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Қ. И. Сәтпаев атындағы Қазақ ұлттық техникалық зерттеу университеті

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ГЕОЛОГИЯ ЖӘНЕ ТЕХНИКАЛЫҚ ҒЫЛЫМДАР СЕРИЯСЫ

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СЕРИЯ ГЕОЛОГИИ И ТЕХНИЧЕСКИХ НАУК

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НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

Editorial address: Institute of Geological Sciences named after K.I. Satpayev
69a, Kabanbai batyr str., of. 334, Almaty, 050010, Kazakhstan, tel.: 291-59-38.

Address of printing house: ST "Aruna", 75, Muratbayev str, Almaty

M. N. Kalimoldayev[1], I. T. Pak[1], S. T. Baipakbayeva[2],
G. A. Mun[3], D. B. Shaltykova[2],I. E. Suleimenov[2]

[1]Institute of Information and Computational Technologies, Almaty, Kazakhstan,
[2]Almaty University of Power Engineering and Telecommunications, Almaty, Kazakhstan,
[3]Al-Farabi Kazakh National University, Almaty, Kazakhstan.
E-mail: pak.it@mail.ru, saltanat.baipakbayeva@gmail.com, mungrig@ya.ru,esenych@ya.ru

METHODOLOGICAL BASIS FOR THE DEVELOPMENT STRATEGY OF ARTIFICIAL INTELLIGENCE SYSTEMS IN THE REPUBLIC OF KAZAKHSTAN IN THE MESSAGE OF THE PRESIDENT OF THE REPUBLIC OF KAZAKHSTAN DATED OCTOBER 5, 2018

Abstract. The basic methodological issues that ensure the achievement of the strategic goals identified in the Message of the President of the Republic of Kazakhstan N. A. Nazarbayev to the people of Kazakhstan on October 5, 2018 in terms of creating artificial intelligence systemsare discussed in this article. It is shown that in order to achieve these goals, the transition of interdisciplinary cooperation to a new level becomes extremely important, which is expressed by the thesis on the convergence of technical and humanitarian knowledge. It is shown that for Kazakhstan, at this stage, it is urgent to win its own position in the global flow of research in the field of creating the artificial intelligence systems, when the signs of emerging the global labor division are more evident, thatit once again proves the well-known thesis: in science, the position of catching up is obviously losing. The basis of the strategies for the development of the artificial intelligence systems in the Republic of Kazakhstan are on broad discussion. The basic stable traditions that have developed in Kazakhstan science over the years of independence include the humanities and the natural sciences as well interdisciplinary cooperation.

Keywords: Message of the President of the Republic of Kazakhstan, artificial intelligence, convergence, man-machine systems, global communication network, information war.

One of the most important points in the Message of the President of the Republic of Kazakhstan N. A. Nazarbayev to the people of Kazakhstan from October 5, 2018 is largely focused on the problems of artificial intelligence[1]. This Message says:

SIXTH. Special attention should be paid to the development of innovation and service sectors.

− First of all, it is necessary to ensure the development of such areas of the "economy of the future" as alternative energy, new materials, biomedicine, big data, Internet of things, artificial intelligence, blockchain and others.

− It is on them that the place and role of the country in the global world depend in the future.

− I instruct the Government together with Nazarbayev University in each area to develop special programs with the definition of specific projects.

− One of these could be the creation of a research institute for the development of the artificial intelligence technologies on the basis of a university.

The international expert community also solid in the concepts of "economy of the future" and "artificial intelligence" standing side by side. At the same time, in the world at present there are a significant number of different scientific fields, one way or another connected with the problems of the artificial intelligence, and it continues to grow.

Consequently, it is important for the Republic of Kazakhstan to clearly define a research development strategy in this direction, to find that part of the research front where our country can take a leading position. A simple copying of foreign achievements, following the path laid by others will not allow us to occupy the place in the world about which the President of RK spoke. In turn, the development / definition of its methodological foundations is of top priority for the development of such a strategy.

The formation of such a strategy, as well as its basic methodology, is inseparable from scientific discussions, which becomes obvious if we take into account the fact that the generally accepted interpretation of the concept of "artificial intelligence" does not exist today, just as there is no unambiguous interpretation and notion intelligence".

The main objective of this work is to initiate discussions on this issue in the Kazakhstan scientific community, in order not only to identify specific areas for advancement in the field of creating the artificial intelligence systems, but also to maximize the existing scientific potential. Creating the artificial intelligence systems, Kazakhstan, obviously, should rely on already existing achievements and make the most of its own unique capabilities.

