ISSAI

NAZARBAYEV UNIVERSITY | Institute *of* Smart Systems *and* Artificial Intelligence

ANNUAL REPORT

2021

2021

86 RESEARCH ASSISTANTS

30 UNIVERSITY STUDENTS

1 NVIDIA DGX-1
2 NVIDIA DGX-2
4 NVIDIA DGX A100
7 HPC IN LABS

12 PUBLICATIONS

15 PROJECTS

9 DATASETS
1000+ DOWNLOADS
100+ AFFILIATIONS

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ABOUT ISSAI

The Institute of Smart Systems and Artificial Intelligence (ISSAI) was founded in September 2019 to serve as an engine of research and innovation in Kazakhstan's digital domain, with a focus on AI research.

Located in the C4 Research Building at Nazarbayev University, ISSAI conducts interdisciplinary research in AI to solve real-world problems facing industry and society.

ISSAI aims to develop a national capacity for AI research, drawing on the experience of exemplars in Asia, Europe, and the United States.

ISSAI provides a flexible framework for research, innovation, and collaboration with national and international partners in education, industry and government, and contributes to Kazakhstan's digital ecosystem to advance national development goals.

ISSAI FOUNDING DIRECTOR'S MESSAGE

Humankind is in the midst of its greatest disruptive economic transformation that will dwarf the industrial revolution of the 19th century. Advances in autonomous driving, smart grids, intelligent agents, 5G networks, and personalized health will have profound effects on all facets of our lives over the next decade. Artificial intelligence (AI) is a key technology for all these developments. Countries that want to lead this race will need to reorient their economies and adopt policies to keep AI and data at the center. Training an AI workforce and establishing AI research capacity will be vital to this endeavor.

The Institute of Smart Systems and Artificial Intelligence (ISSAI) was established in 2019 on the basis of Nazarbayev University to support the AI-based development of Kazakhstan. The Institute is the first of its kind in the country and the region. It trains Kazakhstan's digital workforce by conducting advanced research projects in AI and data science. The Institute has over 40 researchers working in a gender-balanced team. The Institute's publications are already appearing in high-impact journals and at prestigious conferences. ISSAI is a strong proponent of "AI for Good" and all projects conform to the highest standards of AI ethical principles. The Institute has established an advanced computational infrastructure and shares this resource with researchers of the country. In addition, ISSAI serves as the largest repository of open-source AI datasets in Central Asia to stimulate data-based research and innovation. ISSAI also organizes outreach programs so that a greater number of young researchers can be introduced to state-of-the-art AI techniques and hardware.

We believe that high-quality research can be conducted when interdisciplinary teams from different cultures and countries come together and unite their efforts to create a better world for future generations. Therefore, we invite everyone who shares our motto "AI for Good" to join our research activities and collaborate with us.

Prof. H. Atakan Varol
Founding Director of ISSAI

RESEARCH PROJECTS

PROJECTS

In 2021, ISSAI conducted the following research projects on the Institute's main research thrusts: Smart Living, Smart Healthcare, and Smart Industry:

AI-based Voice Technologies for Kazakh: Kazakh Speech Corpus and Automated Speech Recognition

AI-based Voice Technologies for Kazakh: Text-To-Speech technology

Particle-based COVID-19 Simulator with Contact Tracing, Testing and Vaccination Modules

Multilingual Automated Speech Recognition: Kazakh-English-Russian

Uzbek Speech Corpus and Automated Speech Recognition

Robust End-to-End Sequential Indoor Localization Using Smartphone Inertial Sensors and WiFi

Speaking Faces: A Large-Scale Dataset of Voice Commands with Visual and Thermal Video Streams

Deep Learning Based Control of Robotic Systems

AI-Based Design of Reinforced Concrete Columns

Maximizing Wireless Power Transfer to Cylindrical Loads with Deep Neural Networks

Design of Deep Optimal Controllers Using Imitation Learning

Optical Tactile Sensors with Integrated Deep Learning

Object Detection in X-Ray Images in Train Wagons and Trucks

Human Memory Augmentation Using Augmented Reality Goggles with Object Detection

PROJECTS

AI-based Voice Technologies for Kazakh

Recognising the acute need for natural language processing and speech technologies for the Kazakh language, ISSAI created a roadmap (see Figure 2). As a first step, in 2020, ISSAI started collecting the largest voice dataset of the Kazakh language, the Kazakh Speech Corpus, which now contains over 500 hours of Kazakh speech from more than 2000 individuals. Using the collected database, ISSAI developed an automated speech recognition (ASR) model.

In April 2021, ISSAI created the first Kazakh Narrator Corpus (Kazakh Text-to-Speech Synthesis). The model built within the course of the corpus construction has two voices: the male "Isseke" and the female "Raya" (available to try out on the ISSAI website).

In September 2021, ISSAI developed a multilingual end-to-end ASR model for three languages used in Kazakhstan: Kazakh, Russian, and English. Kazakhstan is a multinational country where Kazakh is the official state language, while Russian and English are the languages of interethnic communication. In this context, ISSAI initiated the project and developed an ASR model that can simultaneously recognise Kazakh, Russian, and English. This work will further progress the speech processing research and advance speech-enabled technologies in Kazakhstan and its neighbouring countries (available to try out on the ISSAI website).

Figure 2 – ISSAI Roadmap for NLP and Speech Technologies in Kazakh.

PROJECTS

AI-based Voice Technologies for Kazakh: Kazakh Speech Corpus and Automated Speech Recognition

by Yerbolat Khassanov, Saida Mussakhojayeva, Almas Mirzakhmetov, Alen Adiyev, Mukhamet Nurpeiissov, Huseyin Atakan Varol

The ISSAI team has created the largest Kazakh speech dataset, the Kazakh Speech Corpus, consisting of more than 400 hours contributed by over 2000 participants from different regions, age groups, and of both genders.

The dataset was used to develop an automated Kazakh speech recognition system. This technology is used in virtual assistants, such as Siri and Alexa, in voice- or text-enabled applications, such as smart homes or self-driving cars, and will be of great benefit to people with special needs.

The dataset is available at https://issai.nu.edu.kz/kz-speech-corpus/, and the public can test the automated Kazakh speech recognition system in person.

Until now, the lack of an authoritative database has been an obstacle to the use of Kazakh in the digital world. In order to improve this situation, ISSAI has released the Kazakh language dataset as an open-source project available to all researchers and digital entrepreneurs, to maximise its positive impact on the Kazakh economy and society.

So far, over 100 organisations, such as Google, Kaspi Bank, Yandex, Beeline and others, have downloaded our dataset.

ISSAI researchers developed the Automated Kazakh Speech Recognition project

KAZAKH SPEECH CORPUS
for language and speech processing applications

participate in a research study

Issai.nu.edu.kz

PROJECTS

AI-based Voice Technologies for Kazakh: Text-To-Speech technology

by Saida Mussakhojayeva, Aigerim Janaliyeva, Almas Mirzakhmetov, Yerbolat Khassanov, Huseyin Atakan Varol

The ISSAI team has also developed a text-to-speech (TTS) technology for the Kazakh language to convert written Kazakh text into a speech signal.

In the future, this technology can be used to support people with visual impairments, virtual assistants, and other public/civil services (e.g., public transport announcements, advertisements, elevator announcements about door opening/closing, announcements in planes, airports, train/bus stations, shopping malls etc.).
The technology can be tested at https://issai.nu.edu.kz/tts-eng/.
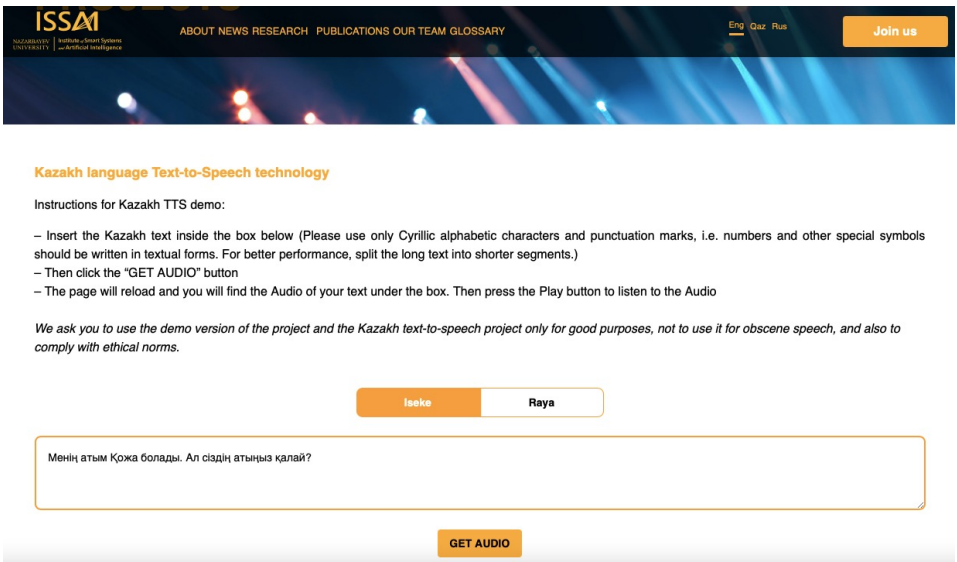
The stories of Qorqyt Ata and Dina Nurpeiissova, narrated by Kazakh male and female computer voices, are available at the following link: https://www.youtube.com/watch?v=NHYn3nH7U5A.

PROJECTS

Multilingual Automated Speech Recognition: Kazakh-English-Russian

by Saida Mussakhojayeva, Yerbolat Khassanov, Huseyin Atakan Varol

The ISSAI team has developed a multilingual end-to-end (E2E) automatic speech recognition (ASR) system applied to three languages used in Kazakhstan: Kazakh, Russian, and English.

Kazakhstan is a multinational country where Kazakh is the official state language, while Russian and English are the languages of interethnic and international communication, commonly used in business, science, and education. Consequently, language mixing is widespread in Kazakhstan. In this context, ISSAI has built a single joint E2E ASR model that can simultaneously recognize the Kazakh, Russian, and English languages.

The technology can be tested at https://issai.nu.edu.kz/multilingual-asr/.

Uzbek Speech Corpus and Automated Speech Recognition

by Saida Mussakhojayeva, Yerbolat Khassanov, Huseyin Atakan Varol

ISSAI stirves to establish academic collaboration with both local and foreign research centers. One of the successful international collaborations is the agreement with the Image and Speech Processing Laboratory, Department of Computer Systems, TUIT (Tashkent, Uzbekistan). As a result of the joint work, the first open-source Uzbek speech corpus was developed.

This work is intended to promote the development and use of the Uzbek language in speech-enabled applications, such as message dictation, voice search, voice command, and other voice-controlled smart devices. Additionally, this work should facilitate the development of assistive technologies in the Uzbek language for people with special needs (e.g., the hearing impaired).

The technology can be tested at: https://issai.nu.edu.kz/uzbek-asr/

Considering the successful implementation of KSC and USC, ISSAI also started buidling a Turkish speech corpus in 2021. ISSAI also plans to begin building a Kyrgyz speech corpus in the summer of 2022.

Particle-based COVID-19 Simulator with Contact Tracing, Testing and Vaccination Modules

by Aknur Karabay, Askat Kuzdeuov, Shyryn Ospanova, Michael Lewis, Huseyin Atakan V

With the start of the COVID-19 testing, tracing and vaccination campaigns, researchers added these modules to make relevant predictions and consider all these measures to suppress the epidemic.

ISSAI has developed a particle-based COVID-19 simulator with contact tracing, testing and vaccination modules. Each particle models a person with parameters: 1) location; 2) velocity; 3) epidemic state; 4) time in the current epidemic state; 5) contact tracing application; 6) COVID-19 test; 7) age group; 8) vaccination status; 9) vaccine hesitancy. The particle-based model provides a more precise simulation analysis and allows for differentiation of population parameters.

This helps to understand the number of infected and healthy citizens, the number of people in each epidemiological status, the speed of infection spread, and the effectiveness of the measures taken.
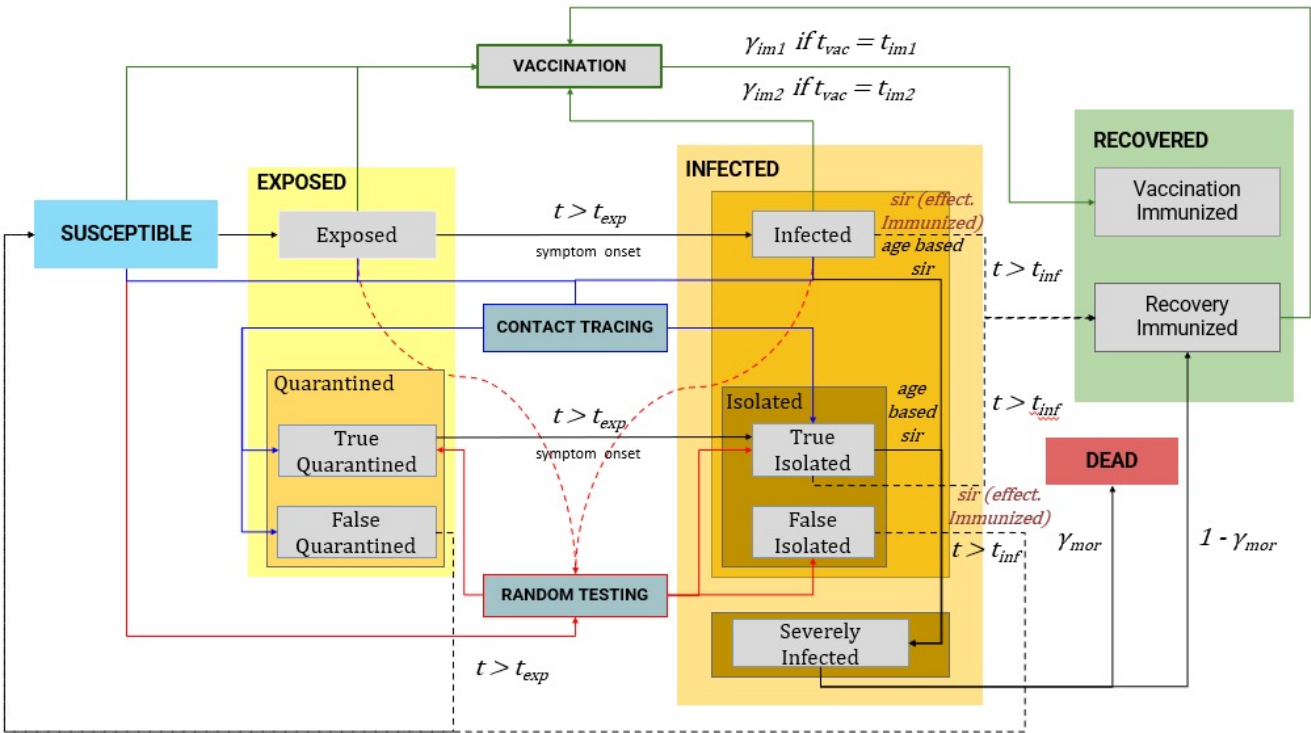
Robust End-to-End Sequential Indoor Localization Using Smartphone Inertial Sensors and WiFi

by Yerbolat Khassanov, Mukhamet Nurpeiissov, Azamat Sarkytbayev, Askat Kuzdeuov, Huseyin Atakan Varol

Existing problem and definition:

- Poor WiFi signal or WiFi signal loss from time to time.
- ISSAI uses built-in smartphone sensors (IMU sensors) to overcome this problem.
- IMU is used for movement detection and displacement detection (integrated in people's phones)
- ISSAI creates the Fusion of IMU and WiFi signals in order to enhance the results of the previous project.

