Max Talanov, ███████████████████████████

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Personal Profile

Bio **Highly-creative head of the scientific group/laboratory and associate professor with broad research and industrial experience**.

I am highly innovative Research Associate in augmented AI, head of the Neuromorphic computing and Neurosimulations laboratory for the last nine years managing breaking-through projects in AI, spiking neural networks (SNN), neuromorphic computing (see below), neurosimulations and robotics. For the 5 years my laboratory reached the publications in Q1 journals: Frontiers in Neuroscience, Frontiers in Cellular Neuroscience, Frontiers in Computer Science, Frontiers in Chemistry, Chaos, Solitons & Fractals and Nature Scientific Reports. Also I have international project management experience in several countries: the UK, Sweden, Finland and France. I worked (2020-2022) as CRO in the B-Rain startup company (still founder) with internationally recognized results. I have wide industrial experience as an R&D project manager and tech leader/software design architect for eight years in international industrial projects in Fujitsu.

Strengths Highly innovative inventor and effective manager of heterogeneous and distributed research and development teams, having a multi-disciplinary mindset in AI, computer science, IT, cognitive science, neuroscience, electronics, philosophy.

Professional Experience

2022-current **Senior Research Associate**, Institute for Artificial Intelligence. Novi Sad. Serbia.

Management and leading multidisciplinary break-through research in AI, SNNs, memristive computing, organic electronics, neurosimulations including real-time neurosimulations, machine to nervous system interface, neurobiologically inspired systems. Leading European grant applications, publication activities. In collaboration with research centers: Istituto dei Materiali per l'Elettronica ed il Magnetismo at CNR Italy, INSERM (France), Medical University of Vienna, Unconventional computing lab at University of Western England, Universitat Autónoma de Barcelona, Universitá degli Studi di Messina; scientists: Victor Erokhin, Marat Minlebayev, Andrew Adamatzky, Jordi Vallverdú, Salvatore Distefano.

2019-current   **Associate professor (docent) at Intelligent robotics department**, Kazan Federal University.

Management of the scientific group; leading multidisciplinary breakthrough research in neuromorphic computing, affective computing, organic electronics, brain to computer interface and machine to brain interface, neurobiologically inspired systems. Management of grant applications, publication activities; bachelor, master, and Ph.D. students, international communications and collaborations. In collaboration with research centers: Universitá degli Studi di Parma, University of Eastern Finland, Unconventional computing lab of the University of Western England, Universitat Autónoma de Barcelona, Universitá degli Studi di Messina, NRC "Kurchatov Institute", Lobachevsky University, HSE University, Innopolis University; scientists: Rashid Giniatullin, Andrew Adamatzky, Jordi Vallverdú, Salvatore Distefano, Victor Kazantsev.

2020-2022   **CRO**, B-Rain labs LLC.

Management of R&D projects, establishing research and development strategy, research networking with other companies, international communications, and collaborations. Management distributed heterogeneous team of researchers and developers using agile methodologies, motivation, planning, and budgeting. Breakingthrough projects software and hardware R&D: Neuromorphic neuroprosthesis, Migraine and pain simulation, GRAS - GPU oriented neurosimulator. Management of collaboration with research centers: CNR-IMEM (Italy), NRC "Kurchatov Institute" (Russia), Mayo Clinic (USA), Skolkovo Institute of Science and Technology (Russia), HSE University (Russia); experts: Victor Erokhin, Vyacheslav Demin, Igor Lavrov.

2018-2019   **Head of computational neurotechnology projects of the neuroscience laboratory**, KFU.

Management of the scientific group; leading multidisciplinary breakthrough research in computational neurobiology and management of grant applications, publication activities; managing bachelor and master students; international communications and collaborations. In collaboration with research centers: the University of Eastern Finland, INSERM; scientists: Roustem Khazipov, Rashid Giniatullin.

2017-2018   **Deputy director for science of the Information Technology and Intelligent Systems Institute (ITIS)**, KFU.

Management of research activities: planning, funding, publications strategy, publicity, and international networking management.

2014-2015   **Lecturer**, Innopolis university.

Lecturing Affective computation course from three perspectives: Philosophical ("Model of six" by Marvin Minsky), Psychological (Wheel of emotions by Plutchik), Neurobiological: ("Cube of emotions" by Hugo Lövheim).

2006-2014 **Software Design Architect**, Fujitsu GDC Russia.

Leading R&D projects the domains of affective computing, machine cognition, machine learning, code generation automation, natural language processing in several countries, including the UK, Sweden, Finland, France. Software Design architect in different projects based on Scala, OpenCog.RelEx, Neo4j, OpenCog.PLN, Stanford Parser, open NARS, MinorThird, Java, EJB, Hibernate, Spring, IBM MQ, Oracle BPEL

Teaching Experience

2017-Now, KFU *Artificial intelligence*: the introduction in artificial intelligence including: machine learning and reinforcement learning, decision making, reasoning, knowledge bases and data representations, natural language processing, intelligent agents. During the course students should develop the AI project using principles and technologies discussed in the course.