Such opportunities really exist. First of all, this refers to the significant developments of Kazakhstani scientists in the field of interdisciplinary cooperation.

Such experience, without exaggeration, is invaluable for the creation of the artificial intelligence systems, since the problematics of the artificial intelligence de facto does not belong to any of the established scientific disciplines. Moreover, even the already existing developments and research in this area clearly show that the thesis on the convergence of technical and humanitarian knowledge, originally formulated by philosophers, is now becoming flesh and blood. An illustration of this can be found in such publications as [2], which clearly demonstrate the advantages of using the achievements of humanitarian knowledge to create promising technical systems. This is not surprising - the existence of natural language is inseparable from the human intellect. There is a point of view, according to which intelligence as such exists only to the extent that a person has developed the ability to communicate using natural language means, which is often expressed by the phrase "It is not we who speak the language, it is the language that we speak."

Moreover, the rapid development of the telecommunications industry has de facto led to the emergence of non-trivial man-machine systems, one of which can be considered a community formed by users of any of the social online networks. Such systems already have their own nontrivial behavior, which is not reduced to the behavior of individual users, and some authors have already raised the question of the possibility of the emergence of "spontaneous intelligence" in this kind of systems, which, as expected, may well differ significantly from human [3]. In the current literature, the term "cyberrantropology" is increasingly common, also reflecting such tendencies and the validity of the thesis on the convergence of technical and humanitarian knowledge in the 21st century [4].

Many Kazakhstani scientific schools favorably differ in their quite developed traditions of interdisciplinary cooperation that have developed over the years of independence. A significant part of the works, which today are the basis for further advancement in the field of artificial intelligence, are performed at the interface of the humanities and technical sciences, the humanities and natural sciences. A reflection of the successful interdisciplinary cooperation of this kind is, in particular, a textbook on the history and philosophy of science [5] recommended by the MES of the RK for all specialties of the magistracy.

An important element of the methodology for creating artificial intelligence systems can also be a non-trivial interpretation of the complex category, which was simultaneously given from the standpoint of philosophical knowledge, and from the positions used to create technical systems [6-8]. Initially, it was developed in order to create systems of molecular informatics [6-8], but this interpretation can also be applied to the field of artificial intelligence.

In accordance with the provisions of [6-8], the system should be interpreted as "complex" when there is a complementary analogue of the neural network. Such an interpretation of the complex allows a significantly different approach to the problem of the origin of the Mind in the course of natural evolution. Namely, the emergence of Reason through mutational mechanisms, the interpretation of which goes back to the Darwinian point of view, seems extremely unlikely, as is proved, in particular, by the extremely uneven nature of the cultural development of humanity [9,10]. The most famous in this respect is the

phenomenon of the "Greek miracle" [11, 12] – more than a brief period by historical standards, when almost all attributes of modern civilization (science, philosophy, classical literature, etc.) appeared in a limited area of Ancient Greece .

Such a dramatic change in the state of any complex system obviously does not fit into any interpretation based on the Darwinian point of view, which follows simply from the simplest estimates of time scales. Moreover, until very recently, the nature of the "Greek miracle" remained unclear [9, 10].

The concepts of the complex, reflected in [7, 8], allow us to propose a mechanism for the evolution of complex systems, alternative to those considered in the framework of Darwinian theories. In accordance with this mechanism, the evolution of a complex system of any nature proceeds in two stages. At the first stage, an analogue of a neural network complementary to a complex system evolves. Physically, this stage corresponds to the restructuring of the system of inter-element bonds, i.e. transformations are latent. At the second stage, the advantages are obtained by those elements whose characteristics more fully correspond to the new state of the system.

In relation to the problem of the origin of Mind on Earth, the implementation of this mechanism should inevitably lead to the fact that the primary is collective reason – a collective neural network formed by individuals together (the remote analogue of such a network is an anthill). Accordingly, the individual Mind, as well as the intellect of modern man, is a later evolutionary invention. The existing ideas about the collective unconscious, about sociocultural codes and other collective effects that cannot be reduced to the behavior of certain people also speak in favor of such a conclusion. It is also appropriate to emphasize that philosophical literature also gained recognition of the public consciousness for a long time, and it is also recognized that it is not reducible to the consciousness of individuals (moreover, the problem of the subjectivity of social consciousness is also discussed in philosophical literature [5]).

The question of the genesis of the Mind as applied to the development of a strategy for the development of the artificial intelligence systems in the Republic of Kazakhstan is of considerable interest for several reasons.

