ID	Name	Name/title of your research project(s)	PI(s) of the project	A short introduction about the project. Please share what is exciting about the project and why this project is exciting for students.	Link to the picture you want to use for this article when Admission team updates the website. OR other information you may want to share.
1	Wong Kok Seng	Privacy-Preserving, Robust, and Explainable Federated Learning Framework for Healthcare System	PI: Kok-Seng Wong (VinUni), Bo Li (UIUC). Co-PI: Khoa Doan (VinUni)	Federated learning (FL) is an emerging machine learning approach that can potentially revolutionize the healthcare system. It is a decentralized learning method that enables training models on data distributed across multiple institutions or devices while keeping the data local and secure. This project focuses on designing a trustworthy FL framework for the healthcare system with theoretical guarantees for its privacy, robustness, and agent-level data valuation and explainability, aiming to make the healthcare systems more efficient and trustworthy. This project allows students to work with advanced technologies, contribute to a rapidly evolving FL field, and design impactful applications. The students will be embedded in a highly international research group offering comprehensive expertise in machine learning on medical datasets. Also, we provide the students with direct access to computing facilities optimized for machine/deep learning.	Image: https://drive.google.com/file/d/1-8_ku5IRC0TTNm0BRja26yqYjcT7aayA/view?usp=sharing More info about the project: https://smarthealth.vinuni.edu.vn/project/privacy-preserving-robust-and-explainable-federated-learning-framework-for-healthcare-system/ [There are some problems with the content of this link. I need to check it later before posting this link into the webpage]

2	Dinh Nguyen Van	Resilience-Aware Edge Computing for Massive and Secure Internet-of-Things Networks	Nguyen Van Dinh	The emergence of new applications such as machine-to-machine communication between over 10 billion smart objects through the 'Internet of Things' (IoT) will increase manyfold both the volume and variety of the data traffic. With emerging networks of systems becoming increasingly complex with intricate interactions, users' level of satisfaction (e.g., throughput, transmission delay) is not effectively covered by traditional network utility maximization approaches. In addition, connecting billions of smart IoT devices through wireless communications is a huge challenge and remains intractable, especially under resource-constrained networks. This project aims to develop a novel resilience-aware edge computing framework for designing, analyzing, and optimizing future large-scale IoT networks, in the presence of system uncertainties and edge nodes' failures. The expected outcomes of this project will be innovative learning and distribute resilient resource management algorithms that provide efficient, robust, and secure resource allocation solutions for a very large number of IoT devices across different resource-constrained networks. This will significantly improve real-time responsiveness and deliver seamless and high-quality service anytime and anywhere for networks, producing economic and societal benefits (e.g., remote surgeries, autonomous driving, factory automation, etc.), so crucial to the economic success of Vietnam.	https://vinuniversity-my.sharepoint.com/:w:/r/personal/dinh_nv2_vinuni_edu_vn/Documents/VinUniversity%20Documents/Project%20pics.docx?d=w49074f54276c4738b91dfcddc9fb8bee&csf=1&web=1&e=Ul4kvC

3	Dinh Nguyen Van	Task-Oriented Communications Design for Intelligent Cyber-Physical Systems	Nguyen Van Dinh	Modern communication systems have been hitherto engineered to optimize the transfer of syntactic information, guided by task-agnostic Quality-of-Service (QoS) metrics. In the future cyber-physical world, however, communication technologies must accommodate the requirements of machine networks coordinating to achieve specific collaborative tasks. Moreover, the machines' communication strategies are inherently interdependent on their interactions with the cyberphysical environment, being an observation of its state or probing it with actions. In this context, the ultimate performance indicator guiding the design is the task effectiveness, whereas all other conventional QoS metrics should be ideally considered as derivatives of the design process. As a result, it becomes apparent that current communication design processes are not capable of embracing the task-oriented philosophy as dictated by emerging cyber-physical application domains. This project envisions the joint design of communication strategies and action policies in collaborative multi-agent environments, directly driven by task effectiveness metrics. Even though environment semantics could be implicitly captured in the derived strategies, the project does not explicitly require the modeling of semantics to achieve a concise architecture focused solely on the end result, namely the effective execution of the collaborative task. The project philosophy is captured within a general design framework, further specified to the Internet of Things (IoT) with the three key application areas, aiming to: i) achieve plant stability in massive networked industrial IoT systems; ii) empower complex collaborative tasks in connected multi-robot systems; and iii) enhance the immersiveness in digital multi-sensory services.	https://vinuniversity-my.sharepoint.com/:w:/r/personal/dinh_nv2_vinuni_edu_vn/Documents/VinUniversity%20Documents/Project%20pics.docx?d=w49074f54276c4738b91dfcddc9fb8bee&csf=1&web=1&e=Ul4kvC