2016-2017, KFU; 2014-2015, Innopolis University *Affective computation*: the extended view on the emotions and reimplementation in a computational system problem including: philosophical, psychological, neurobiological and computational perspectives. The course starts from birds eye view on the problems, carries on to neurobiological details of a neuromodulation and psychological models of emotions, then progresses into philosophical questions of consciousness and thinking and ends up with cognitive architectures and spiking neural networks review. *Course syllabus online*.

2014-2016, KFU; 2014-2015, Innopolis University *Software Design Architecture*: the course for bachelor students, intended to be starting point from basics of software design and UML to principles and design patterns, with extended use of practical examples. During the course students should develop project using principles of design studied. *Course syllabus online*.

Projects

Memristive brain (2016-now)	*Description*: The project is dedicated to the bio-inspired memristive implementation of mammalian nervous circuits capable of real-time processing and self-learning in medical or robotic systems. *Breakthrough*: *Computer science, AI and robotics*: the new type of hardware with new options of self-learning and adaptation real-time is implemented using bio-inspired architectures with new level of understanding of the functions of neurobiological mechanisms. *Electronics*: the development of memristive direction could lead to a revolution in the IT industry, triggering the development of highly effective self-learning devices. *Neuroscience*: the brain-computer interface has a new boost with the use of memristors as the interface between living cells and not-living electronic memristors in a hybrid system. *In collaboration with:* Victor Erokhin, CNR-IMEM, Italy. *Frontiers in Neuroscience paper*.
GRAS (2020-now)	*Description*: The neurosimulation framework and infrastructure development for the distributed high-performance computing of neuronal topologies of several thousands of neurons. The design and development of neurosimulator for bio-plausible computing of neural networks of a spinal cord, cortical columns, as well as real-time one-board wearable computers real-time processing of neuronal activity. *In collaboration with:* Igor Lavrov, Mayo Clinic, USA.
Neuro-simulation neuroprosthesis (2020-now)	*Description*: The augmented AI project for the reimplementation of walking pattern via neurosimulation of spinal cord segment model for patients with complete spinal cord trauma. *Breakthrough*: *Body Cyberisation*: the first reimplementation of the bio-compatible part of the nervous system (central pattern generator) via neurosimulation reproducing its functionality. *Machine to brain interface*: the first implementation of a self-adaptive "speaking nervous system language" interface to integrate electronic devices with the mammalian nervous system. *Robotics*: the reimplementation of a part of a mammalian nervous system part compatible with modern electronics that leads towards standalone intelligent robotic systems operating in real-time. *In collaboration with:* Igor Lavrov, Mayo Clinic, USA.
Emotional social robot "Emotico" project (2020-2022)	*Description*: The simulation of psycho-emotional states based robotic project for further integration in the social environment. *Breakthrough*: *Robotics*: the first time the robotic system with the influence of dopamine and serotonin was proposed and implemented. *In collaboration with:* Evgeni Magid, KFU, Russia. *IEEE paper*.

Migraine and pain simulation (2020-2022)	*Description*: The neurosimulation of repetitive neuronal activity of A-δ and C fibers triggering migraine and pain. *Breakthrough*: *Neuroscience*: the first indication of the neurosimulation of ATP mechanisms taking part in pain neuronal activity. *In collaboration with:* Rashid Giniatullin, UEF, Finland. *Frontiers in Cellular Neuroscience paper 1*. *Frontiers in Cellular Neuroscience paper 2*.
NeuCogAr (2014-2018)	*Description*: Neurobiologically inspired cognitive architecture for simulation of neurobiologically plausible emotions (based on works of Hugo Lövheim) in computational and robotic systems based on neural simulations. *Breakthrough*: *Affective computing*: the first time the bio-plausible implementation of psycho-emotional states mapped to computational processes is demonstrated. *Cognitive architectures and robotics*: the first time the bio-plausible emotional drives is implemented to form behavioral strategies of an artificial system. We have already demonstrated: the "fear-like" and "disgust-like" states. *In collaboration with:* Jordi Vallverdú, Universitat Autónoma de Barcelona.
Robot Dream (2015-2017)	*Description*: The integration of an HPC mammalian brain simulation with a real-time robotic system. Two-phase architecture based on the working metaphor of a mammalian dream. The "dream phase" consists of emotional experience collection, processing, and behavioral strategy update is implemented as neural simulations on HPC cluster. The "wake" robotic system is based on the memristive implementation of mammalian brain circuits, implemented in the memristive brain project. *Breakthrough*: *Robotics*: the first time the bio-plausible emotional driven cognitive architecture integrated with robotics embodiment will be demonstrated including sensory input and motor output neural systems.
BioDynaMo (2015-2017)	*Description*: HPC framework of the bio-plausible dynamic, growing neural tissues simulations including a mammalian growing brain. *In collaboration with:* CERN, Newcastle university, Intel, Innopolis University.
TU (2012-2017)	*Description*: Thinking-Understanding. The cognitive architecture implementing the approach of the intelligent system for helpdesk automation based on machine cognition: natural language processing (NLP), probabilistic reasoning and "Model of six" - the model of human mental processes by Marvin Minsky
Menta (2011-2012)	*Description*: The framework for automatic software application development via genetic algorithms and NLP
IDP (2010-2011)	*Description*: Intellectual document processing, the project for data-mining of unstructured documents via NLP and ML