First of all, it allows you to give an adequate interpretation of the concept of "intelligence", which is most convenient to demonstrate, starting from the well-known Turing test. As is known, the criterion proposed by Turing directly focuses on the comparison of the hypothetical machine intelligence and human intelligence. According to Turing, the machine, which the interlocutor-researcher is not able to distinguish from the person in the process of dialogue, has the artificial intelligence.

This point of view has faced and continues to face serious criticism. In particular, D. Searle, who formulated the concept of the so-called "Chinese room", argued that the machine is able to pass the Turing test even without "knowing how" to think, more precisely, not perceiving the semantics of the language. It is enough to develop an adequate program that operates with syntax, i.e. with superficial grammatical structures and rules for their construction. In [13], a curious illustration of the "Chinese room" concept is used: by accessing extensive information resources via the Internet, a student can prepare a high-quality essay on almost any topic (and even answer questions) without being too good at it. Thus, the student as if "places" himself in the "Chinese room", without understanding the semantics of his essay.

This example is only one of the fragments of numerous discussions, which until very recently were conducted (and are conducted) when trying to uncover the essence of the concepts of "intellect" and "artificial intelligence".

The generally accepted point of view has not yet been worked out, but this issue can also be approached from other positions. As long as humanity still does not have a clear understanding of the essence of the intelligence, then the question is quite natural: should the intelligence as such have to be close to human? Otherwise, instead of the traditional question "Can a car think?", Another should be considered – "Is the intelligence necessarily associated with the human intelligence?" (Note that the authors of many papers, in particular, [13], are already very close to this very formulation of the question.)

As the physicists say, to set a task is to solve it in half. The question itself "Are there other forms of the intelligence besides human?" De facto contains the answer. In fact, from the point of view of the mechanism of formation of the Mind considered above, the intelligence, first of all, should be regarded as a species attribute. Simplifying, it is the Mind that is the basic evolutionary invention, which allowed our biological species to occupy a dominant position on this planet. However, no one said that such an invention is the only one possible (in terms of converting the accumulated information into an efficiently used

resource). Here it is appropriate to recall the point of view of T. Nigel [14], who argued that a person cannot fully imagine the experience of another creature (for example, a bat), since other creatures have completely different ways of perceiving the surrounding world (even more this refers to distributed forms of intelligence).

From this point of view, it is permissible to offer the following interpretation of the concept of the intelligence, which, in our opinion, is the most general.

Intellect is a property of a complex system and / or its elements that makes it possible to convert accumulated information into a reproducible resource, which, in turn, can be converted into other types of resource (for example, food). In essence, this definition considers the intelligence as a kind of information processing system, in which self-organization processes lead to the emergence of a new quality.

We emphasize that the qualities inherent in the human intellect, which are most often discussed in the literature (creativity, goal setting, predictive ability, ability to reflect, etc.) can be considered as particular forms of implementation (if not to say - as certain tools) the ability to convert the accumulated information into a replicable resource.

From this point of view, it is advisable to return to the questions raised by the authors of such works as [3]. Moreover, it is advisable to make a comparison between the point of view [3] and the ideas formulated above about the nature of evolution, which led to the emergence of Reason. Indeed, in accordance with the point of view of the author [3] and similar to her, the rapid evolution of the telecommunications environment, which is taking place at the present time, can lead to the emergence of nontrivial information entities developing in this environment. These entities, theoretically, may well evolve over time into some kind of "intellect", if we proceed from the interpretation proposed above. We explain this.

Suppose that in a telecommunication environment some informational entity arises, the behavior of which is expressed in the "use" of information (it is more correct to talk about converting information into a resource). The simplest form of "use" of information is self-preservation, inseparable from "striving" for self-reproduction. The correct formulation of such a "striving" is given through the principle of global evolutionism, which has long been substantiated in philosophical literature and is currently included in the mandatory program for the course "History and Philosophy of Science" [5]. In accordance with this principle, the evolution of any complex system proceeds in a direction that ensures the most efficient use of available resources (in the broadest sense of the latter term). Obviously, information can be considered as a unique resource, occupying a special position in the list of all possible resources of other varieties – it, in contrast to others, is not consumed when used, but accumulates. Consequently, the emergence of the intelligence, understood in the broadest sense of the term, can be considered quite expected, since the gradual increase of complex systems in the course of evolution sooner or later should have led to the emergence of a system capable of using the most effective resource.

