

# SANZHAR ASKARULY, PH.D.

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## Education

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- Ulsan National Institute of Science and Technology** **Aug 2016 - Feb 2023**  
*Combined M.S. and Ph.D. in Biomedical Engineering, supervised by Prof. Woonggyu Jung* *Ulsan, South Korea*
- Nazarbayev University** **Aug 2011 - Jun 2016**  
*B.Eng. in Electrical and Electronics Engineering, supervised by Prof. Alex Pappachen James* *Nur-Sultan, Kazakhstan*

## Research Projects

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- OtoMobile: AI-assisted video otoscope for low-resource settings** **Dec 2019 – Present**  
*Funded project | Research scientist/engineer | National Research Foundation of Korea* *Active*

- Prepared **machine learning pipeline** for labeling, pre-preprocessing, **exploratory analysis** of eardrum data
- Adapted training strategy of YOLOv5 **detection model** to achieve **87%** mAP, focusing on lightweight deployment
- Built Android application for real-time video streaming from custom otoscope to Google Glass via WiFi
- **Prepared setup**, conducted **clinical study** with over 100 patients in collaboration with Ajou University Hospital

- Development of anti-aging evaluation method using bioimaging and AI** **Oct 2016 – Oct 2019**  
*Funded project | Research scientist/engineer | Korea Health Industry Development Institute* *Completed*

- Suggested **novel concept** to apply deep learning approach for **rapid scanning** in optical coherence **tomography**
- Adapted **super-resolution generative adversarial network** architecture for **3D volume restoration** task
- Implemented custom skin surface segmentation algorithm in **MATLAB**, suggested morphological **evaluation metrics**
- Interned at Kyungpook National University to develop CNN-based model for age classification of OCT skin data

- Farabio: Deep learning toolkit for biomedical imaging** **Dec 2020 - Present**  
*Open source PyTorch library | Creator | [github.com/tuttelikz/farabio/](https://github.com/tuttelikz/farabio/)* *Active*

- Built PyTorch wrappers for **5 Kaggle biomedical** datasets: Data Science Bowl 2018, APTOS 2019, Chest X-Ray, etc.
- **Implemented modules** in **Python** to integrate **10+ computer vision** models: U-Net, DeepLab, SSD, YOLO, etc.
- Presented poster for deep learning community at **PyTorch Ecosystem Day**, overall **2k+** downloads with pip

- Mobile AI: Focus on biomedical applications** **Aug 2021 - Sep 2021**  
*Summer course | Lead instructor | [tbl-unist.github.io/mobile-ai-21/](https://tbl-unist.github.io/mobile-ai-21/)* *Completed*

- Conducted **5 computer vision seminars** to train **10+ biomedical engineers**, shared video lectures on YouTube
- Released **3 programming practicums** to teach deep learning models for **classification, segmentation, detection**
- Prototyped 2 demo AI-integrated Android applications to showcase the use of mobile technologies for digital medicine

- XenoScan: Deep learning-based phenomics screening platform** **Oct 2018 – Dec 2021**  
*Funded project | Research scientist/engineer | Samsung Research Funding Center, Samsung Electronics* *Completed*

- Developed **large-scale** custom **segmentation** pipeline for **>2,000 tadpoles**, worked with Attention U-Net
- Experimented with Vision Transformers for drug screening, **investigated results** using explainable AI, i.e. Grad-CAM
- Implemented geometry and color quantification **image processing** to monitor phenotype changes of *Xenopus laevis*

- Advanced color fundus photography using deep learning for screening glaucoma** **Jan 2022 - Feb 2022**  
*Funded project | Research engineer | Ulsan National Institute of Science and Technology* *Completed*

- Integrated **C++ OpenCV image processing** for fundus analysis on custom mobile application with Android NDK
- Deployed **regression model** to predict the RNFL thickness values for glaucoma screening with **Tensorflow Lite**

- Hearing and snoring test** **Oct 2017 - Feb 2018**  
*Research project | Research engineer | Ulsan National Institute of Science and Technology* *Completed*

- Developed hearing test mobile app based on sound frequency change with progress monitoring using MPAndroidChart
- Integrated spectrum analysis functionality for the investigation of frequency components of the snoring sound
- Built electronic hardware platform collecting multiple sensor information (including pulse oximeter, temperature, stretch for breath, sound, camera) with real-time Bluetooth connectivity into customly developed Android application in **Java**

