VASILIKI (VICKY) BIKIA, PHD

AI Researcher for Health Applications

Portfolio
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BIO

I am an AI Researcher focused on combining machine learning with healthcare to improve patient monitoring and care. My expertise includes developing predictive algorithms that integrate machine learning and numerical simulations across clinical and digital data. I emphasize the importance of interoperability to ensure seamless data integration across platforms and operational efficiency. My work with multimodal foundation models focuses on enhancing the accuracy of biomarker monitoring. Additionally, I leverage large language models to improve clinician-machine interactions and support. My leadership and communication skills help me effectively lead cross-functional teams in academic settings. Passionate about both the theory and practice of health technologies, I am dedicated to advancing healthcare through innovation and technology.

SKILLS

Programming & Libraries:	Python, PyTorch, TensorFlow, Pandas, NumPy, scikit-learn, matplotlib, MATLAB, SQL, bash
Tools & Platforms:	Git/GitHub, VS code, Conda, Google Firebase, Azure, Apache Spark, Docker, Epic COSMOS (early adopter), LaTeX
Machine learning:	supervised learning, deep learning, foundation models, feature engineering, neural networks, representation learning, transfer learning, model evaluation and validation
Data & Statistics:	data imputation, normalization, dimensionality reduction, signal processing, inferential statistics
Soft skills:	leadership, collaboration, strong analytical and problem-solving skills, adaptability and responsiveness

EXPERIENCE

9/2024–Present
Postdoctoral Researcher — **Institute of Human-centered AI, Stanford University, US**

- Developing and testing large multimodal models to enhance biomarker identification and predict patient outcomes.
- Leveraging representation learning for both textual and visual medical data, creating models that are applied to downstream tasks, yielding more nuanced and precise clinical predictions.
- Building patient-facing chatbots to help individuals better understand imaging results and hospital discharge instructions.

8/2022–8/2024
Biomedical & Machine Learning Engineer — **Byers Center for Biodesign, Stanford University, US**

- Conceptualed and protyped the Spezi Data Pipeline as part of the Stanford Spezi framework, enabling researchers to uncover new insights in health data and propel digital health innovation. This first end-to-end data pipeline for digital health data accessibility and analysis workflows has garnered multiple early adopters both within and beyond Stanford.
- Explored the clinical utility of smartwatches for arrhythmia's detection in children [1].
- Collaborated with major pharmaceutical companies, integrating digital biomarker insights to enhance personalized strategies.

10/2021–10/2023
Postdoctoral Researcher — **LHTC, École Polytechnique Fédérale de Lausanne, CH**

- Led research projects in clinical biomarkers, AI in healthcare, aging, and cardiovascular mechanics.
- Developed regression methods for improved accuracy in the non-invasive estimation of central blood pressure (absolute errors < 5 mmHg for 87% of the testing population), and cardiac output (< 0.5 L/m for the 84% of the test data).
- Built the first NN-enabled estimators for cardiac output and cardiac contractility using non-invasive peripheral blood pressure as a sole input, achieving high agreement ($r > 0.95$) and low errors in silico testing.
- Increased accuracy in the prediction of arterial stiffness indicators (critical biomarkers for vascular aging and disease) using a pioneering ML pipeline, achieving predictions with low errors (6%) and high agreement ($r = 0.95$).
- Patented novel theory and technologies for hemodynamic monitoring applications.
- Wrote and secured grants, overseeing projects from conception to implementation and ensuring objectives were met within timelines and budgets.
- Managed and guided diverse teams comprising students and senior scientists.

1/2015–9/2016 **Co-Founder and Engineer** **Prognosis Parkinson's Disease Support, GR**

- Co-founded Prognosis Parkinson's Support, a mobile application for early detection of Parkinson's Disease by leveraging unobtrusive data collected from sensors on smartphones and smartwatches.
- My work included: i) developing classification algorithms for disease detection using voice data, ii) performing gait patterns analysis, iii) establishing a mobile/cloud ecosystem for patients to access tailored solutions such as medication reminders, exercise routines, symptom tracking, and comprehensive data analysis.

