ARTIQ

ARTIQ - AI Centres of Excellence

Application for a Host Institution

Institution: National Centre for Research and Development, National Science Centre
Project Joint National Project: ARTIQ – AI Centres of Excellence
Deadline for the submission of applications: 8th of April-11th of May 2021

I. HOST INSTITUTION DATA

Identification data of the Host Institution

Name (full)	Medical University of Bialystok
Name (short)	MUB
Name of the main organisational unit (where applicable)	
Address of the registered office	
Street	J. Kilińskiego
Building No.	1
Office No.	
Postal code	15-089
City/district	Bialystok
Post office	Bialystok
Municipality	Bialystok
County	
Province	Podlaskie

Correspondence address (if different than the address of the registered office)	
Street	
Building No.	
Office No.	
Postal code	
City/district	
Post office	
Municipality	
County	
Province	
EPUAP [Electronic Platform for Public Administration Services] mailbox	/UniwersytetMedycznyBial/skrytka
Legal form	A unit of the public finance sector within the meaning of the provisions of the Act of 27 August 2009 on public finance (Journal of Laws No. 157, item 1240, as amended)
The person appointed for contact with NCBR and with the potential Leader/Project Manager	
First name	Łukasz
Last name	Szczerbiński
Position	Assistant Professor in the Department of Endocrinology, Diabetology and Internal Medicine
Phone number	Department of Endocrinology, Diabetology and Internal Medicine
E-mail address	łukasz.szczerbiński@umb.edu.pl
The person authorised to represent the applicant	
First name	Marcin
Last name	Moniuszko
Function/Position	*Vice-Rector for Science and Development*

II. CAPACITY OF THE HOST INSTITUTION TO PERFORM THE PROJECT

1. Description of major research achievements in the scope of implementation of R&D projects, as well as the commercialisation of deliverables of such projects regarding artificial intelligence for the last 5 years prior to or in the year of the application along with a list of the most important publications and patents of the applicant.

The Medical University of Bialystok is one of the most advanced academic centers in Poland focused on artificial intelligence in medicine. The University is a leader in compiling High-Definition Medicine (HD Medicine) data. Our scientific efforts over the past several years have been focused on integrating phenotypic, lifestyle, environmental, genetic, epigenetic, metabolomic, radiomic and other "omic" data into a single all-ecompasing database called the Polish Database of HD Medicine. This database is the source for the application of machine learning algorithms aimed to solve the most crucial, cutting-edge challenges in medicine. Thus far our efforts have been focused on three main domains: oncology, metabolic diseases and populational medicine. MUB has made a comprehensive effort to cultivate an organizational, logistic and research environment to initiate strategic projects in lung cancer (several hundred patients who underwent genomic, metabolomics, proteomic and radiomic tests), cardiovascular diseases (c. 1000 patients who underwent genomic and other large-scale studies), type 2 diabetes (c. 3000 patients included in genomic and metabolomic studies) and assessment of risk factors for lifestyle diseases of the 21st century (Białystok PLUS study including 10,000 residents of Bialystok subjected to extremely detailed clinical, genetic, biochemical and environmental analysis). An extremely important part of our plan is to continue this unique work to create the first Eastern European (and one of the first in the world) in-depth and detailed database dedicated to Artificial Intelligence. However, our goal is not only to generate data, but to understand and apply it using AI to better elucidate the biology of disease, create predictive models to understand both the etiology and prognosis of chronic disease, personalize therapies, and enhance basic science research in the search of new drugs. Thus, we are joining the ARTIQ initiative and are excited to welcome ARTIQ candidates to MUB. We have already been successful in utilizing machine learning algorithms on our database to answer cutting-edge questions, which has resulted in the selected publications and patents indicated below:

Publications:

1. Whole genome sequencing puts forward hypotheses on metastasis evolution and therapy in colorectal cancer. Ishaque N, [...] Moniuszko M, Kozlowski M, Reszec J, Niklinski J, [...] Allgayer H. Nat Commun. 2018 Nov 14;9(1):4782.

2. MicroRNAs as novel targets and tools in cancer therapy. Abba ML, [...] Moniuszko M, Utikal J, Niklinski J, Allgayer H. Cancer Lett. 2017 Feb 28;387:84-94.