				Within these areas, this project shall quantify the anticipated high gains in communication efficiency within machine networks, while pursuing the high-risk paradigm of task-oriented codesign of communication and action policies. The outcomes of the project will impact the research milestones in subsequent applied projects within the wider information and communications technology (ICT) community and ultimately create socioeconomic impact within the verticals of industrial IoT, connected and automated vehicles, and digital multisensory services. In addition, the proposed paradigm will promote the intelligence and sustainability of wireless networks in the direction of green communications, the resilience of critical cyber-physical networks (e.g. unmanned aerial vehicle) and the digital inclusion of Vietnamese citizens.	

4	Calafiore Giuseppe	Smart Charging of Electrical Vehicles	Laurent El Ghaoui, Giuseppe Calafiore	This research project deals with the development of intelligent charging solutions for electric vehicles (EVs). We focus on a scenario in which EVs arrive at an aggregator station with a given state of charge, stay at the station (e.g., a EV parking/recharging lot) for a period of time, at the end of which they wish to depart fully charged, or with a given desired level of charge. This goal has to be achieved at minimum average cost for the drivers, while satisfying structural and operational constraints, such as guaranteeing at every instant of time that the total delivered power stays below the maximum power available at the aggregator. A key point in this context is that many of the problem parameters (e.g., vehicles arrival/departure times, initial state of charge, electricity price, etc.) are imprecisely known, hence an effective solution approach must be able to deal with the intrinsic uncertainty present in the problem. We develop suitable uncertainty models for the considered problem, and we leverage novel robust optimization methodologies, including affine recourse, for designing computationally efficient techniques for minimizing the charging cost under constraints and uncertainty. This project is funded by and will be conducted in collaboration with EDF R&D, the largest European electric production and distribution company in Europe.	This PhD project offers unique opportunities to the successful candidate: it is an international project in which the candidate will travel abroad and cooperate with research groups at Stanford University (prof. Y. Ye), at EDF Paris and at Politecnico di Torino, Italy (prof. G. Calafiore), in addition to the base activity at VinUni (prof. L. El Ghaoui). The project has both theoretical interest and real industrial applications, thus providing the candidate with competencies in a field of growing global interest.

5	Tung Nguyen Dang	Integrated Organic Electronics for Physical AI and Internet of Things	Nguyen Dang Tung	After a short period remaining strictly as a fundamental research subject, Artificial Intelligence (AI) has already impacted our daily life : face recognition in social networks, self-driving cars, AI-assisted medical diagnostics. Those applications all rely on visual data. At the same time, AI-assisted human/machine interaction in the real-world environment require additional and richer types, quality, and quantity of inputs: unlike the maturity of visual data recording, there is no practical AI-compatible technology that can sense, record, and communicate other types of data, such the haptics (sense of touch, pressure, texture etc.), olfaction (sense of smell, hazards, etc.). We propose to change the current vision-based paradigm in AI with integrated organic electronics, providing the sensing technology solutions that match the advances of artificial intelligence. The research components of the project will be: (1) the fundamental study of properties of organic materials, in particular of organic semiconductors, (2) the fabrication of high-performance electronic and optoelectronic sensors based on micro-and nanostructured organic solids; (3) the integration of organic sensors in AI systems, in particular in autonomous robotics, automobiles, and medicine.	https://vinuniversity-my.sharepoint.com/:i:/g/personal/tung_nd2_vinuni_edu_vn/EWftTzmXg_9Iq7Y-xldUJLYBsW_7a-CMF_XwR2D8fnlEuw?e=G0zWY0

6	Linh Nguyen Vu	Development of an AI-powered lower-limb exoskeleton robot with hybrid stiffness outputs	Nguyen Vu	Lower-limb assistive devices are used to facilitate functional leg movements. By providing supporting forces and moments to humans, they can reduce the amount of muscle exertion necessary to perform activities of daily living. This project aims to design an AI-powered lower-limb exoskeleton robot to support humans during rehabilitation training. The significance of this robot is that it can provide hybrid stiffness outputs, which means the joint stiffnesses of the robot can be either passive or active. This feature allows it to perform multiple tasks that require a change in stiffness, speeding up training time and reducing costs. This research also proposes an AI-powered control method for the exoskeleton robot based on the user's motion intentions. It enables the robot to learn the natural movements of healthy subjects (through the information on the joint angles, velocities, torques, and electromyography (EMG) signals), detect the target user's activities with a trained classifier, and then provide appropriate control policies for different intended exercises. Students who join this project are trained and required to work on multidiscipline topics from mechanical design, structural analysis, control and mechatronics, and signal processing to intelligence systems. This unique project offers students a chance to gain a wealth of experience in robotics and assistive technology. They can apply this experience to pursue their next steps, which can be postgraduate studies or industry work.	This proposal was submitted to VinIF 2023.