As you know, the most reliable way to save information is not to ensure the safety of a separate carrier, but to ensure its stable replication. So, there is a point of view according to which Life as such is the result of the "self-preservation" of information fixed by biological macromolecules. In this regard, it is appropriate to recall that any de facto virus is simply a "biological tape recorder" (more precisely, a DNA molecule) on which genetic information is recorded, and all its vital activity is reduced only to its replication. (From the point of view of the physical chemistry of polymers, the virus is an interpolymer complex, all components of which, with the exception of DNA, are purely auxiliary.)

From this point of view, the emergence of non-trivial information entities in the communication space becomes quite predictable: the first thing they should be aimed at is the expansion of its own element basis and stable rewriting. As a result, the communication environment begins to subordinate users. Evidence of this is already becoming very clear. First of all, they are associated with the deformation of the natural language, which is rapidly simplified, as well as with the general degradation of the individual intellectual abilities of the younger generations, which any professor at any university in the world can confirm.

Note that the factor of the possible dominance of the communication environment over users has now already received quite correct evidence at the level of correct mathematical models [6, 15, 16]. In papers [15, 16], the voting procedure was considered in a generalized Council (an example of a concrete implementation is voting in the Council for thesis defense). It was shown that each of the Council members can be considered as an analogue of a neuron (from the point of view that when voting it de facto converts the

array of received information into a discrete variable: "For", "Abstained", "Against"). It is significant that the decision taken by each member of the Council in real conditions is formed not only on the basis of the input data; the mutual influence of Council members on each other is essential. So, the situation is quite realistic when a "Against" vote will be given to a good dissertation, if the author is a student of an opponent, etc. As shown in [15], as a result, members of the Council (provided that their mutual influence on each other exceeds a certain critical threshold) form an analogue of a neural network. Consequently, in this case, the decision to vote in de facto is not taken by the totality of the members of the Council, but by the network they form. This example shows that there are situations where collective effects, even those of the simplest type, begin to dominate the behavior of individuals. It is reasonable to expect that as the analogs of neural networks formed in social systems become more complex, such effects will only increase.

From this point of view, the question of the genesis of Reason turns out to be very closely connected with the analysis of modern trends in the development of telecommunication systems. Indeed, at present, there is an increased intensity of information exchange in interpersonal (and other) contacts while simplifying (to put it simply – stupid) its content (review of existing points of view on this problem is contained in [13]). A vivid illustration of this is provided by Russian television, which - even when discussing very serious problems - transmits to the world the opinions of various "social lionesses" with a dubious reputation, football stars and other similar public, but does not even think to turn to experts.

There is a process inverse to the one that once led to the emergence of the individual Mind: the collective beginning begins to dominate again, the individual – to weaken. It is not excluded that this is an expression of some objective laws of self-organization of non-trivial information systems, a manifestation of the dialectics of the collective and the individual in the aspect of the evolution of Reason.

However, from a purely pragmatic point of view, this is a very controversial one - the question can still not be considered. Much more important is another thing: nontrivial informational entities, the nature of which remains far from clear, are beginning to increasingly influence the daily life of peoples and states. Moreover, the tendencies aimed at the use of such entities in the information war, the tools of which are currently undergoing significant transformations, are already clearly visible [17]. As is known, it is informational influences that become one of the most important tools of geopolitical competition and corresponding methods are rapidly improving. We predict a transition from the direct use of social online networks to methods based on the deformations of the sociocultural code of countries and peoples. This can be illustrated by the latest events related to the conflicts on the territory of Ukraine (the issue of the Tomos and the accompanying decisions of the Constantinople Patriarchate aimed at a direct split of the Orthodox world are no more than the tip of the iceberg).

Further, the development of the artificial intelligence systems – in whatever scenario it occurs – will inevitably go in close conjunction with the further development of the telecommunication systems. Actually, this is a continuation of the already established tendency, which is expressed in the fact that computer equipment is more and more closely integrated with communications, as exemplified by smartphones that have become widespread in recent times.

Consequently, the development of the artificial intelligence systems can both strengthen and weaken the above trends in the transformation of society (or transfer them to a completely different direction). It is from this point of view that the development strategy of the artificial intelligence systems for the Republic of Kazakhstan should be developed. Indeed, if our country follows the path of blindly copying advanced foreign achievements, it will inevitably become hostage to foreign strategies. This becomes especially dangerous if the nature of development follows the scenario of further suppression of the individual beginning - in this case there will be nothing to oppose to massive informational influences, including those aimed at deforming the sociocultural code of the peoples of Kazakhstan.