- One model is trained for the data stream from both sensors.
- The proposed method could be used for applications that require accuracy of one meter.
- An Android application was created to collect data from WiFi and IMU sensors.
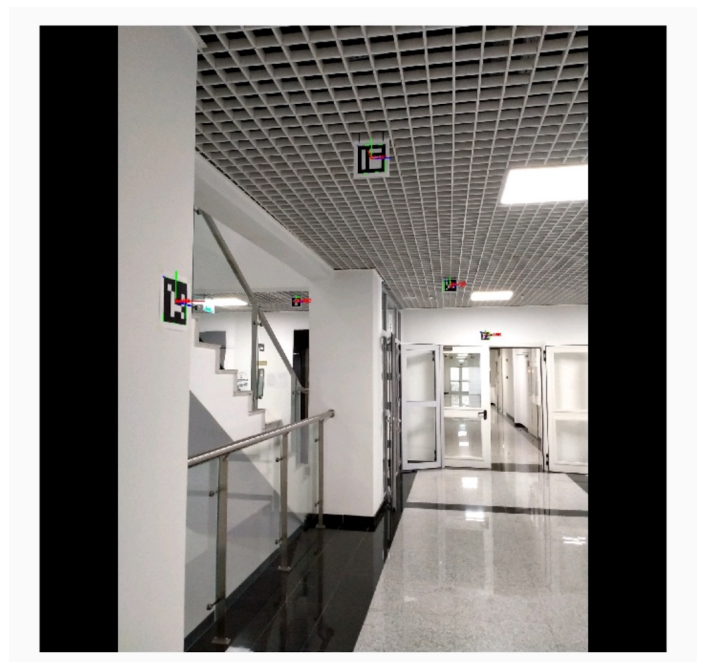
PROJECTS

Speaking Faces: A Large-Scale Dataset of Voice Commands with Visual and Thermal Video Streams

by *Madina Abdrakhmanova, Saniya Abushakimova, Yerbolat Khassanov, Huseyin Atakan Varol*

A large-scale publicly available dataset designed to encourage research in the general areas of user authentication, facial recognition, speech recognition and human-computer interaction.

SpeakingFaces consists of well-aligned high-resolution thermal and visual spectra image streams of faces synchronized with audio recordings of each subject speaking 100 imperative phrases. The data were collected from 140 subjects, yielding 14,000 instances of synchronized raw data (7.5 TB).
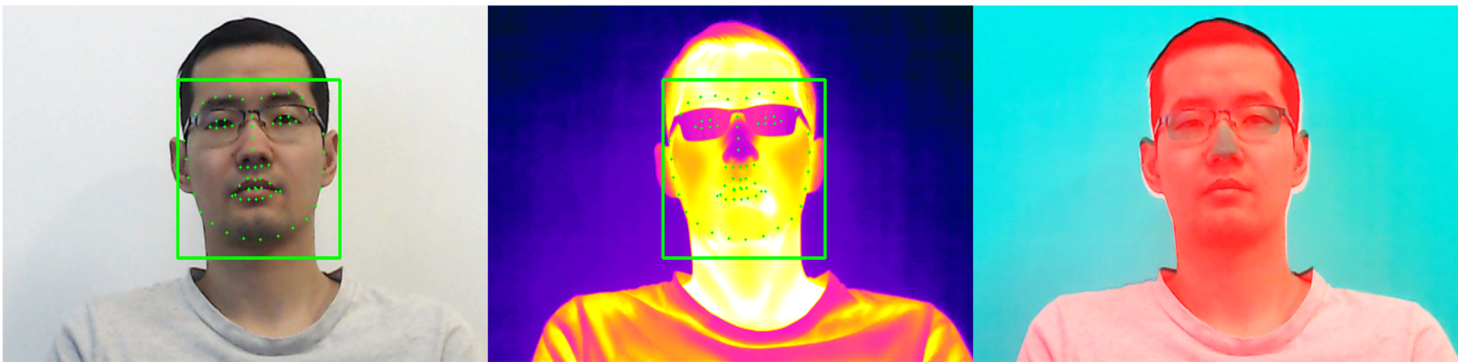
Deep Learning Based Control of Robotic Systems

by *Daulet Baimukashev, Bexultan Rakhim, Matteo Rubagotti, Huseyin Atakan Varol*

Problem
- Solving the optimal control problem formulation is infeasible for real-time applications due to high computational costs.
- Deep neural networks (DNNs) can approximate complex functions with nonlinearities.
- Therefore, we designed a DNN that approximates the OCP solution and stabilizes the system in real time.

Application
- The DNN can be trained using the simulation data.
- The DNN controller outperforms the nonlinear model predictive controller in both cost and inference time.
- In addition, a fault-tolerant and robust version of the controller for the system with parametric uncertainties was designed and tested experimentally.
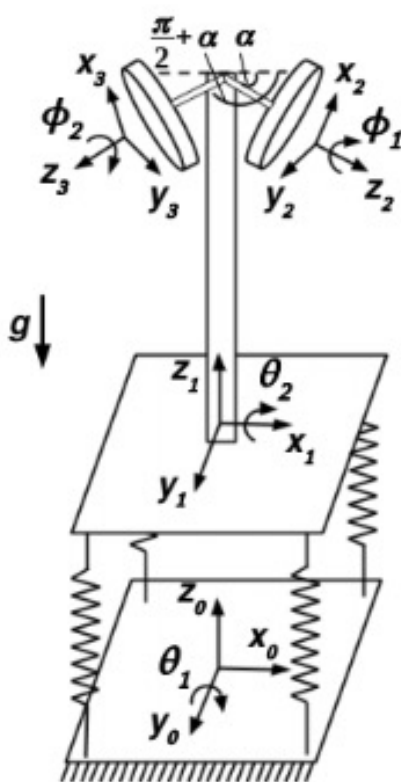
(a) Block diagram.
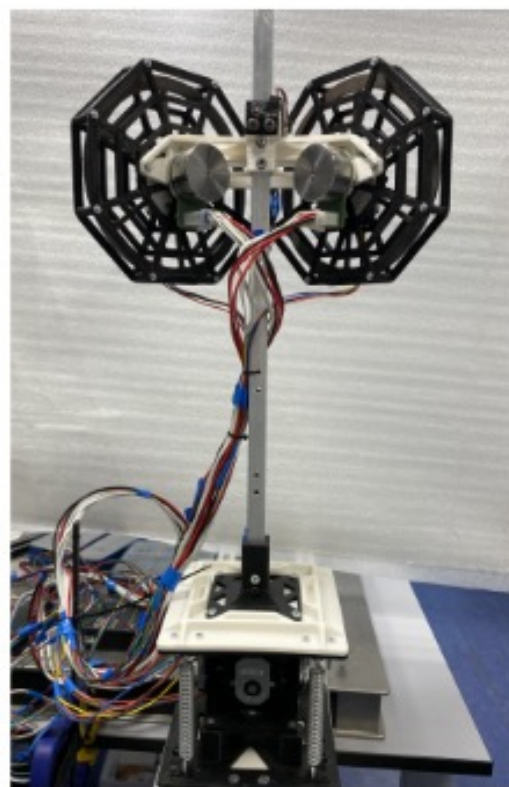
(b) Reaction wheel setup.

AI-Based Design of Reinforced Concrete Columns

Optimizing design costs and time is an important aspect of construction projects, and the integration of AI can presumably reduce these as it can perform these tasks at much higher speeds without directly involving structural engineers throughout the process. In this collaborative project with Prof. Dichuan Zhang (NU School of Engineering and Digital Sciences), we are applying a neural network to create a tool for automatically optimized reinforced concrete (RC) column design.

In 2021, we generated a dataset of 1.425 million RC column designs by using a finite-element model of an RC column. The main challenges are coming from getting the correlation mapping between the input and output parameters of the neural network. We are in the process of improving the filtering of the data we feed into the network and fine-tuning the network itself to achieve stable performance across different sizes of the design. In 2022, we will include the height parameter of the column and apply the achieved model to different concrete material classes.
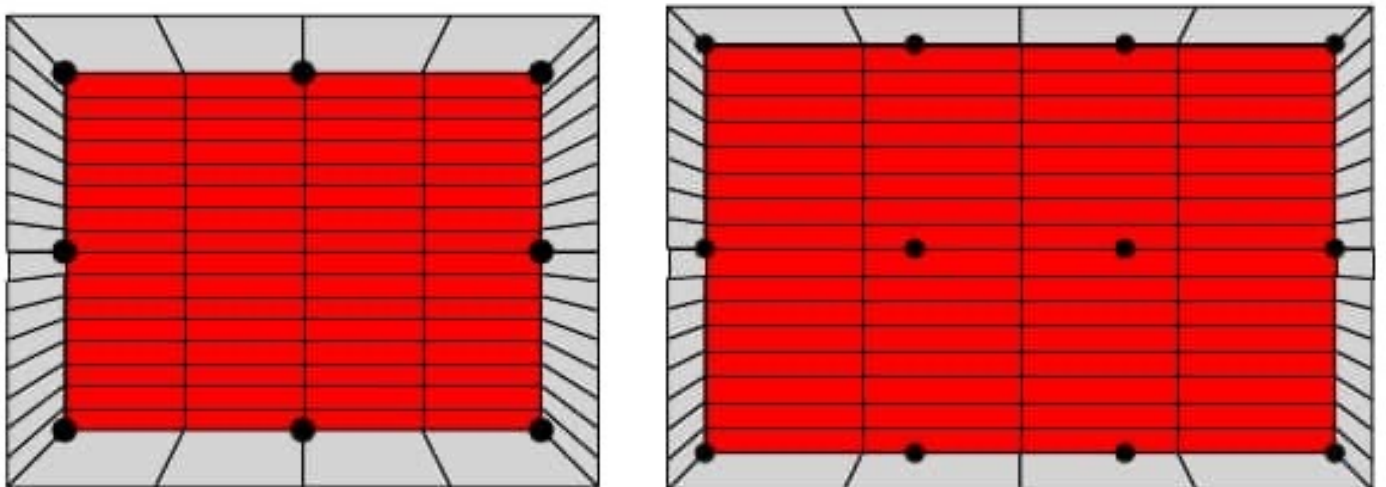

Cross section design provided by
neural network

AI-Based Design of Organic Solar Cell Materials

Organic photovoltaic (OPV) devices consist of photoactive donor and accepter materials sandwiched between two electrodes. They convert solar energy to electrical energy with high efficiency. Recently, there has been a surge of interest in this research area due to the zero emission energy production potential of these devices. Researchers are experimentally trying a variety of combinations to invent OPV solar cells with high power conversion efficiency (PCE). The empirical nature of this research makes it time-consuming and costly. There are an increasing number of publications that provide the SMILES codes of donors and acceptors and also their characteristics, such as HOMO-LUMO energy levels and PCE that have been experimentally obtained. Indeed, researchers have recently compiled these publications and created datasets for machine learning applications. In this collaborative project with Prof. Victor Brus (SSH, Physics), we plan to use these recent datasets to develop machine learning models that can predict the HOMO and LUMO values and PCE given the SMILES strings for donor and accepter pairs. We will then generate new SMILES strings using combinations of different molecular blocks and predict their characteristics using the developed machine learning model. The molecules with good characteristics will finally be synthesized and in this way the trial and error effort will be significantly reduced. Bidirectional Encoder Representations from Transformers (BERT) for NLP will be used for this task.
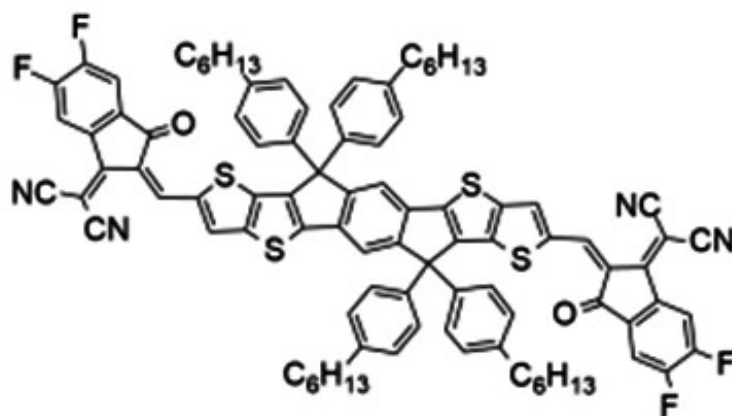

Structural formula (top) and the corresponding SMILES code for ITIC-4F, an indacenodithienothiophene (IDTT)-based postfullerene electron acceptor.

Maximizing Wireless Power Transfer to Cylindrical Loads with Deep Neural Networks

In this collaborative project with Prof. Costas Valagiannopoulos (SSH, Physics), we aim to design a cylindrical structure consisting of energy absorbing elements by using deep neural networks. The cylindrical structure is formed by adding layers one by one, each layer corresponding to a different element type with different physical characteristics. Each layer has its own width parameter that needs to be optimized, so that the overall absorption energy from both polarization modes (TE + TM) is maximized. We consider a number of potential materials: aluminum, amorphous silicon, copper, gallium phosphide, germanium, gold, indium, platinum, silica, silicon, silver and titanium. The approach can be used to maximize wireless energy transfer for super-batteries in a more effective way through machine learning and helps to explore the photonic design of cylindrical materials. The results obtained so far demonstrate that the project is viable, as the results obtained by the NNs outperform the best training sample by 300%. To the best of our knowledge, this is the first project to use a machine learning model that finds an optimal solution using the knowledge of photonic characteristics of the above materials and the physical distance between the source and the receiver, and suggests materials to be used for the design.
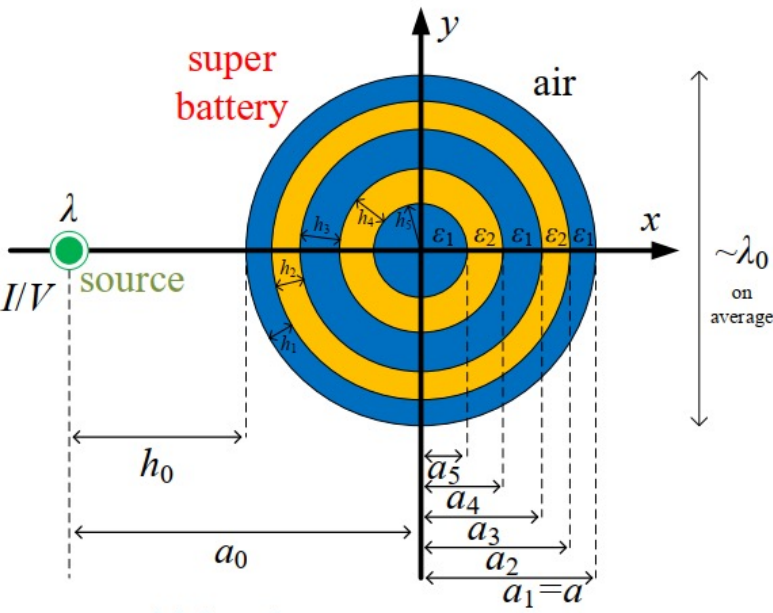