Papers

Total more than 60 published papers at the moment, H-index 12 (Google scholar). In 2020 - 2023 my scientific group published papers in world leading scientific journals: Frontiers in Computer Science, Frontiers in Neuroscience, Frontiers in Cellular Neuroscience, Nature Scientific Reports.

Selected papers

[1] Elvira Chebotareva, Ramil Safin, Artur Shafikov, Dinar Masaev, Andrey Shaposhnikov, Ilnaz Shayakhmetov, Evgeni Magid, Nadezhda Zilberman, Yuriy Gerasimov, and Max Talanov. "Emotional social robot" Emotico"". In: *2019 12th international conference on developments in esystems engineering (dese)*. IEEE. 2019, pp. 247–252.

[2] Yuriy Gerasimov, Evgenii Zykov, Nikita Prudnikov, Max Talanov, Alexander Toschev, and Victor Erokhin. "On the organic memristive device resistive switching efficacy". In: *Chaos, Solitons & Fractals* 143 (2021), p. 110549. URL: https://www.sciencedirect.com/science/article/abs/pii/S0960077920309401.

[3] Dinar N. Masaev, Alina A. Suleimanova, Nikita V. Prudnikov, Mariia V. Serenko, Andrey V. Emelyanov, Vyacheslav A. Demin, Igor A. Lavrov, Max O. Talanov, and Victor V. Erokhin. "Memristive circuit-based model of central pattern generator to reproduce spinal neuronal activity in walking pattern". In: *Frontiers in Neuroscience* 17 (2023). ISSN: 1662-453X. URL: https://www.frontiersin.org/articles/10.3389/fnins.2023.1124950.

[4] Yulia Mikhailova, Anna Pozdeeva, Alina Suleimanova, Alexey Leukhin, Alexander Toschev, Timur Lukmanov, Elsa Fatyhova, Evgeni Magid, Igor Lavrov, and Max Talanov. "Neurointerface with oscillator motifs for inhibitory effect over antagonist muscles". In: *Frontiers in Neuroscience* 17 (2023), p. 423. URL: https://www.frontiersin.org/articles/10.3389/fnins.2023.1113867/full.

[5] Alexey Mikhaylov, Alexey Pimashkin, Yana Pigareva, Svetlana Gerasimova, Evgeny Gryaznov, Sergey Shchanikov, Anton Zuev, Max Talanov, Igor Lavrov, Vyacheslav Demin, et al. "Neurohybrid memristive CMOS-integrated systems for biosensors and neuroprosthetics". In: *Frontiers in neuroscience* 14 (2020), p. 358. URL: https://www.frontiersin.org/articles/10.3389/fnins.2020.00358/full.

[6] Alina Suleimanova, Max Talanov, Oleg Gafurov, Fail' Gafarov, Ksenia Koroleva, Anaïs Virenque, Francesco M Noe, Nikita Mikhailov, Andrea Nistri, and Rashid Giniatullin. "Modeling a nociceptive neuro-immune synapse activated by ATP and 5-HT in meninges: novel clues on transduction of chemical signals into persistent or rhythmic neuronal firing". In: *Frontiers in cellular neuroscience* (2020), p. 135. URL:

https://www.frontiersin.org/articles/10.3389/fncel.2020.00135/full.

[7] Alina Suleimanova, Max Talanov, Arn MJM Van den Maagdenberg, and Rashid Giniatullin. "Deciphering in silico the Role of Mutated Na V 1.1 Sodium Channels in Enhancing Trigeminal Nociception in Familial Hemiplegic Migraine Type 3". In: *Frontiers in Cellular Neuroscience* 15 (2021), p. 644047. URL: https://www.frontiersin.org/articles/10.3389/fncel.2021.644047/full.

[8] Max Talanov, Alexey Leukhin, Hugo Lövheim, Jordi Vallverdú, Alexander Toschev, and Fail Gafarov. "Modeling Psycho-Emotional States via Neurosimulation of Monoamine Neurotransmitters". In: *Blended Cognition.* Springer, Cham, 2019, pp. 127–156.