The convergence of humanitarian and technical knowledge is of considerable interest from the point of view of purely economic problems. Namely, the innovative development of Kazakhstan is currently constrained, mainly due to the fact that domestic technical and technological developments do not find demand in the domestic market, public-private partnership in the field of innovation activity in Kazakhstan has also not reached an economically significant level. To a large extent [18,19], this is due to the low communication connectivity of the domestic scientific and educational space. To solve this problem, first of all, a platform is needed for sustainable interdisciplinary cooperation, which also implies the need to look for breakthrough areas on which it is advisable to concentrate efforts. The general vector of deve-

lopment is set by the Message of the President of the Republic of Kazakhstan dated October 5, 2018, but further specification is necessary. In this context, science as such should be viewed primarily as a sociocultural phenomenon: for example, the problem of low efficiency of public-private partnership is interpreted from a methodological point of view through the low coherence of this institution with society. Consequently, for a breakthrough in the field of creating new technical systems, humanitarian technologies are needed, studying, among other things, the nature of assimilation of certain ideas by society, as well as allowing to decide on the prospects of a particular technical system in advance. The artificial intelligence systems coupled with big data processing methods can also solve this problem. However, in order for such systems to function effectively, a complex problem of interaction between science and post-industrial society is required, which also requires stable interdisciplinary cooperation. This circumstance shows that the thesis of the convergence of technical and humanitarian knowledge is extremely important from the point of view of the formation of the economy of the future.

An illustration of this is the concept of Industrialization 4.0. It is worth recalling that its initiators were the German industrial and academic circles, which entered into close cooperation in order to achieve a very ambitious goal – to create the prerequisites for a qualitative leap in the industrial potential of Germany and to exclude the cheapness of labor force from geopolitical competition. It is precisely this that, ultimately, is focused on cyber-physical systems, industrial Internet, etc. The development of such a large-scale concept as Industrialization 4.0 can only be a product of a highly developed philosophy of science, where, historically, Germany has quite certain advantages ("It is not obvious, but the high quality of a Mercedes car is closely related to Hegel's philosophy"). As a result, the ideology of this concept is fully focused on the interests of Germany, therefore, for Kazakhstan it is vitally important to modify the existing concepts of re-industrialization in their own interests. In particular, for Kazakhstan, as a country whose geopolitical potential is largely determined by natural resources, the development of not cyber-physical systems (which is one of the basic components of the Industrialization 4.0 concept), but cyber chemical systems oriented towards the deep and diversified processing of raw materials is of considerable interest.

Thus, the artificial intelligence systems in the foreseeable future are capable of significantly transforming society. There are two scenarios – further enhancing the effects associated with the revival of the "collective mind", as a certain impersonal entity that subordinates individuality to itself, and the further growth of the power of the human Reason. In a certain sense, the world is at a fork (you should correctly speak about the point of bifurcation). Which of these scenarios is being implemented is far from being determined, but from the point of view of the national interests of the Republic of Kazakhstan, the second is obviously preferable.

The implementation of the first of the above scenarios will mean the deliberate subordination of Kazakhstan society to foreign influence (simply by virtue of quantitative indicators related to the volume of information replication). However, this statement applies to any of the countries with a relatively small population - the preservation of their identity becomes possible only with the maximum mobilization of the intellectual resources, and particularly personal ones; the challenges of time are too formidable to allow ourselves to hope to get by with ordinary measures.

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М. Н. Калимолдаев[1], И. Т. Пак[1], С. Т. Байпакбаева[2],
Г. А. Мун[3], Д. Б. Шалтыкова[2], И. Э. Сулейменов[2]

[1]Ақпараттық және есептеуіш технологиялар институты, Алматы, Қазақстан,
[2]Алматы энергетика және байланыс университеті, Алматы, Қазақстан,
[3]Әл-Фараби атындағы Қазақ ұлттық университеті, Алматы, Казахстан

ҚР ПРЕЗИДЕНТІНІҢ 2018 ЖЫЛҒЫ 5 ҚАЗАНДАҒЫ ЖОЛДАУЫНЫҢ АЯСЫНДА ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДА ЖАСАНДЫ ИНТЕЛЛЕКТ ЖҮЙЕЛЕРІН ДАМЫТУДЫҢ СТРАТЕГИЯЛЫҚ НЕГІЗІ