The schematic representation of the cylindrical design

PROJECTS

Design of Deep Optimal Controllers Using Imitation Learning

In this collaborative project with Prof. Matteo Rubagotti (SEDS, Robotics), we are developing deep learning-based control systems by imitating (i.e., learning) optimal controller behaviors. The end-to-end nature of these deep controllers simplifies the control structure compared to traditional approaches. This is illustrated in the figures below, which compare the traditional fault-tolerant control (FTC) scheme and the end-to-end deep fault-tolerant controller (DFTC). In this way, it is possible to implement controllers that are feasible in real time, as the inference time of NNs is much shorter than the optimization computations of traditional NMPCs. We are currently also employing this deep learning-based control approach to design robust controllers. In the future, we will extend it to systems without explicit system dynamics that can be computationally simulated using physics engines and finite element methods (e.g., soft robots). Research in this area becomes accepted in leading robotics journals and conferences, and our shared models and codes are frequently downloaded by the research community, hinting at a positive citation impact in the future.
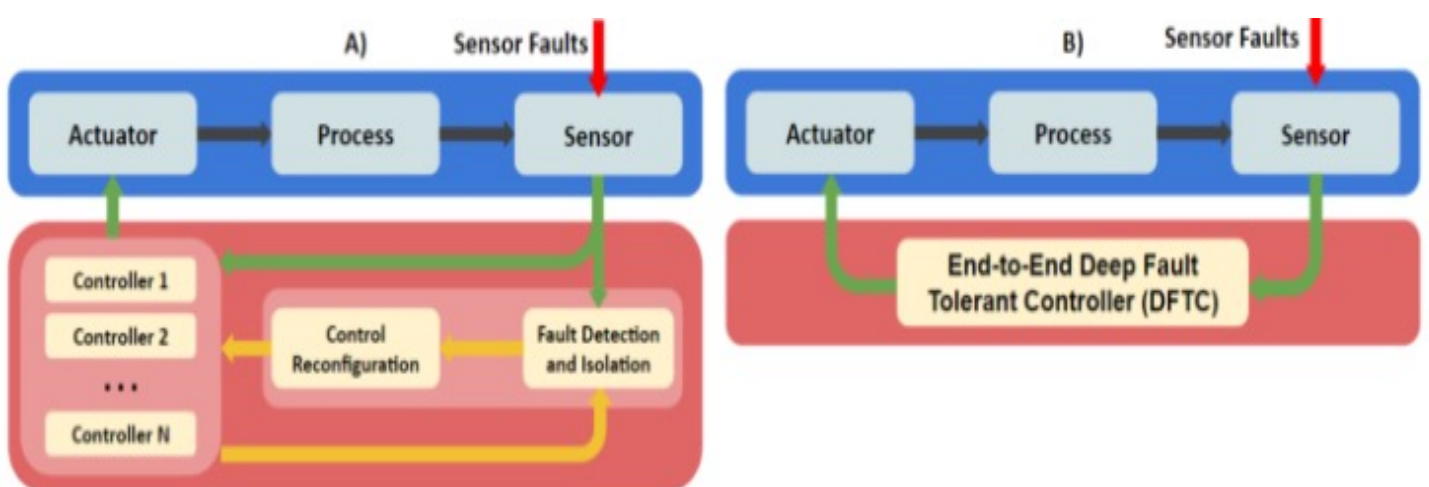

Schematics of the classical FTC system (A) and NN-based end-to-end DFTC (B)

PROJECTS

Optical Tactile Sensors with Integrated Deep Learning

In this collaborative project with Prof. Zhanat Kappassov (SEDS, Robotics), we focused on designing an optical tactile sensor. These elastomeric sensors are unique in that they can measure shear, torsion and pressure with high accuracy and resolution and inherently use neural networks (NNs) for data processing, similar to biomorphic systems.

In 2021, this research was accomplished thanks to the computational resources and know-how at ISSAI. Specifically, we had to create specialized NN architectures, as transfer learning is not possible for this unique type of data. This work is easily accepted in the leading conferences and journals in robotics, such as ICRA, IROS and RAL. Further research on this topic has the potential to lead to publications in the International Journal of Robotics Research and Science Robotics.
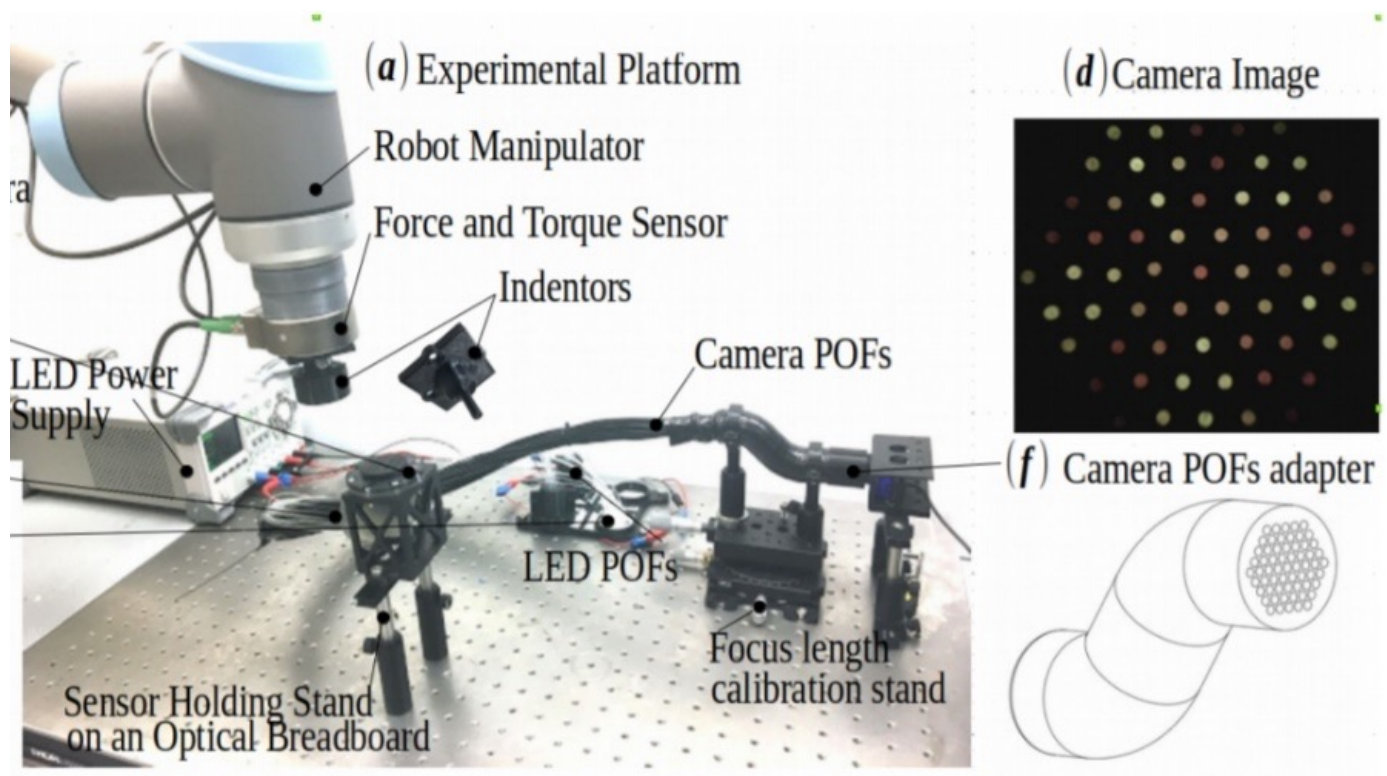

Experimental setup for the optical
tactile sensor

Object Detection in X-Ray Images in Train Wagons and Trucks

In February 2021, ISSAI was contacted by the State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan to solve an important problem of the Customs Service of Kazakhstan: the detection and counting of items in X-ray images of trucks and train wagons crossing Kazakhstan's borders (see the figure below). As part of our collaboration with the State Revenue Committee, ISSAI developed a pilot model for X-ray object detection and in return received 10,000 annotated X-ray images from the other party. The 10,000 images, which contain 20 classes, will be annotated by the State Revenue team using the VGG image annotator. ISSAI has trained the team extensively in annotating the data. Since the small number of images is not sufficient to develop a highly accurate object detection model, we utilize transfer learning in this project. Specifically, we train Yolo-V5 with the grayscale version of the COCO dataset and then perform a final training with the X-ray images only for the final four layers. Our initial results are promising. Considering the lack of open-source X-ray object datasets, we see the probability of an impactful publication with many future citations as very high. In the 4th quarter of 2021, ISSAI developed a pilot model with four classes for the Committee. In 2022, at the request of the Committee, ISSAI will expand the classes to 6 and provide the model for the Committee free of charge for further operation by the Committee itself (as a support for the implementation of AI technologies for government agencies).
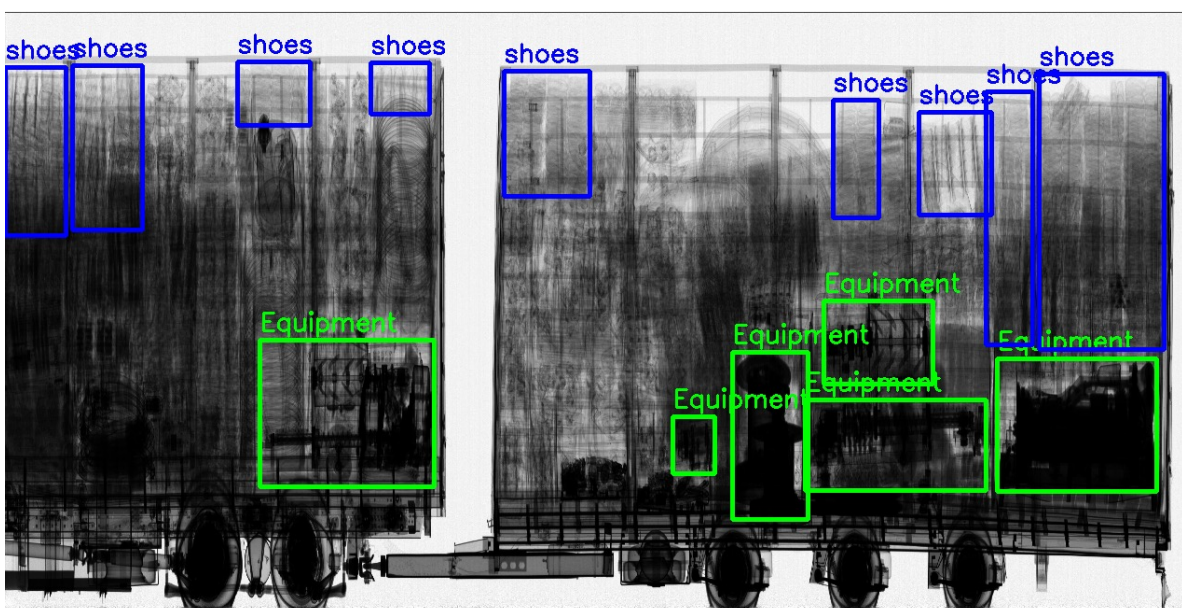
PROJECTS

Human Memory Augmentation Using Augmented Reality Goggles with Object Detection

Our data collection setup consists of two components: 1) the Microsoft HoloLens Augmented Reality Goggles with a built-in color camera for capturing images representing the view of a human user donning these digital glasses, and 2) a server computer on which the automatic object recognition and localization processes operate in real time.

As a result, we acquire the experimental data containing information about what human users have seen and where. The collected visuospatial data are sent to the server to be processed by running the automatic object recognition and localization. Then the result of the object recognition and localization tools is sent in real time to the wearer of the HoloLens digital glasses.
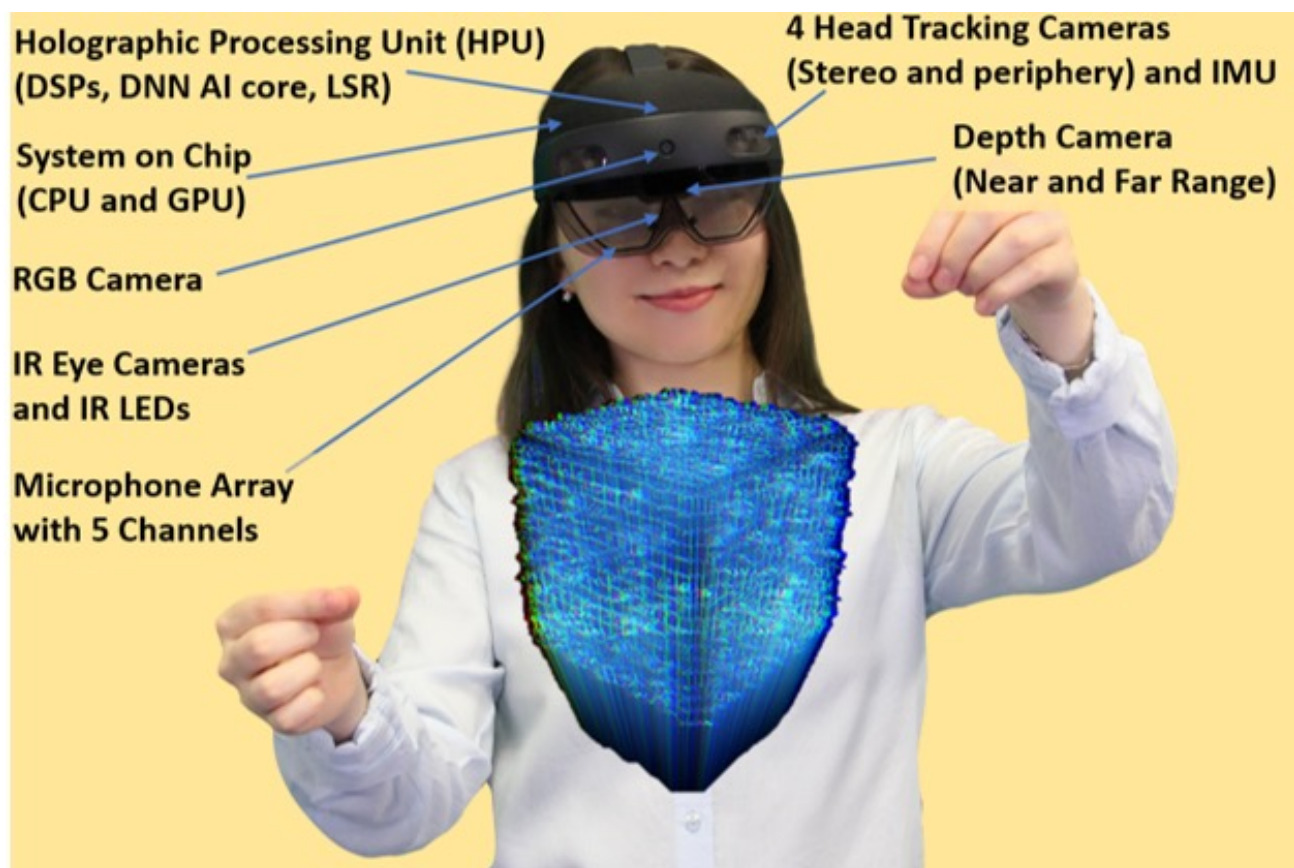
PUBLICATIONS

PUBLICATIONS BY MONTH

JANUARY

Finer-level Sequential WiFi-based Indoor Localization
by Yerbolat Khassanov, Mukhamet Nurpeiissov, Azamat Sarkytbayev, Askat Kuzdeuov, Huseyin Atakan Varol

FEBRUARY

MARCH

A Particle-Based COVID-19 Simulator With Contact Tracing and Testing
by Askat Kuzdeuov, Aknur Karabay, Daulet Baimukashev, Bauyrzhan Ibragimov, Huseyin Atakan Varol

APRIL

A Crowdsourced Open-Source Kazakh Speech Corpus and Initial Speech Recognition Baseline
by Yerbolat Khassanov, Saida Mussakhojayeva, Almas Mirzakhmetov, Alen Adiyev, Mukhamet Nurpeiissov, Huseyin Atakan Varol

MAY

SpeakingFaces: A Large-Scale Multimodal Dataset of Voice Commands with Visual and Thermal Video Streams
by Madina Abdrakhmanova, Askat Kuzdeuov, Sheikh Jarju, Yerbolat Khassanov, Michael Lewis, Huseyin Atakan Varol

End-to-End Deep Fault Tolerant Control
by Daulet Baimukashev, Bexultan Rakhim, Matteo Rubagotti, Huseyin Atakan Varol

JUNE

JULY

USC: An Open-Source Uzbek Speech Corpus and Initial Speech Recognition Experiments
by Muhammadjon Musaev, Saida Mussakhojayeva, Ilyos Khujayorov, Yerbolat Khassanov, Mannon Ochilov, Huseyin Atakan Varol

AUGUST

KazakhTTS: An Open-Source Kazakh Text-to-Speech Synthesis Dataset
by Saida Mussakhojayeva, Aigerim Janaliyeva, Almas Mirzakhmetov, Yerbolat Khassanov, Huseyin Atakan Varol

SEPTEMBER

A Study of Multilingual End-to-End Speech Recognition for Kazakh, Russian, and English
by Saida Mussakhojayeva, Yerbolat Khassanov, Huseyin Atakan Varol

Can A Vibrotactile Stimulation On Fingertips Make An Illusion Of Elbow Joint Movement?
by Dinmukhammed Mukashev, Adilzhan Adilkhanov, Zhanat Kappassov

OCTOBER

A Study of Multimodal Person Verification Using Audio-Visual-Thermal Data
by Madina Abdrakhmanova, Saniya Abushakimova, Yerbolat Khassanov, Huseyin Atakan Varol

NOVEMBER

DECEMBER

A Vaccination Simulator for COVID-19: Effective and Sterilizing Immunization Cases
by Aknur Karabay, Askat Kuzdeuov, Shyryn Ospanova, Michael Lewis, Huseyin Atakan Varol

Robust Detection of Absence of Slip in Robot Hands and Feet
by Yerkebulan Massalim, Zhanat Kappassov, Huseyin Atakan Varol, Vincent Hayward

PUBLICATIONS LINK:
https://issai.nu.edu.kz/all-publications/

JOURNAL ONLY PUBLICATIONS

A Study of Multimodal Person Verification Using Audio-Visual-Thermal Data

A Particle-Based COVID-19 Simulator With Contact Tracing and Testing

End-to-End Deep Fault Tolerant Control

A Vaccination Simulator for COVID-19: Effective and Sterilizing Immunization Cases

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CONFERENCE PUBLICATIONS

USC: An Open-Source Uzbek Speech Corpus and Initial Speech Recognition Experiments

Finer-level Sequential WiFi-based Indoor Localization

A Study of Multilingual End-to-End Speech Recognition for Kazakh, Russian, and English

KazakhTTS: An Open-Source Kazakh Text-to-Speech Synthesis Dataset

A Crowdsourced Open-Source Kazakh Speech Corpus and Initial Speech Recognition Baseline

Can A Vibrotactile Stimulation On Fingertips Make An Illusion Of Elbow Joint Movement?