7	Khoa Doan Dang	Generative AI Technologies for Healthcare Screening	Khoa D Doan, Viet-Anh Nguyen, Nitesh Chawla	Healthcare screening in low and middle-income countries (LMICs) is a pressing challenge due to many factors, including: (i) cultural beliefs and attitudes that discourage engagement in screening programs, (ii) health insurance does not cover the cost of early screening, (iii) limited access to healthcare services, especially in remote regions and to the minority groups, (iv) overloaded infrastructure at clinics and hospital, (v) language and literacy barriers that hinder effective communications between healthcare provider and patients, (vii) misinformation about symptoms and treatments, among others. Our project aims to investigate the potential of using AI technologies, especially Generative AIs or Large Language Models (LLMs), for primary-care screening and develop effective solutions to enable large-scale healthcare access in LMICs, including Vietnam. A part of this project is currently funded by the Melinda and Bill Gates Foundation.	https://vinuniversity-my.sharepoint.com/:i:/g/personal/khoa_dd_vinuni_edu_vn/EeitBIkXaA9Bl8scmKE7kBYBaDpXLoXvgTKiW94wigx0PA?e=hY5Avm
8	Khoa Doan Dang	Improving NLP Applications in Low-resource Languages: One Country At A Time	Khoa D Doan	While Natural Language Processing (NLP) applications have become increasingly more powerful, with some approaching human-level performance, in languages such as English, Chinese, or French, progress in both research and industry applications in low-resource languages, such as Vietnamese or Indonesian, are significantly lagging behind. Plausible explanations are the scarcity of resources and novel transfer-learning algorithms to train NLP models in low-resource settings. While Natural Language Processing (NLP) applications have become increasingly more powerful, with some approaching human-level performance, in languages such as English, Chinese, or French, progress in both research and industry applications in low-resource languages, such as Vietnamese or Indonesian, are significantly lagging behind. Our project focuses on enhancing the performance of NLP applications in Vietnam, which is a linguistically diverse country with over 102 languages belonging to various language categories.	N/A

9	Khoa Doan Dang	Scaling up Generative Energy-based Models	Khoa D Doan	In recent years, machine learning models have been shown to generate highly realistic data, including images, audio, and text. Generative models are also at the heart of machine learning because they are important tools for manipulating high-dimensional data objects. Among these generative models, Diffusion models and Generative Adversarial Networks (GANs) are arguably the state-of-the-art methods for the data synthesis task. However, Diffusion models have expensive training and sampling while GANs suffer from low sample-diversity generation. On the other hand, Energy-based Generative Models (EGBMs) can generate diverse samples but are currently behind state-of-the-art Diffusion and GAN methods in data synthesis tasks. Nevertheless, when combined with a supervised task, EGBMs improve the robustness of the bottom-up models (e.g., from the image to its energy output) while being able to generate diverse samples. In this project, we develop computational techniques to improve the two important aspects of existing EGBMs, i.e., the generated quality and training efficiency. The proposed effort will advance the state-of-the-art EGBMs while exploiting their robustness in discriminative tasks.	N/A

10	Kamel Nidal	Carbon stock estimation and biodiversity assessment in Vietnam using remotly sensed data and deep learning neural networks	Dr Nidal Kamel and Dr Khoa D. Doan	This project proposal aims to integrate satellite and drone data with deep learning neural networks to estimate carbon stock and assess biodiversity in Vietnam. Remotely sensed data, including satellite imagery and drone-based measurements, will be collected to capture information about land cover, vegetation indices, and habitat characteristics. The project will leverage deep learning algorithms to analyze and process the large volumes of data, extracting meaningful features and relationships. By training the neural networks with labeled data, accurate models for carbon stock estimation and biodiversity assessment will be developed. The project will focus on Vietnam's diverse ecosystems, including forests, wetlands, and agricultural landscapes, to provide comprehensive insights into carbon sequestration potential and biodiversity patterns. The outcomes of this project will contribute to conservation planning, policy-making, and sustainable resource management in Vietnam, promoting effective environmental stewardship and biodiversity conservation.	https://www.fao.org/3/y5490/y5490e07.htm
11	Hiệu Phạm	Development of Point-Of-Care Devices to Predict Dengue Infection Status and to Detect Sepsis Biomarkers	Rashid Bashir (UIUC) & Andrew Taylor-Robinson (CHS, VinUni), Enrique Valera (UIUC), Minh Do (UIUC), Phung Nam Lam (Vinmec, CHS,VinUni).	• Develop point-of-care microfluidic approaches to detect multiple dengue or sepsis biomarkers (nucleic acids, cells, and proteins) from the same sample of whole blood. • POC testing of these dengue and sepsis biomarkers could accelerate the clinical decision for early detection of dengue and sepsis, respectively. Importantly, the project plans to demonstrate approaches as global health solutions to make our technologies achievable to historically underserved populations in Vietnam and other low-income countries by reducing the existing gaps of required infrastructure and high cost. • Recruit and train 5-6 PhD students at VinUni and UIUC. These students will be co-advised by UIUC and VinUni faculty in areas of bioengineering, biology, electrical and computer engineering, and infectious diseases.	N/A