3. The Potential of Combined Immunotherapy and Antiangiogenesis for the Synergistic Treatment of Advanced NSCLC. Manegold C, [...] Moniuszko M, [...]. J Thorac Oncol. 2017 Feb;12(2):194-207.

4. Machine-learning facilitates selection of a novel diagnostic panel of metabolites for the detection of heart failure. Marcinkiewicz-Siemion M, [...] Sobkowicz B, Kaminski K. Sci Rep. 2020 Jan 10;10(1):130.

5. Machine-learning-based classification of the histological subtype of non-small-cell lung cancer using MRI texture analysis. Bebas E, [...] Szumowski P, Mojsak M. Biomedical Signal Processing and Control. Volume 66, April 2021, 102446.

Patents:

1. "Bifilar nucleic acid for calming expression of PRODH/POX protein coding gene and its applications, expressive vector, host cell, cell clone, pharmaceutical composition, in vitro method for calming expression of PRODH/POX protein coding gene, monofilar nucleic acid for calming expression of PRODH/POX protein coding gene and its applications" patent application (P.421954) granted by the Patent Office of the Republic of Poland on 20.06.2017.

2. "miRNA biomarkers for differential diagnosis of histopathological subtypes of non-small cell lung cancer" patent application (P.432011) filed on 29.11.2019 in the Patent Office of the Republic of Poland and international patent application (PCT/PL2019/000113) filed on 30.11.2019.

3. Use of a block polymer comprising a block of poly(3-(methacryloylamino)propyl trimethylammonium chloride) (PMAPTAC) for the neutralization of heparin, no: 10052347 granted by the United States Patent and Trademark Office on 21.08.2018.

2. A list of 5 research and development projects within national and international competitions in the area of artificial intelligence and implemented within the last 5 years prior to or in the year of the application (title, manager, source of financing, amount of financing).

A. Research project "Development of Personalized Diagnostic of Malignant Tumors based on tumor heterogeneity and integrated genomic, transcriptomic, metabolomic and imaging PET/MRI analysis. Getting ready for Individualized Therapy", acronym: MOBIT,
Project coordinator: prof. dr hab. Jacek Nikliński
Name of the entity awarding the grant: National Centre for Research and Development
Total project value: **18 905 505 PLN**
The aim of this innovative project was to identify new promising biomarkers of lung cancer by using high-throughput technologies such as next-generation sequencing (NGS), metabolomics, proteomics, PET-MRI imaging techniques analyzed integratively using advanced bioinformatic and machine learning algorithms.

B. Research project: "Center of Artificial Intelligence in Medicine at the Medical University of Bialystok"
Project coordinator: prof. dr hab. Adam Jacek Krętowski
Name of the entity awarding the grant: Polish Ministry of Health
Total project value: **50 000 000 PLN**
The project aims to create the Polish Database of HD Medicine and to analyze the collected data using artificial intelligence methods. As part of the database, it is planned to collect as detailed as possible data on each patient at risk of development of lifestyle diseases, in terms of his phenotypic features, behavioral factors, biochemical status, assessment of the components of the surrounding environment and large-scale "omic" biological data.

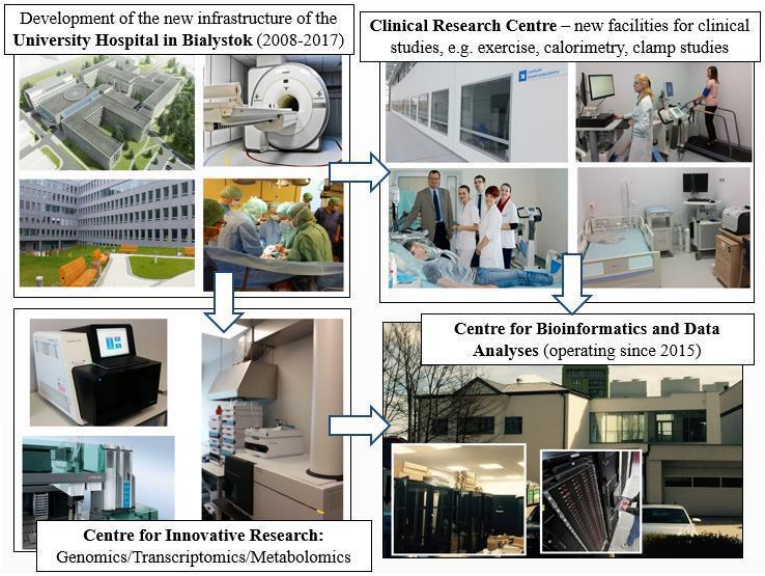
C. IDUB 11 - 5-year development project submitted as part of the prestigious competition "Initiative of Excellence - Research University" of the Ministry of Science and Higher Education
Project coordinator: Prof. Marcin Moniuszko
Name of the entity awarding the grant: Polish Ministry of Science and Higher Education
Total project value: **50 000 000 PLN**
In the competition, the university took 11th place in Poland, and the international team of experts issued a special recommendation to the government to support the initiative presented by our university. Activities under the project will include the implementation of innovative large-scale research in the field of lifestyle diseases allowing the introduction of new diagnostic and therapeutic solutions and artificial intelligence methods supporting them.