[9] Max Talanov, Alina Suleimanova, Alexey Leukhin, Yulia Mikhailova, Alexander Toschev, Alena Militskova, Igor Lavrov, and Evgeni Magid. "Neurointerface implemented with Oscillator Motifs". In: *2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).* IEEE, pp. 4150–4155. URL: https://ieeexplore.ieee.org/abstract/document/9636089.

[10] Alina Tlitova, Alexander Toschev, Max Talanov, and Vitaliy Kurnosov. "Meta-Analysis of Cross-Language Plagiarism and Self-Plagiarism Detection Methods for Russian-English Language Pair". In: *Frontiers in Computer Science* (2020), p. 42. URL: https://www.frontiersin.org/articles/10.3389/fcomp.2020.523053/full.

[11] Jordi Vallverdú, Oscar Castro, Richard Mayne, Max Talanov, Michael Levin, Frantisek Baluška, Yukio Gunji, Audrey Dussutour, Hector Zenil, and Andrew Adamatzky. "Slime mould: the fundamental mechanisms of biological cognition". In: *Biosystems* 165 (2018), pp. 57–70. URL: https://www.sciencedirect.com/science/article/abs/pii/S0303264717304574.

[12] Jordi Vallverdú, Max Talanov, Alexey Leukhin, Elsa Fatykhova, and Victor Erokhin. "Hormonal computing: a conceptual approach". In: *Frontiers in Chemistry* 11 (2023).

▬▬▬ Education Background

2000 **PHD degree in Computer science: Mathematical modeling**, *Kazan State Technological University, Russia*, Faculty of enterprise processes management.

▬▬▬ Society membership

2023 Brain Inspired Cognitive Architecture (BICA), USA

2023 Societá Italiana Caos e Complessitá, Italy

| 2023 | Association for Computing Machinery (ACM), USA |

Professional Training

2014	Teaching Excellence, Carnegie Mellon University, USA
2009	Software Architecture, Carnegie Mellon University, USA
2008	Software Requirements Analysis, Carnegie Mellon University, USA
2007	Managing Software Project Team, Carnegie Mellon University, USA

Grants

Neurosimulation neuroprosthesis project received funding from the Assistance for Innovation Fund.

Memristive spinal cord segment prosthesis project received funding from the Russian Basic Research Fund.

Robot Dream project received funding according to the Russian Government Program of Competitive Growth of Kazan Federal University.

NeuCogAr project received funding from subsidy allocated to Kazan Federal University for the state assignment in the sphere of scientific activities.

Erasmus+ with Birmingham City University we have received in 2016 and 2018 for the lecturers exchange.

Prizes and Awards

2021 - Our article "Modeling a Nociceptive Neuro-Immune Synapse Activated by ATP and 5-HT in Meninges: Novel Clues on Transduction of Chemical Signals Into Persistent or Rhythmic Neuronal Firing" was selected to Cellular Neurophysiology Editors' Pick 2021 collection.

2018 - Best poster award in ESCI-2018 conference.

2017 - Best paper award in DESE-2017 conference.

2005 - Received honorary diploma of the Sun microsystems, Java projects competition, for the MILK - domain specific language for web sites creation.

Patents

Recovery of sensorimotor function with neuroprosthetic system and method thereof international patent WO2022093062A1.

Simulator of neuronal activity based on spiking neural network GRAS the registration of intellectual property of software product or technology N 2020663801.

Thinking-Understanding the registration of intellectual property of software product or technology N 2016618910.

Conference and Workshop Activities

2010 – CEE-SECR, 2013 – AINL, 2015 – AOC@AMSTA, 2015 – AINA, 2015 – BICA, 2016 – Fierces on BICA, 2016 – AOC@AMSTA, 2016– AGI, 2016 –

BICA, 2017 – BICA, 2017 – ICAROB, 2017 – ICINCO, 2017 – DESE, 2018 – ESCI, 2018 – Volga neuroscience meeting, 2021 – IROS, 2021 – BICA, 2021 – BF-NAICS.

I took part in organisation of special sessions of AOC@AMSTA-2016 and AOC@AMSTA-2015 and local series of Software engineering seminars AKSES-2014. I was a general chair of HCC-2017 conference.

Science-pop activities

I had science-pop lecture "Cyberpunk revolution" in cultural center "Smena" in 2021. I took part in *TEDx*, *Science Slam* and *JavaDay* science-pop events in Kazan, as well as I took part in science popular Russian resource *postnauka.ru* especially interesting paper is dedicated to *Marvin Minsky and his role in AI*, also forbes.ru published an interview with me *available here*.

Language Competence

English	Full professional proficiency
Russian	Mother tongue