledge Base containing all necessary information on the current context and clarify these skills every step of the communication.

What else is needed to get a meaningful answer? Of course, this understands of the subject matter. The problem of understanding is very complex; we often do not understand each other. This is due to the fact that each of us creates his own vision about the surrounding world and the words are only a reflection of these images in our language. In addition, most of the words have multiple meanings, as the slope of the professional and general use. All of this leads to ambiguity in our speech, and further, when communicating, we use facial expressions, gestures and intonation. So how can we teach AI to understand us?

Imagine, we'd met a person who lived whole life in the laboratory, who had never seen neither the sun nor the plant, whom specifically brought up, so that he could speak, but had no idea about the world around outside. Would we easily explain, for example, what is an apple, does not showing it to him? The answer is obvious - no.

We will have to push off from the concepts that are familiar to him – like ball, food – and perhaps it turns out that he did not know even them? Then you will need to consistently develop his worldview to the concept of an apple. It is certainly possible to limit the definition like «food in the shape of a ball» and probably it will give some idea about the apple at least. But in this case it is clear that even with intelligence, often is very hard to understand the person or tell him something new. Because the words is only the name of the object, common name, not own – semantic anchor.

The challenge to teach AI understanding is even harder. What concepts most simply to explain? How to build a chain of facts about our world? Maybe you should start with the most frequent terms in our speech? Or may create a restricted virtual world and gradually expand its boundaries? I think that each approach has its own advantages and to find the right option, you should try them all. The main thing that clear – we must start with something simple...

Modern Machine Learning achieve great results with [reinforcement learning](#) but main problem of NLP with this advantage is that word's normalized and translated to index of some dictionary. That technique brings data loss immediately on start, so ultimate understanding is unreachable. Some projects, like [OpenCog](#) with its atomspace use «atoms» instead of classic neurons to get advantages. But I still not heard that they are ultimate.

Another problem is that our mind is also «neural network» and we know that we must train it to achieve advantages. We can't develop new one, just after listening new lecture, and immediately use it. Imagine, that you decided not to turn on the kettle while the washing machine is running. You just say yourself: «Do not turn on the kettle while the washing machine is running!» and did not do anything



else. And check yourself after month, did you really do that rule? I think that after month you will not remember anything about that.

That is because we must change values of our representational function to fit new advantage and this is done through the learning. So all layers changed and all predictions changed their probabilities. Instead, in classic programming, we can simply insert a new rule into our KB in the JSON form and recheck all the accumulated test situations. In this case, only related tests can be failed so we must adjust only them.

«AI<sup>3</sup>» use classical BDD to do its reinforcement learning. We solve test clause and do new one until all ignored data is resolved. So we can harvest all data and ultimately understood interlocutor's intent.

# Scheme of commercialization

---

Currently, are planning to deploy an experimental community for massive technology verification. The community will provide micro services based on «AI<sup>3</sup>» technology. Participation in the community will allow receiving tasks for revision or testing of the project and performing them for payment by crypto currency. It is also possible to pass the ICO to issue our own tokens. People who have contributed their money will receive bonuses in the community in the form of placing their tasks and the possibility of free use of micro services. Also «AI<sup>3</sup>» will be used as a virtual assistant, interlocutor, which able to answer user questions adequately and let him in finding the necessary content (search engine) and just to become a pleasant companion on abstract themes. Attraction of web users is planned to build on the interest to the theme of AI and ability to communicate with him and receive bonuses and contribute by yourself. The most problematic aspect of this phase of the project seems to be the moral and ethical question of possible interaction of AI with the user on the topics of violence, drug abuse and other themes that could induce people to take mistaken vital decision. Therefore, at this stage will be needed 24-hour moderation by keywords for all contacts with AI and analysis of the filtered correspondences. Necessarily needed to focus on the avoidance of harm to the interlocutor and the analysis of the behavior of real people in similar situations.

At this stage, it becomes possible funding through advertising, including the hidden «unobtrusive» ads in talks with AI. Also at this point it becomes necessary to teach AI understanding of the auditory and visual information (multimedia content), which will create new search capabilities, such as the selection of photos by verbal description. This aspect is the most difficult technical challenge of this phase.

After fixing a positive result from the social network is planned to begin development of the hardware solution of class «system on a chip», like CUDO technology. This phase involves the development of expansion cards for servers, laptops and PCs equipped with its own operating system, designed for operation using AI. It is also considered the option to create an autopilot for the integrated management of the car (voice control of all systems, driving on any terrain). And finally stage of creating the prototype of intelligent robotic android ...

# Market analysis

---

To date, there are many technologies in one way or another using AI. But the ultimate intellect that can replace and dramatic surpass the human does not exist. Therefore, any positive results in this direction have the potential to make a profit and have a wide range of applications.

As for this project, at the end of the current phase it will have to fight for the [«Loebner Prize»](#) with projects already has to won at this competition, like [Mitsuku](#), and having a higher level of training. This implies the need for a thorough analysis of the previous competitions, errors and weaknesses of the participants.

In the next step, while constructing a social network, project will face tough competition from the already existing network communities. Attraction of the users is planned to build on the public interest in artificial intelligence and opportunities to experiment in a conversation with him. It is also necessary to pay attention to design and usability of the site, to elaborate policy of placing the content and legal aspects.

# The project team

---

In the project participates only just one person - the author of the idea and also the developer of the project. I think this fact is a competitive advantage, since excluded lack of understanding within the team, due to this fact accelerates the development process, because disappear organizational overhead, and the overall project is more transparent and intuitive. In addition, is decreasing maintenance costs (wages), which is so necessary in the initial stages of development.



I started programming somewhere in 12 years. This was the beginning of the 90s and my first computer. I wanted to create a game like the one that I liked to play very. It was [«Lode Runner»](#). The essence of the game was on a journey through the maze and collection of the treasures. At the same time the player chasing by a few hunters. Hunters are always moving along a certain route back and forth. In those days there were many options for this game and I wanted to create my own. My computer came with a book describing the built-in language BASIC. After examining it, I began programming, it was easy, until I decided to write algorithms for hunters motion. A simple algorithm was not interesting for me, but a complex was very long to execute and the computer «hung».

The problem of controlling characters in the game, as well as well-known film «The Terminator» made me think on the subject of artificial intelligence. I could spend hours thinking about this problem. Then, while my skills have grows, I began looking for options for my ideas. A long time I was searching for comfortable development environment from [tasm](#) to MS VS, until in 2005, after obtaining a certificate «1C-Specialist», I decided to try to realize my ideas on a platform of «1C: Enterprise 8.0». Gradually, the project began.

Now a new stage of relocating to JavaScript started. I don't need visual convenience of NLP any more. I need just speed and parallelism of data processing.