D. ImPRESS - "International Interdisciplinary PhD studies in Biomedical Research and Biostatistics. Supporting the career and training in omic-based research and biostatistics by inter-national and - sectoral mobility"
Project coordinator: Prof. Marcin Moniuszko
Name of the entity awarding the grant: EU Framework Program for Research and Innovation Horizon 2020 in 2014-2020, awarded in the COFUND competition in as part of the Maria Skłodowska-Curie Action
Total project value: **3 616 560 EUR**
The aim of the project is to create International Interdisciplinary PhD studies in Biomedical Research and Biostatistics for 15 young scientists from around the world involved in research in the area of civilization diseases and methods in the field of biostatistics and bioinformatics, necessary for the development and interpretation of data obtained in research projects.

E. "Speech analysis as a tool for early detection and monitoring of civilization diseases - VAMP (Voice Analysis for Medical Professionals)"
Project coordinator: Prof. Karol Kamiński
Name of the entity awarding the grant: EU Intelligent Development Operational Program 2014-2020, Priority axis: Increasing the scientific and research potential
Total project value: **3 748 477,65 PLN**
The project involves the development of an innovative computer diagnostics system VAMP (Voice Analysis for Medical Professionals), which can improve the early detection of civilization diseases, mental disorders and neurodegenerative changes.

3. Available research equipment, apparatus/infrastructure and intangible assets held in the context of implementation of a project regarding artificial intelligence.

The University offers very modern infrastructure for scientific research, including projects regarding artificial intelligence. We are the only medical university in Poland who already has the Centre for Artificial Intelligence in Medicine (created in 2019) with all the IT infrastructure needed to process and analyze big datasets. Moreover, in 2015, the Centre for Bioinformatics and Data Analyses was open, where servers for most of the big data from the university's projects are stored (including HPC cluster worth 4.5 million EUR). Both Centres are also prepared to accommodate scientists, with office spaces, conference rooms and lecture halls. Besides the IT part, our university has also a strong setting of facilities dedicated to generating big medical data - the key in AI driven studies, and implementing its discoveries in real life. The Clinical Research Center (opened in April 2015) is a facility for clinical research in the area of metabolic, cardiovascular, neurodegenerative diseases and oncology - the project funded by the Polish Government as a part of ”Reconstruction and Development of the University Hospital in Bialystok” (total budget 118 million EUR). It possesses equipment for the high-throughput genomics/transcriptomics (NovaSeq, HiSeq 4000), proteomics and metabolomics (Orbitrap MS) analyses. The Laboratory of Molecular Imaging and Technology Transfer – an SME company, owned and run by the MUB at the Bialystok Science and Technology Park (BSTP) offering the most modern PET-MRI hybrid for molecular imaging. Moreover, the university created an MUB Biobank - the centre with infrastructure and trained staff dedicated to collect and store all the biological material from the projects conducted at the university. The Euroregional Laboratory of Pharmaceutical Analysis is the first facility in the country that possesses the competence to control drugs and formulations derived from cross-border exchange and to provide qualitative and quantitative evaluation of toxic substances in medicinal preparations, food and biological material. The Euroregional Centre of Pharmacy is a highly specialized pharmaceutical-analytical unit, which introduces modern research techniques to the daily scientific work. ECP conducts research in collaboration with various national and international centers that involves synthetic and natural drug discoveries, mechanism evaluation of drug action, toxicity profiling and pharmacokinetic-pharmacodynamic drug(s) technology. The Center of Experimental Medicine is the most advanced center specialized in managing an animal laboratory and conducting experimental studies on laboratory animals. It provides a unique base for basic research and preclinical studies for national and international entities. It obtained the Good Laboratory Practice (GLP) certificate to conduct experimental research on animals in the fields of toxicity studies and pharmacokinetic studies. It is important to note that these facilities are located within the campus of the University Hospital, being in direct connection with the clinical environment and access to patients and healthcare providers. Moreover, a new modern building for the Centre for Populational Medicine, Centre for Regenerative Medicine and Genomics Laboratory, funded from the EU Operational Programme, will be established at the university campus in 2022. All the above mentioned available research equipment, infrastructure and intangible assets make MUB a perfect place to conduct AI in medicine studies. Our integrated biomedical and healthcare infrastructure is serving as a world top-class facility generating data for AI algorithms but also a perfect place for implementation of AI driven solutions in real life.