183.102

154.

DATASETS

DATASETS

All research datasets and models developed by the Institute are open-source and publicly available for download from ISSAI's website. ISSAI datasets are available for free download from https://issai.nu.edu.kz/issai-datasets/

Kazakh Speech Corpus (KSC)

The KSC is the largest publicly available dataset developed to advance various Kazakh speech and language processing applications. It contains around 335 hours of manually transcribed audio comprising over 154,000 utterances spoken by participants from different regions of Kazakhstan.

Kazakh Text-to-Speech (KazakhTTS)

The KazakhTTS is a high-quality open-source speech dataset that contains over 90 hours of audio recorded by two professional speakers (one male and one female).

Speaking Faces

A large-scale publicly-available dataset designed to encourage research in the general areas of user authentication, facial recognition, speech recognition and human-computer interaction.

SF-TL54: A Thermal Facial Landmark Dataset with Visual Pairs

A thermal face dataset with manually annotated bounding boxes and facial landmarks. The dataset was constructed using our large-scale SpeakingFaces dataset (https://issai.nu.edu.kz/speaking-faces/). In total, the dataset contains 2,556 thermal-visual image pairs of 142 subjects, where each subject has 18 thermal-visual image pairs (2 trial x 9 positions).

TFW: Annotated Thermal Faces in the Wild Dataset

*The dataset contains thermal images acquired in **indoor (controlled)** and **outdoor (uncontrolled)** environments. The indoor dataset was constructed using previously published SpeakingFaces dataset. The outdoor dataset was collected using the same FLIR T540 thermal camera with a resolution of 464x348 pixels, a wave-band of 7.5–14 μm, the field of view 24, and an iron color palette. The dataset was manually annotated with face bounding boxes and five-point facial landmarks.*

Uzbek Speech Corpus (USC)

The USC is an open-source speech corpus that has been developed in collaboration between ISSAI and the Image and Speech Processing Laboratory in the Department of Computer Systems of the Tashkent University of Information Technologies (https://tuit.uz/en/kompyuter-tizimlari). The USC comprises 958 different speakers with a total of 105 hours of transcribed audio recordings.

DATASETS

Russian Speech Corpus (OpenSTT-CS334)

The OpenSTT-CS334 is a manually re-transcribed 334- hour clean subset of the Russian OpenSTT (https://github.com/snakers4/open_stt). The dataset contains recordings only from the books and YouTube domain.

Kazakh-accented English

The dataset consists of Kazakh-accented English recordings (~7.7 hours) extracted from the SpeakingFaces (https://doi.org/10.48333/smgd-yj77), i.e., native Kazakh speakers uttering English verbal commands given to virtual assistants and other smart devices, such as 'turn off the lights', 'play the next song', and so on.

WiFine

A finer-level sequential dataset of WiFi received signal strengths (RSS). The dataset contains 290 trajectories collected across 3 floors of the C4 building of Nazarbayev University. The RSS values with corresponding position coordinates (x,y,z) are recorded around every 5 seconds.

IMUWiFine

A finer-level sequential dataset of IMU and WiFi received signal strengths (RSS). The dataset contains 120 trajectories covering an aggregate distance of over 14 kilometers. The dataset was collected across 3 floors of the C4 building of Nazarbayev University.

https://issai.nu.edu.kz/issai-datasets/

[DOI] [Code] [Download] [Cite]

Kazakh Speech Corpus (KSC)
The KSC is the largest publicly available dataset developed to advance various Kazakh speech and language processing applications. It contains around 335 hours of manually transcribed audio comprising over 154,000 utterances spoken by participants from different regions of Kazakhstan.

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[DOI] [Code] [Download] [Cite]

Kazakh Text-to-Speech (KazakhTTS)
The KazakhTTS is a high-quality open-source speech dataset that contains over 90 hours of audio recorded by two professional speakers (one male and one female).

LICENCE: Creative Commons Attribution 4.0 International License(https://creativecommons.org/licenses/by/4.0/)

[DOI] [Code] [Download] [Cite]

Speaking Faces
A large-scale publicly-available dataset designed to encourage research in the general areas of user authentication, facial recognition, speech recognition and human-computer interaction.

LICENCE: Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0/)

[DOI] [Code] [Download]

SF-TL54: A Thermal Facial Landmark Dataset with Visual Pairs
A thermal face dataset with manually annotated bounding boxes and facial landmarks. The dataset was constructed using our large-scale SpeakingFaces dataset (https://issai.nu.edu.kz/speaking-faces/). In total, the dataset contains 2,556 thermal-visual image pairs of 142 subjects, where each subject has 18 thermal-visual image pairs (2 trial x 9 positions).

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[DOI] [Code] [Download]

TFW: Annotated Thermal Faces in the Wild Dataset
The dataset contains thermal images acquired in **indoor (controlled)** and **outdoor (uncontrolled)** environments. The indoor dataset was constructed using our previously published SpeakingFaces dataset. The outdoor dataset was collected using the same FLIR T540 thermal camera with a resolution of 464x348 pixels, a wave-band of 7.5–14 µm, the field of view 24, and an iron color palette. The dataset was manually annotated with face bounding boxes and five-point facial landmarks.

[DOI] [Code] [Download] [Cite]

Uzbek Speech Corpus (USC)
The USC is an open-source speech corpus that has been developed in collaboration between ISSAI and the Image and Speech Processing Laboratory in the Department of Computer Systems of the Tashkent University of Information Technologies (https://tuit.uz/en/kompyuter-tizimlari). The USC comprises 958 different speakers with a total of 105 hours of transcribed audio recordings.

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[DOI] [Code] [Download] [Cite]

Russian Speech Corpus (OpenSTT-CS334)
The OpenSTT-CS334 is a manually re-transcribed 334-hour clean subset of the Russian OpenSTT (https://github.com/snakers4/open_stt). The dataset contains recordings only from the books and YouTube domain.

LICENCE: Creative Commons Attribution-NonCommercial 4.0 International License (https://creativecommons.org/licenses/by-nc/4.0/)

[DOI] [Code] [Download] [Cite]

Kazakh-accented English
The dataset consists of Kazakh-accented English recordings (~7.7 hours) extracted from the SpeakingFaces (https://doi.org/10.48333/smgd-yj77), i.e., native Kazakh speakers uttering English verbal commands given to virtual assistants and other smart devices, such as 'turn off the lights', 'play the next song', and so on.

LICENCE: Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0/)

[DOI] [Code] [Cite]

WiFine
A finer-level sequential dataset of WiFi received signal strengths (RSS). The dataset contains 290 trajectories collected across 3 floors of the C4 building of Nazarbayev University. The RSS values with corresponding position coordinates (x,y,z) are recorded around every 5 seconds.

LICENCE: Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0/)

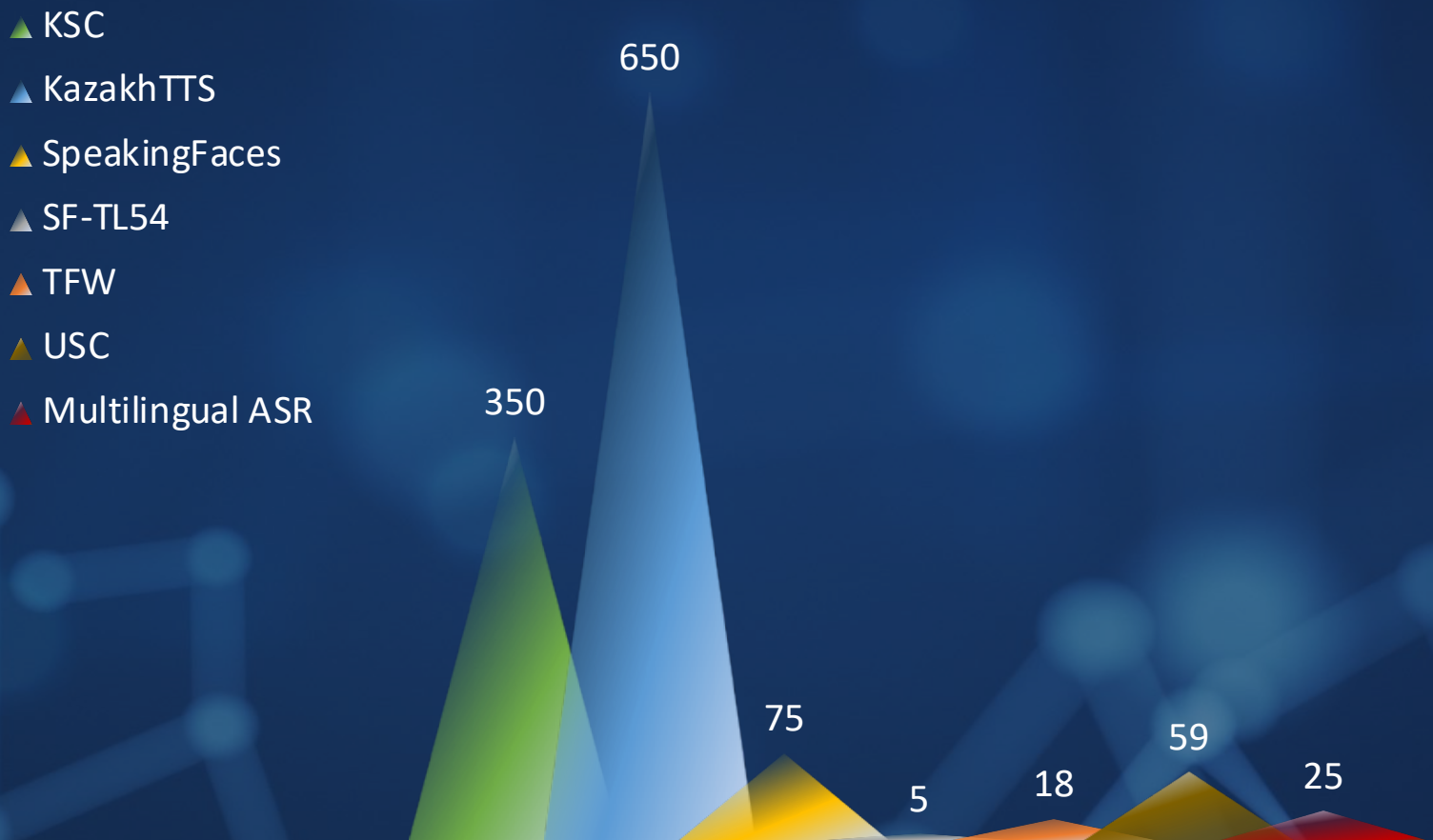**30**

[DOI] [Code] [Download]

IMUWiFine
A finer-level sequential dataset of IMU and WiFi received signal strengths (RSS). The dataset contains 120 trajectories covering an aggregate distance of over 14 kilometers. The dataset was collected across 3 floors of the C4 building of Nazarbayev University.

LICENCE: Creative Commons Attribution 4.0 International License (https://creativecommons.org/licenses/by/4.0/)

DATASETS: The number of downloads for each dataset

- 🔺 KSC
- 🔺 KazakhTTS
- 🔺 SpeakingFaces
- 🔺 SF-TL54
- 🔺 TFW
- 🔺 USC
- 🔺 Multilingual ASR

650

350

75

5

18

59

25

More than 60 local and international companies and educational organizations have downloaded ISSAI datasets.

The list includes affiliations like Kaspi Bank, BTS Digital, Beeline, Microsoft, Google inc, Satbayev University, Kazakh British Technical University, Astana IT University, Beijing Language and Culture University, Tianjing University, John Hopkins University, University of California Berkely, Facebook etc.

SATBAYEV UNIVERSITY

GITHUB STATISTICS

22 REPOSITORIES

TOP 6 MOST POULAR REPOSITORIES:

KazakhTTS

COVID-19-Simulator

ISSAI_SAIDA_Kazakh_ASR

SpeakingFaces

Chest-X-ray-module

Particle-Based-COVID19-Simulato

TOP LANGUAGES:

- Python
- Jupyter Notebook
- Shell
- JavaScript
- MATLAB

GITHUB SOFTWARE LIBRARY PUBLICATIONS

Github open-source models:

ISSAI shares the pre-trained AI models of its projects on ISSAI GitHub page. Anyone can download the models for free.

ISSAI GitHub: https://github.com/IS2AI

CONFERENCES

PARTICIPATION IN CONFERENCES

ISSAI participates in a number of local and international events. More information is available on ISSAI website:

16th February 2021 ISSAI participated in UNESCO webinar on "Managing AI"

1st April 2021 ISSAI participates in IRCAI AI UNESCO Center Launch

7th April 2021 ISSAI participated in the II Central Asia Nobel Fest 2021

23 April 2021 Kazakh Speech Corpus presented at the international conference EACL 2021

18th September 2021 ISSAI participated in the Virtual Symposium on Process Safety and Asset Integrity Management in the Digital Age

1st October 2021 ISSAI Postdoctoral Scholar Yerbolat Khassanov presented two research papers at SPECOM 2021

3rd November 2021 ISSAI participated at the UAE conference on "Creative Economy"

5th November 2021 ISSAI participated at 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society

5th November 2021 ISSAI team presented AI for Kazakh language projects at the Fifth Forum of Online Content Creators in Kazakh Language

6th December 2021 ISSAI researchers participated at the AUA-Universiti Malaya Overseas Study Program on Artificial Intelligence in Health Science

9th December 2021 ISSAI discusses the creation of national corpora for Kazakh at an international conference

9th December 2021 ISSAI Founding Director Professor Atakan Varol gives a speech at the Global Webinar Series on Artificial Intelligence, Explainability, and Trustworthiness in Financial Services

19th December 2021 2nd Asia Europe Foundation (ASEF) Higher Education Innovation Laboratory

12th January 2022 14th IEEE/SICE International Symposium on System Integration (SII 2022)

22nd January 2022 Global Young Scientists Summit 2022

PARTICIPATION IN CONFERENCES

ISSAI participated in UNESCO webinar on "Managing AI"

On 15th February 2021, ISSAI participated in a UNESCO webinar on managing AI. UNESCO published the report "Managing Artificial Intelligence and Advanced ICTs for Knowledge-based Societies", which was translated into Russian in 2020.