EDUCATION

9/2017–7/2021 **Doctor of Philosophy in Bioengineering (with honors)** **École Polytechnique Fédérale de Lausanne, CH**
Thesis: Non-invasive monitoring of key hemodynamical and cardiac parameters using physics-based modelling and artificial intelligence | **Supervisor**: Prof. Nikolaos Stergiopulos

10/2011–6/2017 **Diploma in Electrical & Computer Engineering (with honors)** **Aristotle University of Thessaloniki, GR**
Thesis: Implantable microsystem for blood pressure monitoring from the aorta using BLE protocol |
Supervisor: Prof. Anastasios Delopoulos

PROJECTS

SpeziDataPipeline: Python Package for End-to-End Digital Health Data Management **StanfordSpezi/SpeziDataPipelineTemplate**
Role: Lead Developer and Data Scientist | **Tools:** `Python`, `Firebase Admin SDK`, `Pandas`
The Spezi Data Pipeline offers a comprehensive suite of tools for managing, analyzing, and visualizing healthcare data from the cloud. By adhering to interoperability standards, it ensures robust, standardized, and interoperable data handling across different systems and software. Designed to streamline data workflows for digital health applications, it supports smartphone and wearable data, including activity data, nutritional information, vital markers, and questionnaire responses. Users can select, save, download data, apply filtering and statistical methods, and create interactive visualizations. The SpeziDatapipeline is published as a Python package in PyPI repository.

iFLOW: Non-invasive Cardiac Output Estimation
Role: Project Lead | **Tools:** `MATLAB`
Developed an inverse problem-solving algorithm for non-invasive cardiac output estimation [2,3] from easily obtained blood pressure data. Applied a gradient-descent optimizer for tuning a 1-D arterial tree model to patient-specific standards. Performed method validation across diverse human cohorts (~200 subjects), establishing accuracy and reliability.

CardioML: Machine Learning Predictive Models for Aortic Biomarkers **Vicbi/CardioML_ParamEstimators**
Role: Project Lead | **Tools:** `TensorFlow`, `NumPy`, `Pandas`
Developed a ML pipeline to predict aortic hemodynamics, such as aortic blood pressure and flow, from standard blood pressure measurements [5, 8]. Employed and compared various regression models (decision trees, random forests, support vectors, gradient boosting) for training and testing, demonstrating practical utility in clinical settings. Collaborated with clinicians to ensure relevance and applicability.

Non-invasive Prediction of Cardiac Contractility **Vicbi/STI_Elastance_AIEstimator**
Role: Project Lead | **Tools:** `Pytorch`, `TensorFlow`, `NumPy`, `Pandas`
Developed and tested methodologies using xgb models and deep learning frameworks (CNNs) to predict cardiac stiffness [5-7] from non-invasive pressure and/or flow signals. Evaluated models' performance on multi-thousand instances of virtual subjects, showing effectiveness and providing a solid PoC for future application in real human data.

ELASTICITYDB: Synthetic Population Dataset for Cardiovascular Analysis **Vicbi/SyntheticDataGenerator**
Role: Project Lead | **Tools:** `MATLAB`, `Python`
Designed and created a synthetic population of 3'018 virtual subjects to enhance easy, cost- and time-efficient data analysis for cardiovascular studies [9]. Utilized Gaussian distributions from gender- and age-specific literature data to vary model biomechanical model parameters, and adapted anatomy to simulate varying body types.