4. Facilities or incentives to establish an AI Centre of Excellence in the entity.

MUB will employ the PI of the AI Centre of Excellence on a fixed-term employment contract as an academic teacher/researcher, without teaching duties. He/she would hold a faculty position at the University, which will further allow him/her to freely apply for research funding in order to develop and raise the level of research excellence of the research group and MUB, to successfully compete at international level and help close the research gap.

MUB offers:
- Group leader position (professor level) on an initially 5-year appointment with the possibility of extension, subject to external merit-based evaluation
- Research independence
- Access to state-of-the-art research infrastructure
- Available laboratory space for the AI Centre of Excellence
- Full technical, administrative, and organizational support from MUB
- Additional annual salary for the AI Centre of Excellence PI and the team
- Possibility to apply for social funds (financing: vacations, children's vacations, cultural, educational, sport, recreation and tourism activities).

Working conditions proposed for the AI Centre of Excellence PI and research team are in line with the principles of the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers, as MUB is implementing Human Resources Strategy for Researchers including provisions of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. Working conditions inscribed in the Charter and Code are very attractive for the researchers, and constitute a very high standard compared to common working conditions in Poland. What is more, working conditions and remuneration of the PI and the team are far more attractive than working conditions in the Podlasie region, where Bialystok is located, and the whole country.

International networking will be supported at the institutional level by encouraging mobility through conferences, short research visits and trainings. Research excellence will be secured by a combination of new facilities and progressive individuals. Thanks to the workshops organized by the MUB's Technology Transfer Office, the researchers of the AI Centre of Excellence will have greater exposure to the priorities of industry and other relevant employment sectors in order to facilitate their cooperation with the private sector. Increased attractiveness of the institution and the scientific environment to internationally excellent and mobile researchers will also be a huge benefit for MUB. There will be a strong emphasis on establishing a competitive grant supporting team. This will be achieved through regular exposure of the AI Centre of Excellence group to a broad selection of international grant application types, professional development of grant managers, and through training the scientists to improve their grant writing skills. Moreover, a dedicated grant manager capable of supporting the scientists in finding suitable calls will be appointed. With the increased capacity of our grant supporting system, the newly established strategic partnerships and the continuous transfer of knowledge from the international partners, together with the excellent research, will guarantee a successful participation in internationally competitive funding programmes.

5. Other information concerning internationalisation of the entity, foreign scientists employed in this institution, availability of seminars in English, etc..

- Strong and long-lasting cooperation with major research centers in the world (i.a.: Harvard University, Massachusetts Institute of Technology, University of California San Francisco, National Cancer Institute in Bethesda, Mayo Clinic, University of Pennsylvania, USA; Heidelberg University, Germany; San Pablo University in Madrid, Spain; INSERM France; University of Zürich, Switzerland; University of Copenhagen, Denmark; Hasselt University, Belgium; China Agricultural University, China) and with international companies (Indivumed GmbH in the field of personalized oncology).

- Joint projects in the Center of Innovative Research (CEMBIO Madrid, University of Hasselt), including one acquired within the Horizon 2020 EU Framework Programme.

- A scientific network with foreign scientists, supervisors and experts, currently involved in the implementation of the unique PhD programme financed by Horizon 2020 Framework Programme, titled "International Interdisciplinary PhD studies in Biomedical Research and Biostatistics" acronym ImPRESS 754432.

- Experience in international, open, transparent and merit-based recruitment of 15 doctoral students of the International PhD Studies in Biomedical Research and Biostatistics and experience in attracting and maintaining international highly qualified and promising personnel; Marie Skłodowska-Curie fellows who come from all over the world, Asia, America, Africa and Europe were recruited in 2018 for 4 years. They are both PhD students and university's employees.