Various stakeholders were invited to discuss the use of AI in various sectors of the CIS region to explore the possibilities of applying international standards in the areas of good governance, justice, education, culture, science, as well as communication and information.
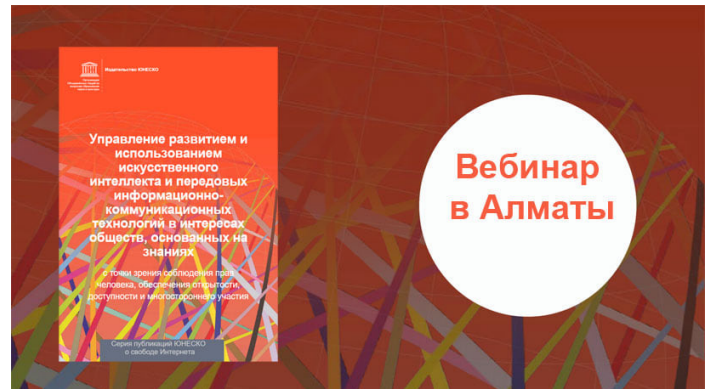
ISSAI participated in IRCAI AI UNESCO Center Launch

On 29 and 30 March 2021, ISSAI members participated in the official launch of the International Research Center on Artificial Intelligence (IRCAI) in the form of a virtual conference. The conference was organized by the Government of the Republic of Slovenia and UNESCO.

The main information and goals of the IRCAI were announced—namely the development of artificial intelligence-based tools, products and services to help UNESCO member states meet the sustainable development goals and make AI fair, transparent, and ethical.

ISSAI participated in the II Central Asia Nobel Fest 2021

On 7th April, ISSAI Technical Project Coordinator Yerbol Absalyamov participated in the Central Asia Nobel Fest 2021 as a moderator of the session *The Birth of Industry 5.0: Artificial Intelligence and Humans.*

Speakers at the session were Kevin Warwick, British engineer and Deputy Vice-Chancellor at Coventry University in the UK, Visiting Professor of Cybernetics at the University of Reading, Michael Bronstein, Head of Graph ML at Twitter, Chair in ML and Pattern Recognition, Imperial College London.


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PARTICIPATION IN CONFERENCES

Kazakh Speech Corpus presented at the international conference EACL 2021

ISSAI postdoctoral scholar Yerbolat Khassanov participated in the 16th conference of the European Chapter of the Association for Computational Linguistics (EACL) 19–23 April, 2021.

EACL is a flagship European conference in the field of computational linguistics. Dr. Khassanov presented ISSAI's recent paper "A Crowdsourced Open-Source Kazakh Speech Corpus and Initial Speech Recognition Baseline".
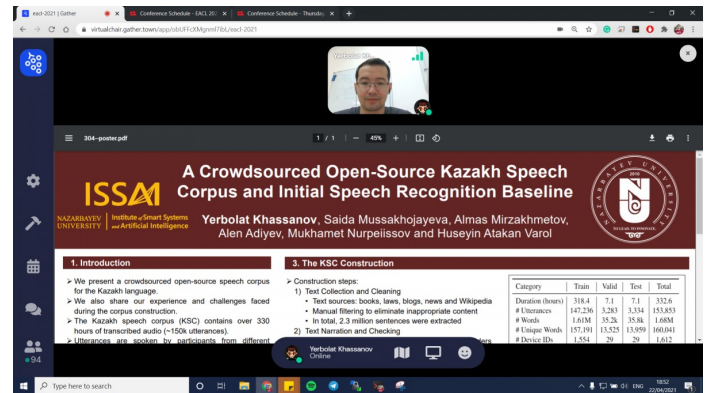
ISSAI participated in the Virtual Symposium on Process Safety and Asset Integrity Management in the Digital Age

On 16 and 17 September 2021, the ISSAI team participated in the Virtual Symposium on Process Safety and Asset Integrity Management in the Digital Age. This symposium was organized by the TU Delft Safety & Security Institute and the Department of Chemical Engineering at Tsinghua University.


The aim of this symposium was to bring researchers and practitioners together to share knowledge and identify and create new opportunities for collaboration in research on process safety and asset integrity management in the digital age.

ISSAI Postdoctoral Scholar Yerbolat Khassanov presented two research papers at SPECOM 2021

ISSAI postdoctoral scholar Yerbolat Khassanov presented two papers at the 23rd International Conference on Speech and Computer. The event was held on 27-30th September 2021 and was hosted by the St. Petersburg Federal Research Center of the Russian Academy of Sciences and Moscow State Linguistic University.

Dr. Khassanov presented the papers "A Study of Multilingual End-to-End Speech Recognition for Kazakh, Russian, and English" and "USC: An Open-Source Uzbek Speech Corpus and Initial Speech Recognition Experiments".
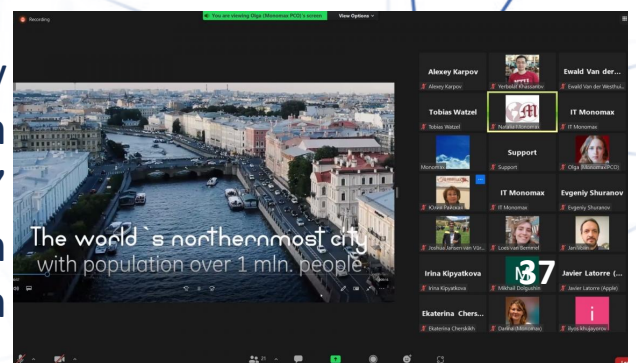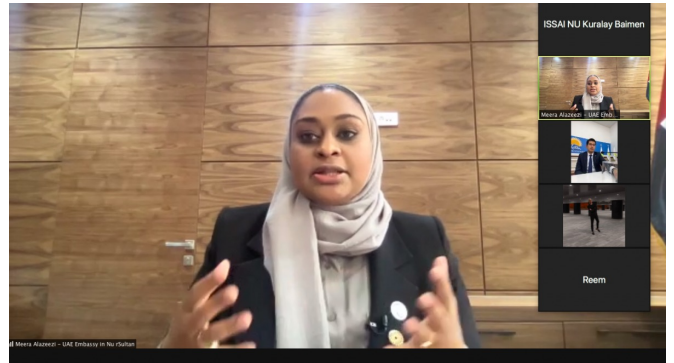
PARTICIPATION IN CONFERENCES

## ISSAI participated in the UAE conference on "Creative Economy"

ISSAI members participated in an online conference hosted by the Embassy of the United Arab Emirates in the Republic of Kazakhstan on 3rd November, 2021.

UAE Embassy diplomats spoke on the topic of creative economy and the measures taken by the UAE government to stimulate this sector. The presentation was given by Ms. Meera Alazizi, Head of the Economic, Political and Media Affairs Department.

ISSAI participated in the 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society

From 30th October to 5th November, the IEEE Engineering in Medicine and Biology Society virtually hosted the 43rd Annual International Conference. The event is widely regarded as the world's largest international conference on biomedical engineering.
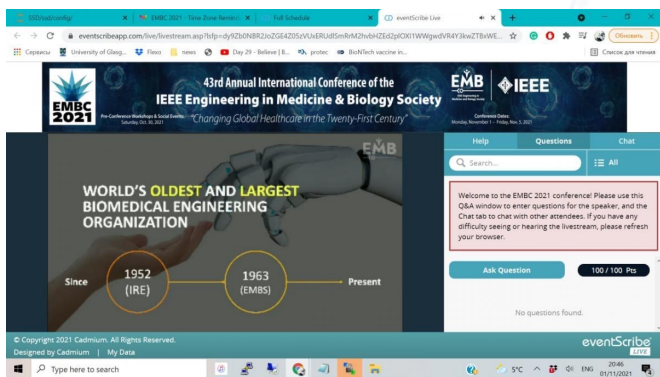
ISSAI data scientist Aknur Karabay presented two papers: *Input Agnostic Deep Learning for Alzheimer's Disease Classification Using Multimodal MRI Images*, and *COVID-19 Vaccination Strategies Considering Hesitancy Using Particle-Based Epidemic Simulator.*

The ISSAI team presented AI for Kazakh language projects at the Fifth Forum of Online Content Creators in the Kazakh Language

Dr. Yerbolat Khassanov and Kuralay Baimenova participated in the Fifth Forum of Online Content Creators in the Kazakh Language, held at the Sheraton Hotel, Nur-Sultan, Kazakhstan. The event was initiated by the US Embassy in Kazakhstan and was held in honor of the 30th anniversary of the establishment of diplomatic relations between Kazakhstan and the United States. As the premier AI research institute in the region, ISSAI was invited to give a presentation of its AI projects for the Kazakh language. The presentation was attended by Minister of Digitalization and Airspace Development Bagdat Mussin, blogger Alisher Yelikbayev, and other prominent figures.

PARTICIPATION IN CONFERENCES

## ISSAI discussed the creation of national corpora for Kazakh at an international conference

On December 8, 2021, ISSAI attended the international scientific and theoretical conference "Lessons of Independence: the past, present, and future of Kazakh linguistics", hosted by the Institute of Linguistics named after Akhmet Baitursynuly.
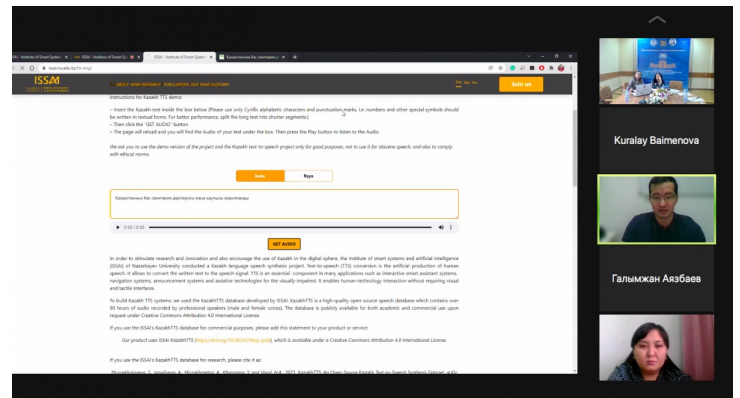
The conference, whose main theme was "The experience of creating national corpora", was held to mark the Institute's 60th anniversary and welcomed participants from Kazakhstan and abroad. ISSAI was represented at the conference by Dr Yerbolat Khassanov, Kuralay Baimenova, and Rustem Yeshpanov. Under a time constraint of 15 minutes, Dr Khassanov was able not only to present ISSAI's Kazakh language-related projects and future plans to expand them, but also to demonstrate their applicability in practice. Dr Khassanov's professional delivery of the presentation received positive appraisals from the conference participants. The organizers of the event expressed their willingness to cooperate with ISSAI in the development of a Kazakh parallel corpus in the future.

ISSAI researchers participated in the AUA-Universiti Malaya Overseas Study Program on Artificial Intelligence in Health Science

Members of the Faculty of Engineering at the University of Malaya organized the AUA-Universiti Malaya Overseas Study Program on AI in Health Science webinar on 1–3 December, 2021.
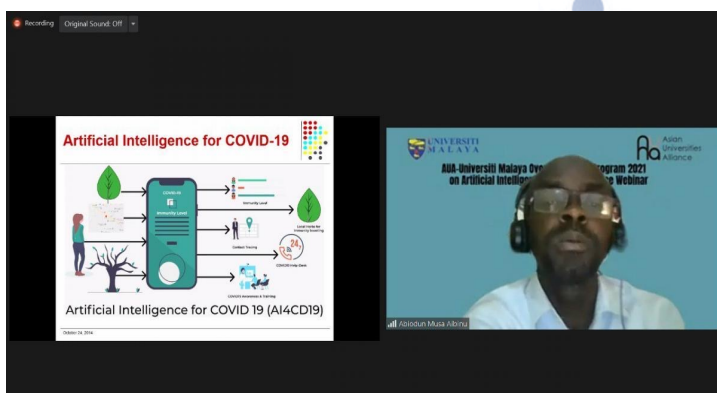

ISSAI researchers Zhanat Makhataeva and Tolegen Akhmetov participated as audience members and attended webinar sessions on AI-driven medical applications, the application of machine learning techniques in health science, recent advances in biomedical image processing, and computational intelligence in healthcare analytics etc.

PARTICIPATION IN CONFERENCES

ISSAI Founding Director Prof. Atakan Varol gave a speech at the Global Webinar Series on Artificial Intelligence, Explainability, and Trustworthiness in Financial Services

The fifth in the series of global webinars held this year by the World Alliance of International Financial Centers (WAIFC), World Economic Forum (WEF) and NVIDIA, the webinar began with the introductory speeches of the organizers. This time, the event focused on Russia and the Commonwealth of Independent States and the potential and application bandwidth of artificial intelligence in the financial ecosystem of the region.

The founding director of the Institute of Smart Systems and Artificial Intelligence, Professor Atakan Varol, represented academia in the webinar. Professor Varol spoke about the mission of ISSAI, gave a detailed overview of the Institute's projects in general and those related to natural language processing in particular.
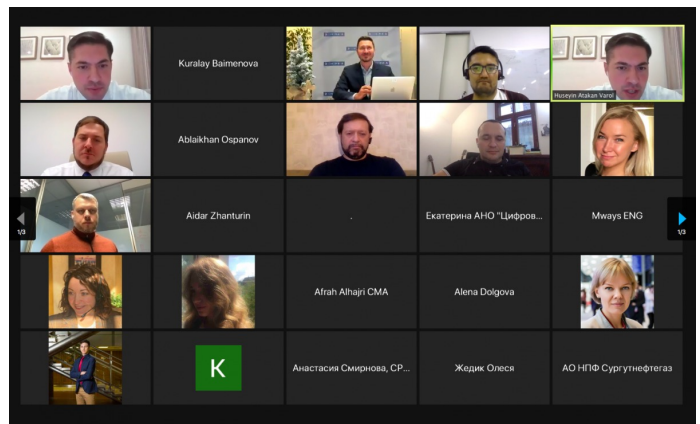

The professor also emphasized the readiness of the Institute to cooperate with national and international partners in education, industry, and government.

2nd Asia Europe Foundation (ASEF) Higher Education Innovation Laboratory

ISSAI Technical Project Coordinator Yerbol Absalyamov participated in the 2nd Asia Europe Foundation (ASEF) Higher Education Innovation Laboratory, known as ASEFInnoLab2, held online from November 4 to December 9, 2021. The program focused on the role of universities in AI innovation ecosystems.

ASEFInnoLab2 offered the participants the opportunity to share best practices, develop new ideas, and explore areas for collaboration on the following two themes:

- Teaching and Entrepreneurship for AI Innovation Ecosystems
- Research and Technology Transfer in AI Innovation Ecosystems.