## Research Activities

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### Journal papers

- Y Ahn\*, J Park\*, **S Askaruly\***, D Kim, G Jang, W Jung, “Deep learning-based volumetric inpainting for optical coherence tomography *in vivo*,” *In submission to SCI*
- **S Askaruly\***, H Yang\*, N Aimakov\*, G Na, Y Ahn, JS You, G Jang, JH Jang, W Jung, “Augmented reality otoscope for non-specialist ear examination with deep learning,” *In preparation to SCI*
- S Yun\*, H Yang\*, **S Askaruly\***, G Na, J Bae, W Jung, T Kwon, “XenoScan: Deep learning-based phenomics screening platform for aquatic model organism development,” *In preparation to SCI*
- H Yang\*, Y Ahn\*, **S Askaruly\***, JS You, S Kim 4, W Jung (2022) “Deep learning-based glaucoma screening using regional RNFL thickness in fundus photography,” *Diagnostics*
- JK Bae, H Roh, JS You, K Kim, Y Ahn, **S Askaruly**, K Park, H Yang, G Jang, K Moon, W Jung (2020), “Quantitative screening of cervical cancers for low-resource settings: pilot study of smartphone-based endoscopic visual inspection after acetic acid using machine learning techniques,” *JMIR mHealth and uHealth*, 8 (3), e16467
- **S Askaruly**, Y Ahn, H Kim, A Vavilin, S Ban, PU Kim, S Kim, H Lee, W Jung (2018) “Quantitative evaluation of skin surface roughness using optical coherence tomography *in vivo*,” *IEEE JSTQE*, 25 (1), 1-8
- S Kim, Y Ahn, **S Askaruly**, P Kim, W Jung, H Lee (2017) “Evaluation of skin texture and wrinkle using optical coherence tomography (Pilot study),” *Journal of the Society of Cosmetic Scientists of Korea* 43 (3), 247-254

### Oral presentations and talks

- **S Askaruly**, H Yang, N Aimakov, G Na, Y Ahn, JS You, G Jang, JH Jang, W Jung “Advanced ear examination using deep learning-assisted mobile otoscope,” *SPIE Photonics West*, 2022
- **S Askaruly** “Optimization algorithms in deep learning,” *CodeSeoul workshop*, 2022
- H Yang, **S Askaruly**, S Yun, G Na, T Kwon, W Jung “High-throughput screening platform for quantitative phenotype analysis of *Xenopus laevis* with deep learning,” *SPIE Advanced Biophotonics Conference*, 2021
- S Yun, H Yang, **S Askaruly**, TJ Park, W Jung, T Kwon “Development of deep learning-based high-throughput phenotype screening platform of *Xenopus laevis* embryos,” *18th International Xenopus Conference*, 2021
- **S Askaruly**, Y Ahn, J Bak, A Vavilin, G Jang, P Kim, H Lee, W Jung “Quantitative classification of OCT skin images with deep learning,” *SPIE Photonics West*, 2018

### Conference proceedings

- H Yang, **S Askaruly**, S Yun, G Na, T Kwon, W Jung “High-throughput screening platform for quantitative phenotype analysis of *Xenopus laevis* with deep learning,” *SPIE Advanced Biophotonics Conference*, 2021
- A Ryskaliyev, **S Askaruly**, A P James “Speech signal analysis for the estimation of heart rates under different emotional states,” *International Conference on Advances in Computing, Communications and Informatics*, 2016

### Poster presentations

- **S Askaruly**, N Aimakov, A Iskakov, H Cho, Y Ahn, MH Choi, H Yang, W Jung, “Farabio: Deep learning for biomedical imaging,” *PyTorch Developer Day*, 2021
- **S Askaruly**, Y Ahn, H Kim, A Vavilin, PU Kim, H Lee, W Jung, “Evaluation of age-related effects on human skin surface roughness using optical coherence tomography,” *OSK Annual Biophotonics Conference*, 2017

### Patents

- W Jung, **S Askaruly**, H Yang, N Aimakov, JH Jang, “Artificial intelligence otoscope and operating method thereof,” *Korea Intellectual Property Rights Information Service*, 10-2022-0017614, filed on 2022.02.10
- W Jung, Y Ahn, **S Askaruly**, “A method and apparatus for detecting wrinkle of skin using optical coherence tomography,” *Korea Intellectual Property Rights Information Service*, 10-2306486, registered on 2021.09.23

### Theses

- Ph.D. dissertation: “Development of deep learning integrated futuristic biomedical platforms for digital healthcare,” presented on 2022.12.09
- B.Eng. capstone project: “Speech signal analysis for the estimation of heart abnormalities,” presented on 2016.04.22

### Teaching experience

- “Mobile AI - Focus on biomedical applications,” Summer course, 2021, <https://tbl-unist.github.io/mobile-ai-21/>
- “Mobile technology development for biomedical engineers,” Summer course, 2020, <https://tbl-unist.github.io/tbl-edge/>

### Academic courses

- ECE543 Computer vision, CSE544 Advanced machine learning, EEE238 Digital signal and image processing
- BME431 Biomedical imaging, BME502 Advanced biomedical engineering, BME509 Advanced biomedical optics

### Skills

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**Programming Languages:** Python, MATLAB, Java, C/C++, Objective-C

**Frameworks and Tools:** PyTorch, scikit-image, OpenCV, Linux, Git, Android, Tensorflow, NDK, Sphinx, Jekyll, Latex

**Speaking Languages:** Kazakh (Native), English (Proficient), Russian (Proficient), Korean (Limited), Turkish (Limited)