- Broad network of visiting professors from world-renowned centres, who regularly give visiting lectures and seminars in English (recently in an online formula), translating into scientific and business relationships.

- An extensive cooperation in the field of scientific research: according to Web of Science, 21.7% of publications were published in cooperation with international centers (2013-2017).

- An active operation of the International Cooperation Office, MUB Welcome Centre and adoption of the MUB Internationalization Strategy. MUB Welcome Centre is a comprehensive service for foreign students, PhD students and academic staff. They are able to receive professional help regarding their functioning at the University and in Bialystok. The skilful Welcome Centre staff help to solve problems connected with studying or working at the University, but also related to everyday life, such as renting an apartment or official issues. Welcome Centre employees are fluent in English, have participated in specialist training courses related to servicing foreign students, international cooperation workshops, intercultural communication workshops, as well as specialized English workshops. Welcome Centre offers assistance in issues such as: how to move around the university; dealing with various matters at the University (advising where to go, who to ask, in what district it is good to rent an apartment to conveniently reach the campus; opening a bank account; scheduling and/or accompanying a doctor's appointment if there's need for translation).

- MUB website operates in 8 languages (including English, German, Swedish, Norwegian, Spanish).

- myMUB smartphone app that is meant to facilitate the functioning and acclimatization of people from abroad at our University. myMUB is completely free. It includes modules such as "About MUB", "Campus" – an interactive map facilitating moving around the University, "Guide", "Schedule", "Białystok", "Exchange Rate" and others.

6. Other significant information confirming the experience and resources of the institution.

Besides the excellent infrastructure, conducted projects, our research experience and created Polish Database of HD medicine, the important and strong part of our portfolio is the development of future scientists as a part of our teaching activity as a university. We are very proud that in recent years we were able to transform our study programs to train young doctors, medical staff and data scientists to work on projects involving artificial intelligence. Our idea was not only to create infrastructure but also to facilitate AI research projects by engaging young scientists who can participate in our ground-breaking discoveries. We opened a new major at our university - biostatistics, with a speciality in bioinformatics, where we want to train young students to become experts in data science and the application of artificial intelligence solutions in the medical field. One of the biggest challenges in science right now is to find skilled and interested people to work on research projects. This problem also affects Polish scientific environment. That is why, for the future centre of excellence in AI, we will be able to provide a highly competent personnel for handling the project. University as an academic institution will serve as a great partner providing access to young enthusiastic people who will be trained in data analysis. The project leader will have extensive support in the field of research on the application of AI in medicine from: bachelor and master students, PhD students and research staff educated here at the University. It is worth mentioning one of our achievements in that direction. Recently we were awarded with grant entitled BECOMING - "Educating Experts of the Future: Developing Bioinformatics and Biostatistics competencies of European Biomedical Students" – a project co-financed by the Erasmus + program of the European Union (Action 2, KA203 projects - Strategic Partnerships for higher education), where MUB co-financing is EUR 80,850 (from total amount of EUR 259 150, project manager: prof. dr hab. Adam Krętowski). It is predicted that in the coming years the demand for well-trained scientists dealing with the analysis and processing of biomedical data will increase. Therefore, the aim of the project is to support changes in the area of the availability of highly qualified bioinformatics and biostatisticians. The above goal will be achieved through establishing a network of scientists from three partner institutions, able to prepare educational programs aimed at training biostatisticians and bioinformatics, exchange of opinions / expertise and best practices between partner institutions, creating modular courses that can be used in educational programs, development of appropriate e-learning materials and their implementation. At the same time it will be crucial to develop a roadmap (action plan) on the legal framework necessary for the organization of transnational education programs in biostatistics and / or bioinformatics applied in life sciences that will facilitate training in these areas. Among the expected results of the project, it is worth to mention: increasing the educational potential of partner institutions in the field of bioinformatics and biostatistics, creating innovative courses in the above-mentioned fields and establishing a foundation for future educational initiatives, such as joint educational programs or student exchange programs. Additionally, partner institutions engage in international partnership projects, in which the main activities will be related to the implementation of new study programs or modification of the existing ones. The implementation of the project was planned for a period of 3 years (2019-2022). The partner organizations in the project are Transnational University Limburg and the University of Pecs.