40
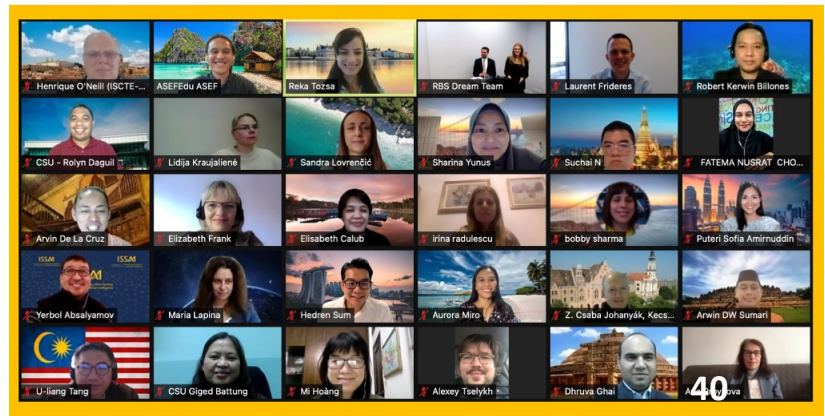
PARTICIPATION IN CONFERENCES

## 14th IEEE/SICE International Symposium on System Integration (SII 2022)

ISSAI participated in the 14th IEEE/SICE International Symposium on System Integration (SII 2022), which was held online on 9–12 January, 2022. At the symposium, ISSAI data scientist Askat Kuzdeuov presented two papers: *SF-TL54: A Thermal Facial Landmark Dataset with Visual Pairs* and *End-To-End Sequential Indoor Localization Using Smartphone Inertial Sensors and WiFi*.

IEEE/SICE SII is the premier symposium series presenting the state of the art and future prospects for system integration. Keynote speakers at the symposium included Prof. Yasuhisa Hirata, a professor in the Department of Robotics at Tohoku University, Sendai, Japan, and Prof. Minna Lanz, a professor of mechanical engineering at Tampere University, Finland.
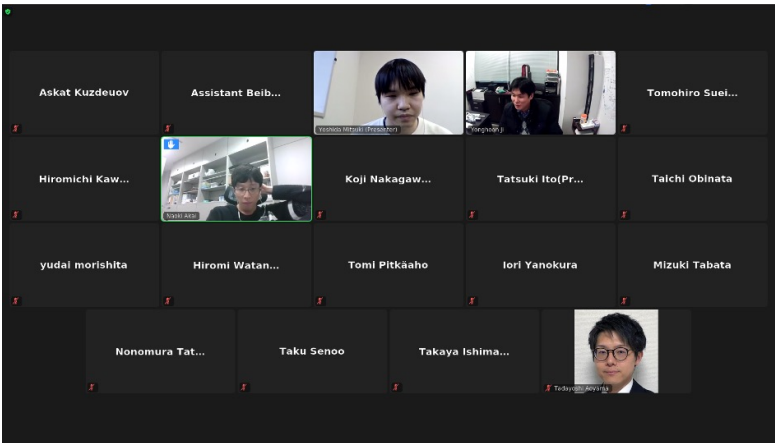
Global Young Scientists Summit 2022

ISSAI researcher Zhanat Makhataeva participated in the Global Young Scientists Summit 2022 (GYSS2022) from 17th to 21st January, 2022. GYSS2022 brought together bright young researchers and top experts to discuss scientific and technological trends and how research can address important global challenges.
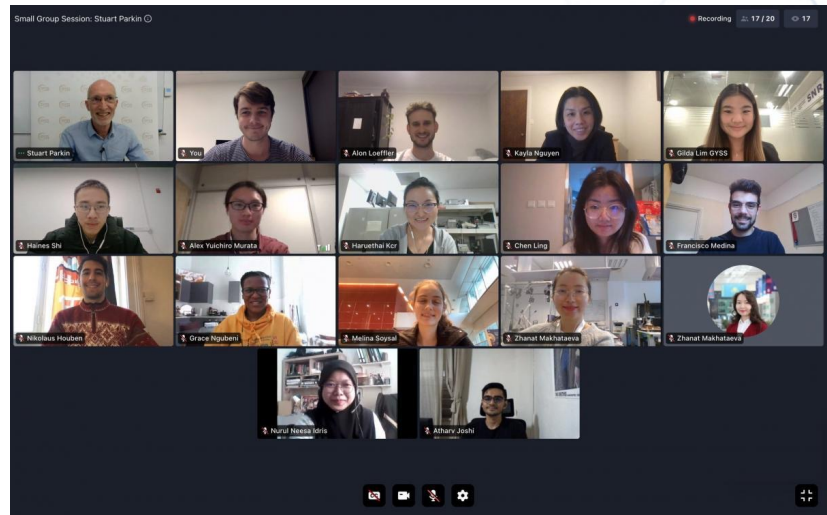
During the networking sessions, Zhanat had a chance to talk to many outstanding young scientists from all over the world. She introduced herself and shared her research experiences in ISSAI and ARMS labs.

The networking sessions provided an opportunity to share experiences and exchange advice and thoughts on managing PhD studies during the pandemic. Summit speakers included recipients of the Nobel Prize, Fields Medal, Millennium Technology Prize, and Turing Award.
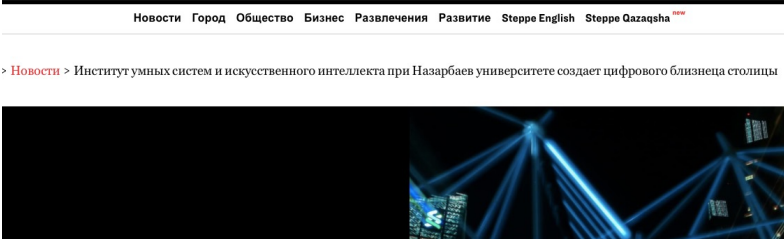
MEDIA

MEDIA COVERAGE

Several local and international media portals issued press releases about ISSAI projects.

Some of these media outlets are: IrishTechNews, Pharmiweb.com, EPM magazine, Khabar TV, Elorda Info, AINews, Today.kz, Tengrinews, Steppe.
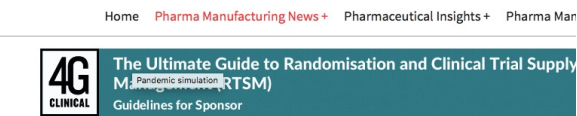

AKNUR KARABAY APPEARS ON THIS EPISODE OF THE IRISH TECH NEWS PODCAST

RONAN LEONARD × MAY 25, 2020

APPLICATIONS   ASIA   COVID-19   CUTTING EDGE   FUTURE TRENDS   INNOVATION   INTERVIEWS   PODCAST   UNIVERSITIES
WOMEN IN TECH   WORLD NEWS

Simulators are now an important tool in the fight against COVID-19 and The Institute of Smart Systems and Artificial Intelligence at Nazarbayev University in Kazakhstan have developed a very accurate simulator.

They have decided to release the source code online so that anyone can use it and Ronan talks to Aknur Karabay who is one of their researchers. Aknur explains how the simulator was created, the four simulation scenarios they ran when testing it, why they released its source code online and where you can find it.

Aknur Karabay on Irish Tech News Podcast

Big data could be key to tracking Covid-19 and easing lockdown, simulator suggests

20 APRIL 2020 09:05

Scientists in Kazakhstan have created a simulator to predict the impact of policies on the spread of Covid-19.

YOUTUBE STATISTICS

602 SUBSCRIBERS

109 EDUCATIONAL VIDEOS

868 hr WATCH TIME

28 600 VIEWS

1:49 AVERAGE VIEW DURATION

TOP 5 VIDEOS:

- Machine Learning Basics: Ensemble Learning
- Introducing the Kazakh Speech Corpus
- Машиналық оқыту негіздері: Оқыту түрлері
- Симулятор COVID-19 на основе частиц
- Машиналық оқыту негіздері: KNN

GENDER

FEMALE	30.4%
MALE	69.6%

AGE

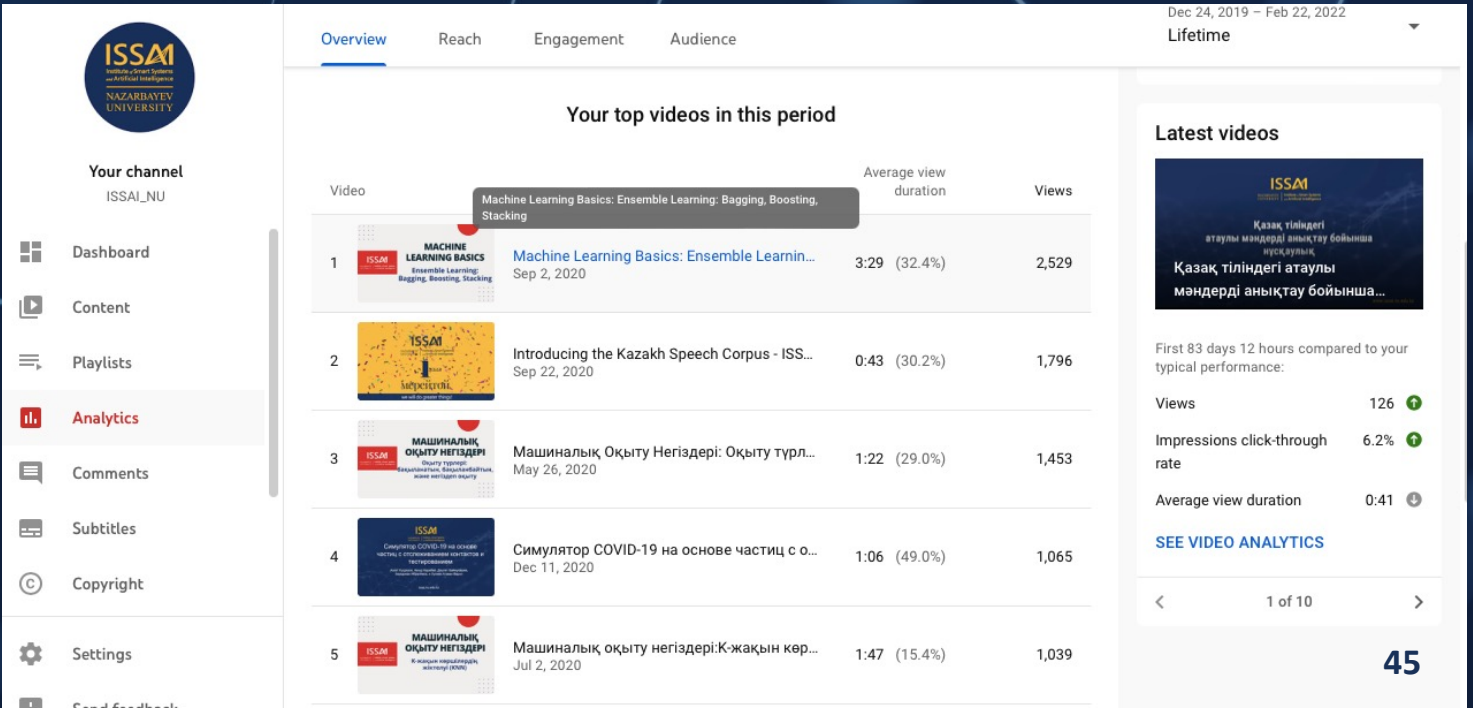|	
13-17 years	2.9%
18-24 years	36.2%
25-34 years	33.3%
35-44 years	24.1%
45-54 years	3.6%
55-64 years	0%
65+ years	0%

YOUTUBE PUBLICATIONS

Another goal of ISSAI is to share its knowledge in the field of machine learning and artificial intelligence with the public. Therefore, from spring 2020, ISSAI Youtube channel was launched where ISSAI hosts various videos and presentations as an educational resource in English and Kazakh.

ISSAI Youtube channel hosts more than 100 videos/ presentations about machine learning and artificial intelligence.
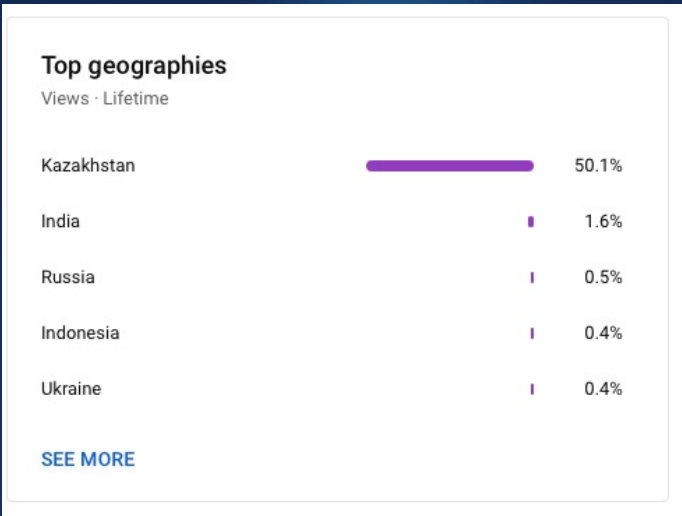
Traffic source types:
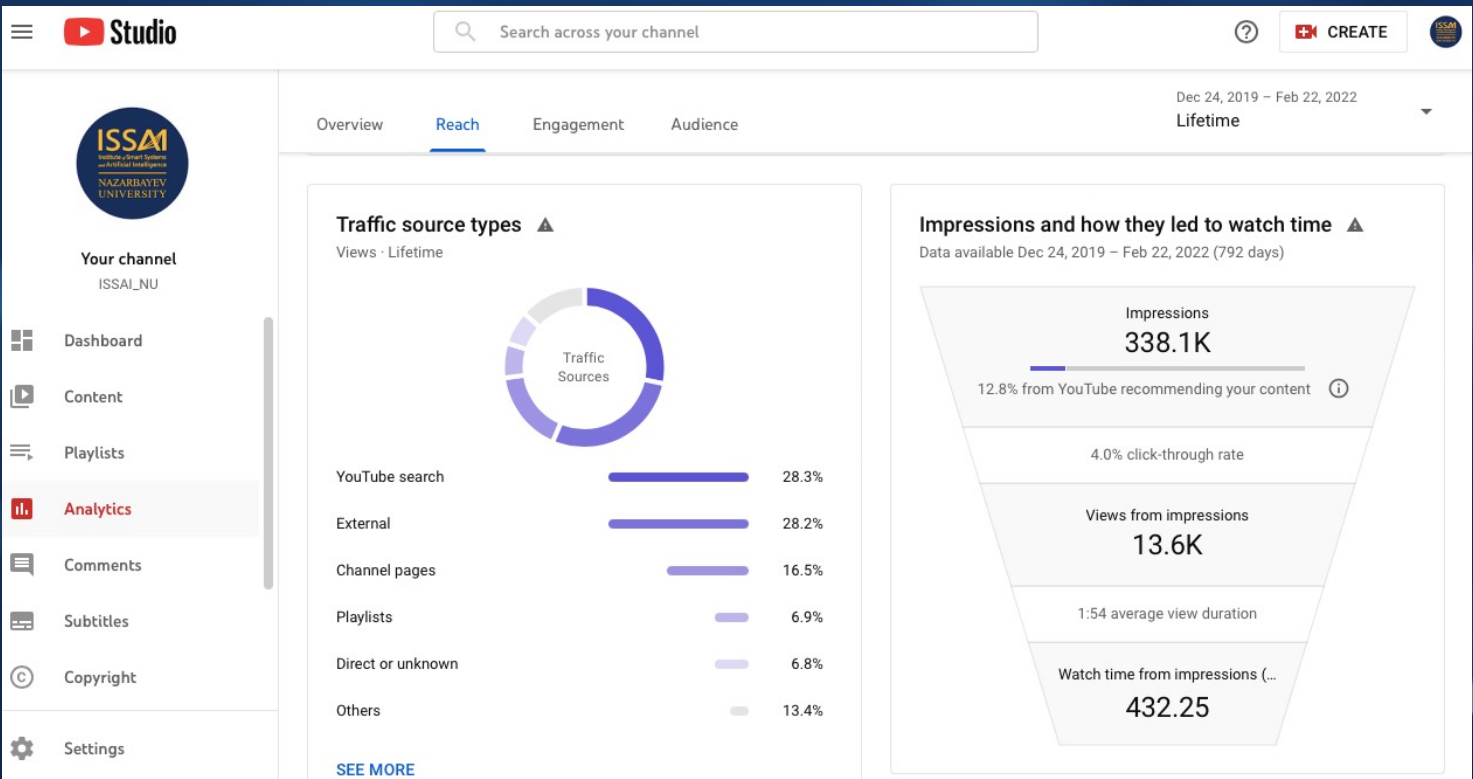
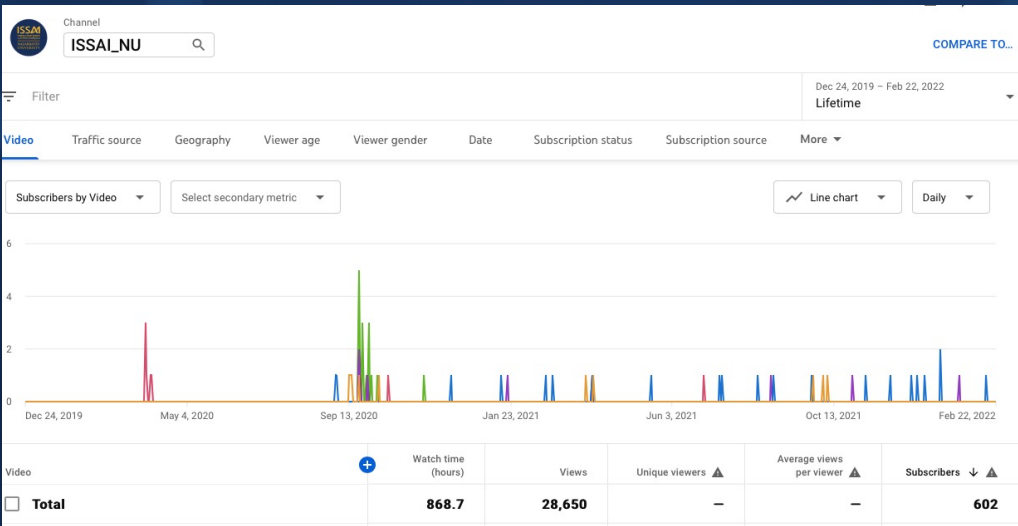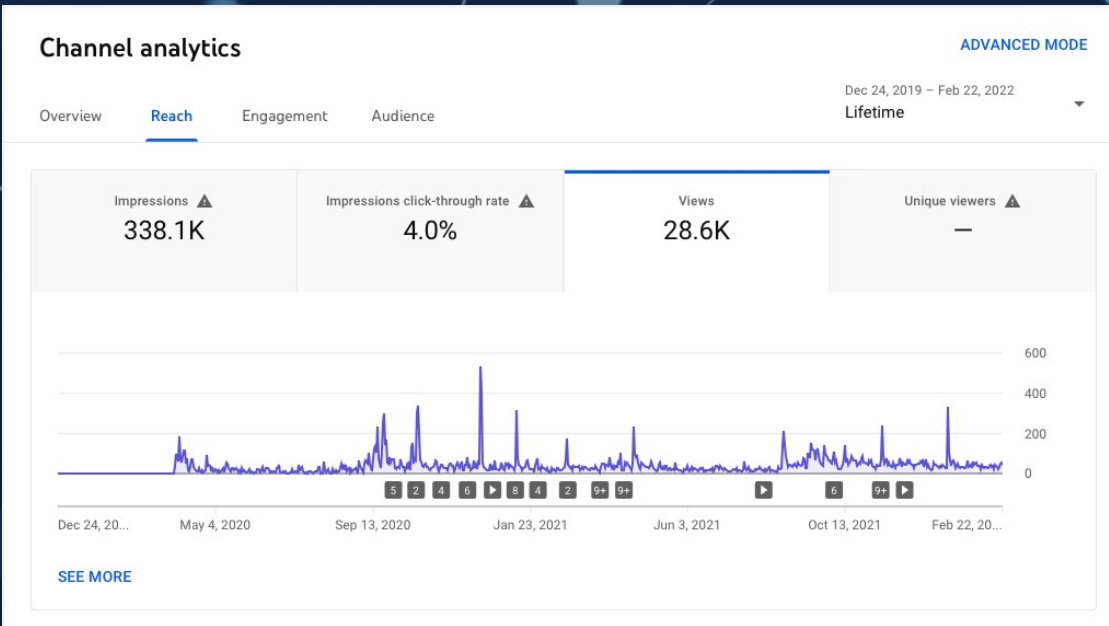## Top videos in this period:

YOUTUBE PUBLICATIONS

Top countries:

Top geographies
Views · Lifetime

Kazakhstan	50.1%
India	1.6%
Russia	0.5%
Indonesia	0.4%
Ukraine	0.4%

SEE MORE

Age and gender:

Age and gender
Views · Lifetime

Female	30.4%
Male	69.6%
User-specified	0%

13–17 years	2.9%
18–24 years	36.2%
25–34 years	33.3%
35–44 years	24.1%
45–54 years	3.6%
55–64 years	0%
65+ years	0%

SEE MORE

Number of subscribers:

Channel
ISSAI_NU   COMPARE TO...

Filter   Dec 24, 2019 – Feb 22, 2022
                                          Lifetime

Video   Traffic source   Geography   Viewer age   Viewer gender   Date   Subscription status   Subscription source   More ▾

Subscribers by Video ▾   Select secondary metric ▾   Line chart ▾   Daily ▾

Video		Watch time (hours)	Views	Unique viewers ▲	Average views per viewer ▲	Subscribers ↓ ▲
Total		868.7	28,650	—	—	602

Number of views:

Channel analytics   ADVANCED MODE

Overview   Reach   Engagement   Audience   Dec 24, 2019 – Feb 22, 2022
                                                       Lifetime

Impressions ▲	Impressions click-through rate ▲	Views	Unique viewers ▲
338.1K	4.0%	28.6K	—

SEE MORE

ORGANIZED
EVENTS

ORGANIZED EVENTS BY ISSAI

Deep Learning Workshop for the National Guard

Former ISSAI data scientist Mukhamet Nurpeiisov held a workshop on deep learning for the National Guard of the Republic of Kazakhstan.

The workshop included a general overview of deep learning and its use cases. In addition, Mukhamet gave a tutorial on how to create a deep learning model for face detection. He showed how to create a dataset and how important it is for the work. They also trained and tested the face detection model.
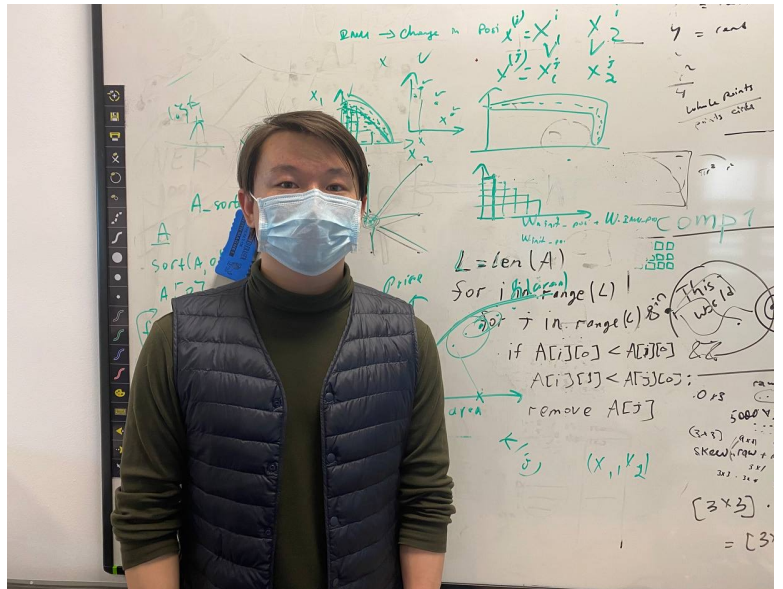
AI workshop for the State Revenues Committee

In March 2021, ISSAI members visited the State Revenues Committee of the Ministry of Finance of the Republic of Kazakhstan.

ISSAI data scientist Mukhamet Nurpeiisov gave a presentation to the Department's workers on the basics of AI and how machine learning algorithms help to solve problems and questions. In addition, Mukhamet emphasized the importance of having enough high quality data to to train machine learning models.

General information about ISSAI's work and projects was also provided.

ORGANIZED EVENTS BY ISSAI

"Science of Digital Transformation" webinar with UIUC

On 13 April, 2001, ISSAI hosted the webinar "Science of Digital Transformation" in collaboration with the University of Illinois Urbana-Champaign. The speakers for the webinar were Professor R. Srikant, Fredric G. and Elizabeth H. Nearing, Endowed Professor of ECE and a Research Professor in the Coordinated Science Lab at UIUC, one of the two co-directors of the C3.ai Digital Transformation Institute.

Professor Srikant also spoke about other examples of using AI and ML to promote digital transformation, such as autonomous driving and using virtual reality for distance learning. The webinar had more than 250 registered participants.
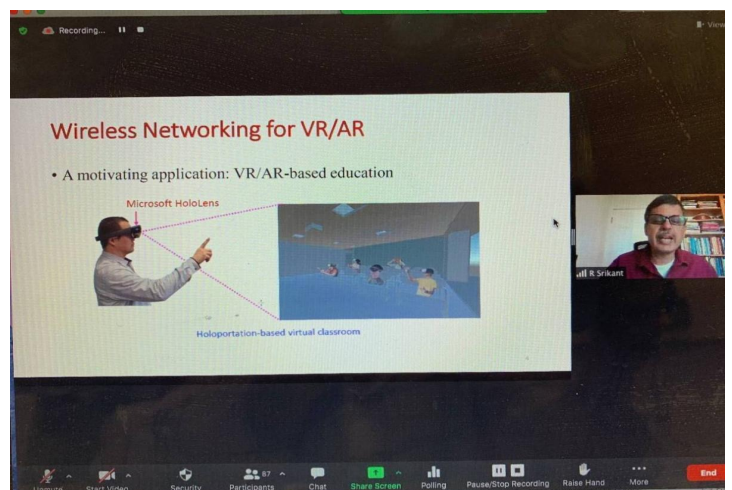
AUA-NU Overseas Study Program 2021

The ISSAI team delivered a series of lectures to the students of the Asian Universities Alliance (AUA) on June 24 and 25, 2021. The lecture series was part of the AUA-NU Overseas Study Program 2021, which aimed to provide participants with the key concepts of data science and artificial intelligence organized by a joint initiative of AUA and Nazarbayev University.

The participants were distinguished students from AUA member universities. The program was targeted at UG students studying computer science, computer engineering and data science.
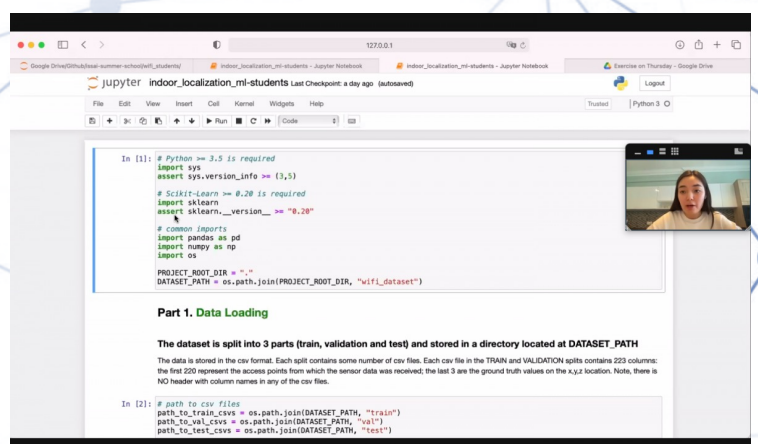
Students were required to have a strong grasp of calculus, probability, linear algebra, and programming in Python. The closing ceremony was honored by NU Provost Ilesanmi Adesida. Provost Adesida emphasized the importance of AI and data science and announced the winners of the competition.

ORGANIZED EVENTS BY ISSAI

NU ISSAI organized the panel session "Artificial Intelligence Education: How to train the future AI workforce for research and innovation?" at EXPO 2020 Dubai

On December 14, 2021, ISSAI was invited by NC "QazExpoCongress" to organize a panel discussion on "Artificial Intelligence Education: How to train the future AI workforce for research and innovation?". The event was held at the National Pavilion of the Republic of Kazakhstan at EXPO 2020 Dubai as part of the 30th anniversary of the Independence of the Republic of Kazakhstan. The session was held both in person and online.

In the first part of the event, ISSAI Founding Director Dr. Atakan Varol presented ISSAI's research projects and shared the Institute's expertise in the fields of Data Science, Smart Systems and AI.

The presentation was followed by a panel discussion moderated by Dr. Vassilios Tourassis, Dean of the Nazarbayev University School of Engineering and Digital Sciences. The distinguished panel of AI experts included Dr. Taieb Znati, Professor and Dean of the College of Information Technology, United Arab Emirates University (UAEU), Dr. Shadab Khan, Head of AI and Applied Sciences, G42, Artur Saudabayev, Co-founder and Chief Technical Officer of Causaly Inc., and Bauyrzhan Aubakir, Director of Analytics and Data Science Department, "First Heartland Jusan Bank".

The speakers talked about the essential skills and knowledge necessary for tomorrow's AI leaders, the importance of a systemic approach to AI ecosystem development, and the significance of soft skills and humanities skills, as well as the readiness to constantly adapt your knowledge to keep up with the latest trends.

ISSAI PEOPLE

ISSAI PEOPLE

Atakan Varol
Director

Yerbolat Khassanov
Post-Doctoral Scholar

Yerbol Absalyamov
Technical Project
Coordinator

Askat Kuzdeuov
Data Scientist

Aknur Karabay
Research assistant

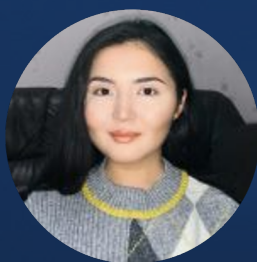**Makat Tileubaliyev**
Computer Engineer

Almas Myrzakhmetov
Computer Engineer

Kuralay Baimenova
Senior PR manager

Madina Abdrakhmanova
Data Scientist

Saida Mussakhodjayeva
Data Scientist

Gibrat Kurmanov
Administrative manager

Zhaniya Koishibayeva
Research assistant

Raushan Utemuratova
Research assistant

Rustem Yeshpanov
Research assistant

Alen Adiyev
Research assistant

Beket Myrzanov
Research assistant

Ulzhan Bissarinova
Research assistant

Assanali Aidarkhan
Research assistant

Tomiris Rakhimzhanova
Research assistant

ISSAI PEOPLE

56

30

20

■ RAs   ■ Students   ■ Full-time
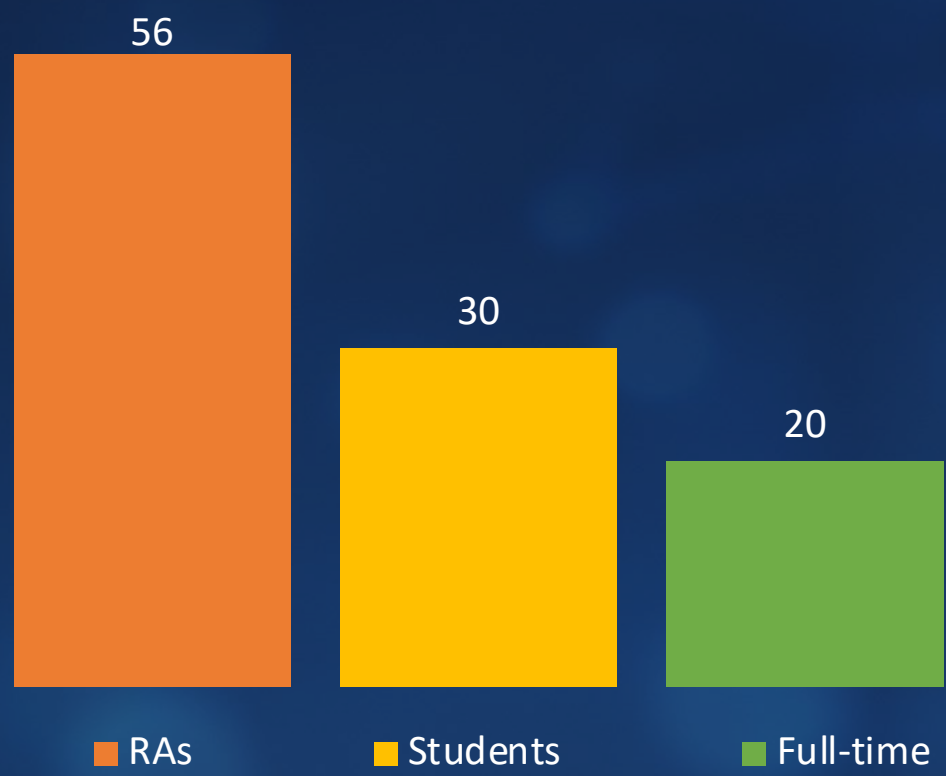
In 2021, about 86 research assistants were hired and involved in the research works and activities as part-time employees. Of these, 30 were university students. Twenty of the workers were full-time employees.