AWARDS AND HONORS

2024 **MIT EECS Rising Stars 2024, Boston, US.**
2021 **Nomination for Best EPFL PhD Thesis, EPFL, Lausanne.**
2016 **Aristotle University of Thessaloniki Excellency Award, AUTH, Thessaloniki, Greece.**
2016 **Seeds Innovation and Technology Competition, 4th place, National Bank of Greece, Athens.**
2016 **Keynote talk, Woman in S.T.E.M, MICROSOFT – Europe Commission, Venice, Italy.**
2015 **ImagineCup (300K+competitors), Ability Award, 1st place, MICROSOFT, Redmond, WA.**
2015 **ImagineCup (300K+competitors), World Citizenship, 3rd place, MICROSOFT, Redmond, WA.**

APPROVED RESEARCH GRANTS

1/2024–1/2028 **VITAL – Virtual Twins as Tools for Personalised Clinical Care** **École Polytechnique Fédérale de Lausanne, CH**
Role: Main Researcher Partner | **Funding Organization:** Horizon Europe | **Amount Awarded:** EUR 12 million
Played a leading role in the development and drafting of the VITAL project which focuses on utilizing virtual twins as innovative tools for personalized clinical care.

8/2022–4/2023 **Development and Testing of an AI-Based Method to Predict Post-Operative Outcomes** **Stanford University, US**
Role: Postdoctoral Researcher | **Funding Organization:** Firmenich Fellowship **Amount Awarded:** CHF 15,000
Awarded a prestigious Firmenich Fellowship among a competitive field of candidates from top Swiss institutions, for my project on developing and testing an AI-based method to predict post-operative outcomes using mobile activity data.

11/2021–10/2023 **A novel non-invasive device for cardiac output monitoring** **École Polytechnique Fédérale de Lausanne, CH**
Role: Research Lead | **Funding Organization:** Innosuisse | **Amount Awarded:** CHF 300,000
Successfully acquired significant Innosuisse funding for a pivotal proof-of-concept study focusing on a novel non-invasive cardiac output monitoring device. Developed software and prototype, aimed at validating the feasibility and market potential. Conducted the data analysis and modeling, which led to the successful clinical validation of the device across a wide range of cardiac output values in an in vivo patient cohort.

11/2020–9/2023 **Hemodynamics of physiological ageing** **École Polytechnique Fédérale de Lausanne, CH**
Role: Project Lead | **Funding Organization:** Swiss National Science Foundation | **Amount Awarded:** CHF 500,000
Successfully obtained funding from the Swiss National Science Foundation for a landmark study on physiological ageing, focusing on in vivo characterization of age-related changes in aortic anatomy, elastic properties, and cardiac parameters. Led the effort in designing the data collection protocol. Developed and validated highly precise models that are applicable across various age groups and genders.

SELECTED PUBLICATIONS AND PATENTS

[1] Zahedivash, A., Chubb, H., Giacone, H., Boramanand, N. K., Dubin, A. M., Trela, A., Lencioni, E., Motonaga, K. S., William Goodyer, W., Navarre, B., Ravi, V., Schmiedmayer, P., **Bikia, V.**, Aalami, O., Ling, X. B., Marco Perez, M., & Ceresnak, S. R. (2023). Utility of smart watches for identifying arrhythmias in children. Nature Communications Medicine, 3(1), 167. doi: 10.1038/s43856-023-00392-9

[2] **Bikia, V.**, Pagoulatou, S., Trachet, B., Soulis, D., Protogerou, A. D., Papaioannou, T. G., & Stergiopulos, N. (2019). Noninvasive cardiac output and central systolic pressure from cuff-pressure and pulse wave velocity. IEEE journal of biomedical and health informatics, 24(7), 1968-1981. doi: 10.1109/JBHI.2019.2956604

[3] **Bikia, V.**, McEniery, C. M., Roussel, E. M., Rovas, G., Pagoulatou, S., Wilkinson, I. B., & Stergiopulos, N. (2022). Validation of a Non-invasive Inverse Problem-Solving Method for Stroke Volume. Frontiers in Physiology, 12, 798510. doi: 10.3389/fphys.2021.798510

[4] **Bikia, V.**, Pagoulatou, S., & Stergiopulos, N. (2021). System and methods for real time noninvasive estimation of cardiovascular parameters.