Аннотация. Қазақстан Республикасы Президенті Н. Ә. Назарбаевтың 2018 жылы 5 қазанда айтылған Жолдауында анықталған стратегиялық мақсаттарға жетуді қамтамасыз ететін негізгі әдістемелік мәселелер, соның ішінде жасанды интеллект жүйелерін құру туралы талқыланады. Мақсаттарға қол жеткізу үшін тех-никалық және гуманитарлық білімнің жақындасуы туралы тезистері арқылы айқындалған пәнаралық ынты-мақтастықты жаңа деңгейге көшіру өте маңызды болып табылатыны көрсетілген. Қазақстан үшін осы кезеңде, яғни жаһандық еңбек бөлінісінің белгілері айқынырақ болып келе жатқанда, жасанды интеллект жүйелерін жасау саласындағы ғаламдық зерттеулерде өз ұстанымдарын ұстану қажеттілігін танымал тезис дәлелдейді: ғылымда «қуып жетушінің» ұстанымы алдын-ала жеңіліске алып келеді. Қазақстан Республи-касындағы жасанды интеллект жүйелерін дамыту стратегиясының негізгі ережелері кең талқылануда. Бұған мүмкіндік беріп отырған негіз – тәуелсіздік кезеңінде отандық ғылымдағы дамыған гуманитарлық ғылымдар мен жаратылыстану ғылымдары арасындағы пәнаралық ынтымақтастықтың тұрақты дәстүрлері.

Ключевые слова: Қазақстан Республикасы Президентінің Жолдауы, жасанды интеллект, конвергенция, адам-машина жүйесі, ғаламдық байланыс желісі, ақпараттық соғыс.

М. Н. Калимолдаев[1], И. Т. Пак[1], С. Т. Байпакбаева[2],
Г. А. Мун[3], Д. Б. Шалтыкова[2], И. Э. Сулейменов[2]

[1]Институт информационных и вычислительных технологий, Алматы, Казахстан,
[2]Алматинский университет энергетики и связи, Алматы, Казахстан,
[3]Казахский национальный университет им. аль-Фараби, Алматы, Казахстан

МЕТОДОЛОГИЧЕСКАЯ ОСНОВА СТРАТЕГИИ РАЗВИТИЯ СИСТЕМ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В РЕСПУБЛИКЕ КАЗАХСТАН В СВЕТЕ ПОСЛАНИЯ ПРЕЗИДЕНТА РК ОТ 5 ОКТЯБРЯ 2018 г.

Аннотация. Обсуждаются базовые методологические вопросы, обеспечивающие достижение стратегических целей, определенных в Послании Президента Республики Казахстан Н. А. Назарбаева народу Казахстана от 5 октября 2018 г. в части создания систем искусственного интеллекта. Показано, что для достижения указанных целей исключительно важным становится переход междисциплинарного сотрудничества на новый уровень, что выражается тезисом о конвергенции технического и гуманитарного знания. Показано, что для Казахстана на данном этапе остро необходимо завоевать собственное положение в общемировом потоке исследований в области создания систем искусственного интеллекта, где все отчетливее проявляются признаки складывающегося мирового разделении труда, что еще раз доказывает известный тезис: в науке позиция догоняющего заведомо является проигрышной. На широкое обсуждение вынесены базовые положения стратегии развития систем искусственного интеллекта в РК. Основой для этого являются устойчивые традиции междисциплинарной кооперации, сложившиеся в отечественной науке за годы независимости, в том числе, между гуманитарными и естественными науками.

Ключевые слова: Послание Президента РК, искусственный интеллект, конвергенция, человеко-машинные системы, глобальная коммуникационная сеть, информационная война.

Information about authors:

Kalimoldayev M. N. – Institute of Information and Computational Technologies, Almaty, Kazakhstan; mnk@ipic.kz; https://orcid.org/0000-0003-0025-8880

Pak I. T. – Institute of Information and Computational Technologies, Almaty, Kazakhstan; pak.it@mail.ru; https://orcid.org/0000-0003-4892-5996

Baipakbayeva S. T. – Almaty University of Power Engineering and Telecommunications, Almaty, Kazakhstan;saltanat.baipakbayeva@gmail.com;

Mun G. A. – Al-Farabi Kazakh National University, Almaty, Kazakhstan; mungrig@ya.ru; https://orcid.org/0000-0001-5522-1255

Shaltykova D. B. – Almaty University of Power Engineering and Telecommunications, Almaty, Kazakhstan; https://orcid.org/0000-0002-6245-6447

Suleimenov I. E. – Almaty University of Power Engineering and Telecommunications, Almaty, Kazakhstan; esenych@ya.ru; https://orcid.org/0000-0002-7274-029X

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