DIVERSITY

ISSAI strives to be a diverse community providing opportunities for everyone and encouraging and supporting women in technical ideas. Currently (as of February 2022) 9 of the 22 ISSAI team members are female. Throughout the Institute's history, there have been 49 female members.

The number of research assistants by quarter

(some research assistants may have worked for more than one quarter)
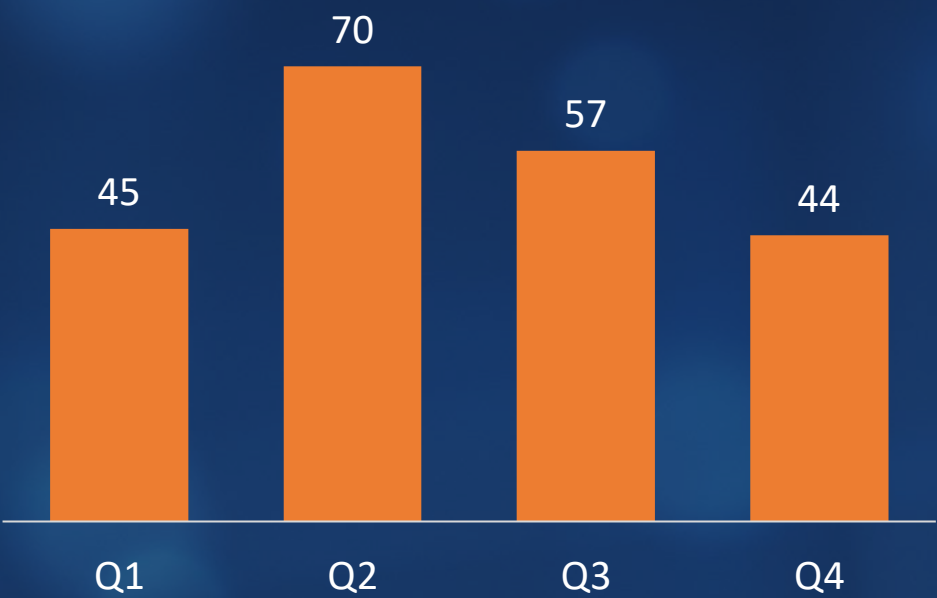
The number of research assistants by degree type
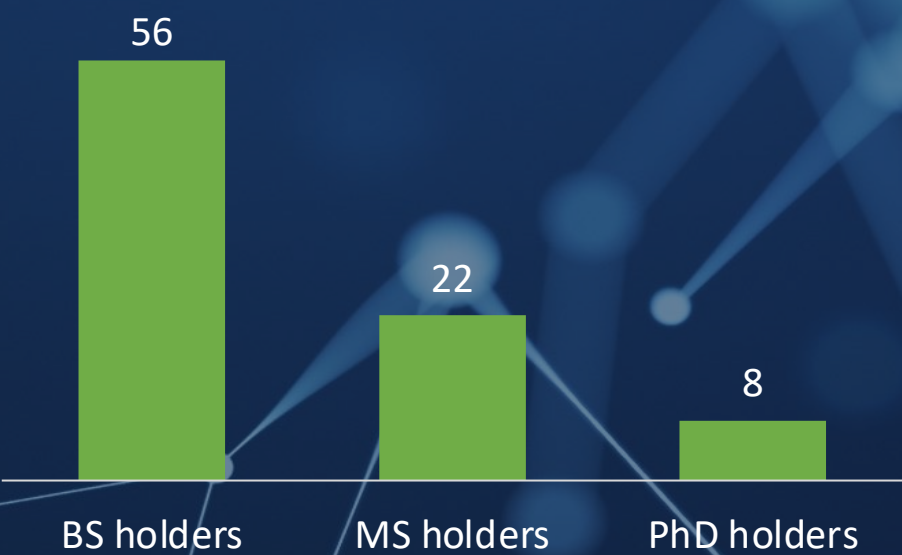
The number of research assistants by affiliation
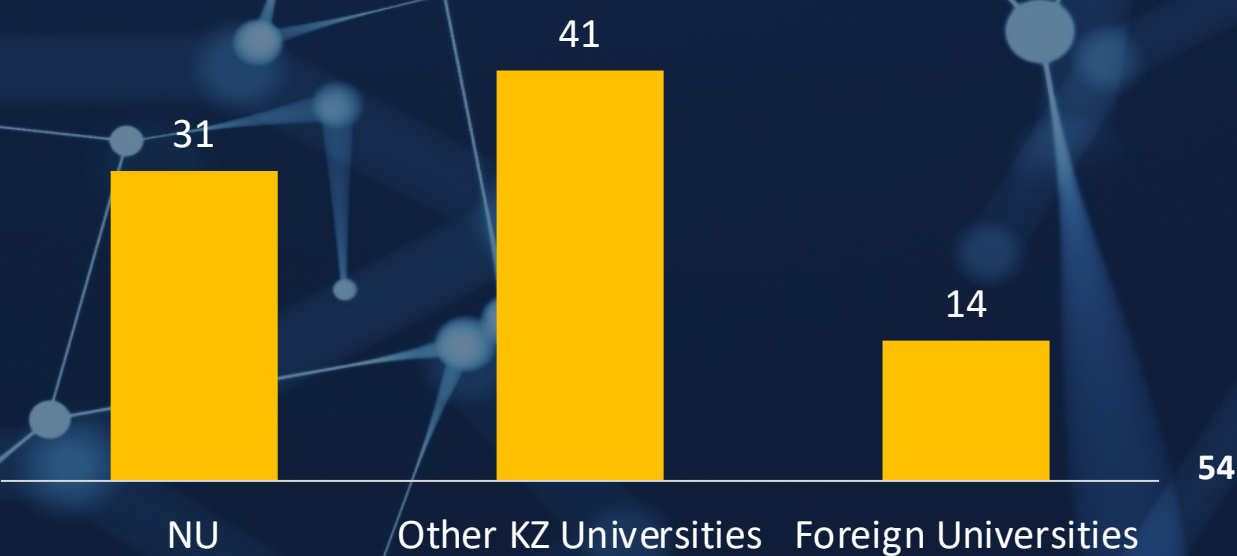
OPPORTUNITIES FOR STUDENTS

Opportunities for summer internship:

ISSAI invites undergraduate and graduate students from diverse academic backgrounds to complete an internship. An intern works alongside data scientists and post-doctoral researchers on ISSAI projects and gains first-hand experience with state-of-the-art computational facilities. Internships can be completed on either a paid or unpaid (possibly credit-bearing) basis, depending on the applicant's educational background and skills. The average duration of an internship is six to eight weeks; the minimum duration of an internship is one month. Applicants go through a recruitment procedure including interview.

Opportunities for visiting researchers:

ISSAI welcomes individuals with backgrounds in computer science, data science, applied mathematics, robotics or related fields to join ISSAI as visiting researchers. As a visiting researcher, one will have the opportunity to work on cutting-edge projects, co-author impactful publications, gain experience in data science and AI, learn how to use advanced AI servers, and enjoy the vibrant academic environment of Nazarbayev University. The position is remunerated based on the highest academic degree gained; the minimum duration of stay is three months.

OPPORTUNITIES FOR STUDENTS

In the summer of 2021, ISSAI provided students from different Kazakhstani and foreign universities the opportunity to enroll in a special summer research program (SRP). The main goal was to give students the opportunity to gain hands-on experience working on the Institute's AI projects, acquire knowledge and skills in the field of AI, and widen their real-life experience working with ISSAI data scientists.

Students from various universities applied to the SRP. To be admitted, applicants had to go through the selection process. Students with the best academic achievements were then selected. The SRP lasted two months, from the end of May to the end of July 2021.

Each SRP participant was assigned a supervisor or a mentor from the team of ISSAI data scientist.

The supervisors explained to SRP participants the project they were working on together, shared their knowledge, offered participants the opportunity to work on real-life AI projects, and guided them along the way.

All SRP participants were very happy with the results of the program. At the end, they were presented with certificates of completion.

COMPUTATIONAL
RESOURCES

COMPUTATIONAL RESOURCES

In 2020, ISSAI received two NVIDIA DGX-2 servers. The server type specializes in general-purpose computing on graphics processing units (GPGPU) to accelerate deep learning applications. It is considered the world's fastest workstation for high-level AI development. These systems have become the de facto standard for AI research.

In 2022, ISSAI has upgraded its computational resources, by installing NVIDIA DGX A100 systems in ISSAI labs at Nazarbayev University (NU). Due to the increasing number of research projects conducted by ISSAI and the demand for servers by the NU research community, the capacity of the previous NVIDIA DGX-1 and DGX-2 servers was no longer sufficient.

Therefore, the NU management decided to expand the computational resources, by installing four NVIDIA DGX A100 servers. For instance, the University of Florida has 140 DGX A100 supercomputers, Cambridge University has 80 DGX A100 servers, and TU Dresden has 272 A100 supercomputers.

The ISSAI research team was the first to operationalize DGX systems in Kazakhstan and has garnered substantial know-how and expertise in the use of these systems. ISSAI's growing deep computation capacity enables NU faculty members to intensify their research efforts in AI.

COOPERATION

PRESENTATIONS TO OFFICIALS

ISSAI participates in a number of local and international events (online and offline) and receives official delegations and visits from various organizations.

Chairman of the Kazakhstan's Science Committee visits ISSAI

On May 4, 2021, Chairman of the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan Zhanna Kurmangaliyeva visited ISSAI labs.

During the visit, ISSAI technical project coordinator Yerbol Absalyamov presented ISSAI projects, and postdoctoral scholar Yerbolat Khassanov demonstrated demo versions of the automated Kazakh speech recognition system and the Kazakh language text-to-speech project.

ISSAI visited by Jusan Bank Senior Management

On June 19, 2021, Prof. Atakan Varol participated in the "Jusan Club Meeting", held at Nazarbayev University. The program of the event included a welcome speech by President of Nazarbayev University Shigeo Katsu, Deputy Chairman of the Board of Directors of Jusan Bank Yerbol Orynbayev, and a series of presentations on the development of Jusan Bank. The participants visited ISSAI labs, where the Institute's technical project coordinator Yerbol Absalyamov gave a presentation on ISSAI's projects and achievements.

PRESENTATIONS TO OFFICIALS

Chairman of the Milli Majlis of Azerbaijan visited ISSAI

The Chairman of the Milli Majlis of Azerbaijan Sagiba Gafarova visited ISSAI as part of her official visit to the Republic of Kazakhstan.

During the visit, ISSAI postdoctoral scholar Yerbolat Khassanov and technical project coordinator Yerbol Absalyamov presented ISSAI research projects and achievements. One of ISSAI's projects presented was the AI-related voice technology for the Kazakh language, which helps to foster the use of the Kazakh language in the digital world. In addition, PhD student Zhanat Makhataeva presented the projects of ARMS Lab on augmented reality and tensegrity robotics.

International journalists visited ISSAI

On October 11, 2021, journalists from the United Kingdom visited NU ISSAI labs. The visit took place within the framework of the 30th anniversary of the Independence of the Republic of Kazakhstan.

During the visit, ISSAI technical project coordinator Yerbol Absalyamov and ISSAI postdoctoral scholar Yerbolat Khassanov gave a presentation on ISSAI's projects and showed demos of the Kazakh Automated Speech Recognition and Kazakh Text-to-Speech projects.

After that, researcher Zhanat Makhataeva presented her project on augmented reality. Later, PhD student Azamat presented a project on tensegrity robotics. The visitors publish articles in various British and European journals and magazines related to technologies, business, and finance.

INTERNATIONAL ORGANIZATIONS

ISSAI is a member of the International Telecommunications Union, IEEE and DataCite.

The International Telecommunication Union (ITU) is the specialized United Nations Agency for ICT services and technologies promotion, collaboration, and standardization.

ISSAI researchers are members of the Institute of Electrical and Electronics Engineers (IEEE), the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity.

DataCite is a leading global non-profit organization that provides persistent identifiers (DOIs) for research outputs. With the help of DataCite, organizations assign DOIs to their research works. Since August 2020, ISSAI has been a certified repository with the right to assign up to 100 DOIs.

ISSAI also collaborates scientifically with leading universities (e.g., ETH Zurich and Sorbonne University).

In 2022, ISSAI will also seek to establish scientific and research collaboration with Kazakhstani universities and laboratories.

AI ETHICS

Artificial Intelligence (AI) has emerged as a breakthrough technology of the 21st century, with impactful applications ranging from medical diagnostics and treatment to autonomous systems that gather data through sensor networks and "learn" from experience. Cognizant of Voltaire's admonition that with great power comes great responsibility, and further recognizing the myriad moral and ethical challenges associated with AI applications, ISSAI operates in accordance with the following ethical principles:

1. Societal Well-Being – sometimes described as "AI for Good", AI systems should prioritize the benefits for humanity and the stewardship of the environment, emphasizing sustainability and observing the Hippocratic credo of "first, do no harm".

2. Human-Centered Values – AI systems should respect human rights, the rule of law, and the democratic values of freedom and dignity. AI systems should respect the privacy and anonymity of people, incorporating data protection and observing the values of equality, non-discrimination, diversity, social justice, and internationally recognized labor rights.

3. Transparency – AI systems utilize algorithms and learning methodologies that can be inscrutable. Thus, it is imperative to ensure responsible disclosure of a system's design, methodologies, capabilities, limitations, and risks such that humans can understand and challenge the outcomes.

4. Technical Resilience and Robustness – an AI system must operate in a safe and secure manner, with engineered fault-tolerance and the capacity to detect risks and avoid harm in the event of an error or system failure.

5. Accountability – Organizations and humans developing, using and/or operating AI systems should be accountable for their proper functioning in line with the above principles.

CONTRIBUTION TO THE DEVELOPMENT OF KAZAKH LANGUAGE

In addition to developing AI-based speech and natural language processing technologies for Kazakh, the ISSAI team has also created a Kazakh glossary of AI and robotics terms (more than 1200 terms) to popularize the Kazakh language in the field of smart systems, artificial intelligence, and robotics. The glossary is available free of charge on ISSAI's website. The glossary is updated on a monthly basis.

CONTRIBUTION TO THE DEVELOPMENT OF KAZAKH LANGUAGE

To have the Kazakh Glossary of AI and Robotics terms officially approved, in 2021, ISSAI representatives attended three meetings of the Republican Terminology Commission under the Ministry of Education and Science of the Republic of Kazakhstan as experts in the field of artificial intelligence. During the meetings, the members of the Republican Terminology Commission reviewed the terms, and the ISSAI members provided them with explanations.

Currently, ISSAI is awaiting the Commission's official notification of the approval of the terms.