[5] **Bikia, V.**, Papaioannou, T. G., Pagoulatou, S., Rovas, G., Oikonomou, E., Siasos, G., & Stergiopulos, N. (2020). Noninvasive estimation of aortic hemodynamics and cardiac contractility using machine learning. Nature Scientific Reports, 10(1), 15015. doi: 10.1038/s41598-020-72147-8

[6] **Bikia, V.**, Adamopoulos, D., Pagoulatou, S., Rovas, G., & Stergiopulos, N. (2021). AI-based estimation of end-systolic elastance from arm-pressure and systolic time intervals. Frontiers in Artificial Intelligence, 4, 579541. doi: 10.3389/frai.2021.579541

[7] **Bikia, V.**, Lazaroska, M., Scherrer Ma, D., Zhao, M., Rovas, G., Pagoulatou, S., & Stergiopulos, N. (2021). Estimation of left ventricular end-systolic elastance from brachial pressure waveform via deep learning. Frontiers in Bioengineering and Biotechnology, 9, 754003. doi: 10.3389/fbioe.2023.1341852

[8] **Bikia, V.**, Rovas, G., & Stergiopulos, N. (2023). Cardiac output estimated from an uncalibrated radial blood pressure waveform: validation in an in-silico-generated population. Frontiers in Bioengineering and Biotechnology, 11, 1199726. doi: 10.3389/fbioe.2023.1199726

[9] **Bikia, V.**, Rovas, G., Pagoulatou, S., & Stergiopulos, N. (2021). Determination of aortic characteristic impedance and total arterial compliance from regional pulse wave velocities using machine learning: An in-silico study. Frontiers in bioengineering and biotechnology, 9, 649866. doi: 10.3389/fbioe.2021.649866

[10] Zanelli, S., Agnoletti, D., Alastruey, J., Allen, J., Bianchini, E., **Bikia, V.**, ... & Charlton, P. H. (2024). Developing technologies to assess vascular ageing: a roadmap from VascAgeNet. Physiological Measurement. doi: 10.1088/1361-6579/ad548e

TEACHING ACTIVITIES AND SUPERVISION

1/2024–5/2024 **CS342 Building for Digital Health Class**
Institution: Stanford University
Role: Instructor/Lecturer
This course on digital health is designed for both computer science students and faculty members who are interested in creating a digital platform that will directly impact healthcare or clinical research. Its goal is to give students the opportunity to apply their skills to real-world health technology development projects, while enabling School of Medicine faculty to leverage these talented individuals to help advance their technology concepts toward patients.

9/2021–8/2022 **BIOENG-312 Fluid Mechanics**
Institution: École Polytechnique Fédérale de Lausanne, Lausanne
Role: Instructor/Lecturer
This course on fluid mechanics is designed for engineering students interested in understanding the fundamental concepts of fluids, covering fluid characteristics, statics, Bernoulli equation, fluid kinematics, control volume analysis, differential analysis, dimensional analysis, and viscous flow in pipes.

9/2021–8/2022 **ME-481 Biomechanics of the Cardiovascular System**
Institution: École Polytechnique Fédérale de Lausanne, Lausanne
Role: Instructor/Lecturer
This course explores the physiology of the cardiovascular system, delving into topics such as blood biophysics, cardiac mechanics, hemodynamics, and biomechanics of the arterial and venous systems. Learning outcomes include the ability to explain the link between physiology and tissue mechanics and to identify mechanical behaviors from experimental data.

9/2021–9/2023 **Supervision of undergrad and grad students**
Institutions: Stanford University, and École Polytechnique Fédérale de Lausanne, Lausanne
Role: Mentor/Supervisor
Supervised (past and on-going) students: Adrit Rao, Marija Lazaroska, Julian Raud, Méline Zhao, Deborah Scherrer, Emma Marie Roussel, Marie Grandreau, Mary-Lou Perrier, Thibaut van Lambaart.

LANGUAGES

Greek - native, **English, French** - Full working proficiency