12	Hiệu Phạm	Point of Care and Telehealth Diagnostics for Data-Driven Smart Health Systems.	Brian Cunningham (UIUC), Wang, Xing (UIUC) & Quynh Le (CECS, VinUni), Cuong Danh Do (CECS, VinUni).	• Creation of diagnostic technologies that can be deployed in home-based self-testing scenarios that are linked to a patient's mobile device, as well as point of care scenarios that are used in clinics. • Developing AI algorithms on the smartphone help to analyze, classify, early-diagnostic and detect abnormalities from the sample. • Recruit and train 5 PhD students and 3 graduate students at VinUni and UIUC.	N/A
13	Hiệu Phạm	Wastewater Epidemiological Surveillance in Vietnam	Helen Nguyen (UIUC) and Andrew Taylor-Robinson (VinUni), Minh Do (UIUC) Ahmed Elbanna (UIUC), Maurizio Trevisan (CHS, VinUni) Nguyen Xuan Hung (Vinmec), Le Cu Linh (CHS, VinUni), Huynh Dinh Chien (CHS, VinUni).	• Determine the prevalence of SARS-CoV2 in the selected communities. The project findings will give valuable insights into understanding the evolution of AMR in response to human behavior and community practices (taking unprescribed drugs and not completing the course) and medical practices (overprescription of antibiotics). • Develop a non-invasive, privacy-preserved tool for epidemiological surveillance for pathogen transmission in local communities. While a pandemic is global, its transmission is local and should be studied in a local context. • Train several PhD students and one Postdoc Scholar.	N/A
14	Hiệu Phạm	Privacy-Preserving, Robust, and Explainable Federated Learning Framework for Healthcare System	Bo Li (UIUC) & Kok-Seng Wong (CECS, VinUni), Stephen Schiffer (CHS, VinUni) .	• To design a trustworthy FL framework for the healthcare system with theoretical guarantees for its privacy, robustness, and agent-level data valuation and explain ability, aiming to make the healthcare systems more efficient and trustworthy. • Develop a medical application focusing on image-based disease detection and diagnosis such as cancer, bone fracture, and etc. The application consists of three tasks: detection, characterization, and monitoring of tumors. • Recruit and train 5 PhD students at VinUni and UIUC	N/A

15	Hiệu Phạm	Evaluating the Effect of Antiviral Drugs using Polarized Light Imaging and Machine Learning Approaches: The Case of Human-induced Pluripotent Stem Cell-derived Cardiomyocytes	Stephen Boppart (UIUC), Marina Marjanovic (UIUC), Mark Anastasio (UIUC), Mai Thi Chan (VinUni), Nhung Thi Nguyen (VinUni), Hieu Huy Pham (VinUni), Wray Buntine (VinUni).	• We propose to develop a standard and robust procedure to evaluate the effectiveness of antiviral drugs using label-free, noninvasive light imaging and machine learning-based approaches. • To demonstrate this with a representative example, we will start with the evaluation of the effects of Molnupiravir, used for treating SAR-CoV- 2, on cardiomyocytes derived from a human-induced pluripotent stem cell. This project will then be extended to evaluation of other antiviral drugs. • Recruit and train 5 PhD students at VinUni and UIUC.	N/A
16	Hiệu Phạm	Detection and quantitation of cancer ctDNA and miRNA for point of care lung cancer therapy selection	Brian Cunningham (UIUC); Xing Wang 9UIUC), Yi Hyeon Gyu (VMEC & VinUni); Nguyen Xuan Hung, (VMEC & VinUni); Tran Thi Mai (VinUni).	• Focus specifically on rigorously demonstrating the performance of a novel assay approach called “Activate, Cleave, Capture, and Count” (AC3) for ultra-sensitive detection and quantification of several well-known mutations with clinical relevance for guiding initial therapy selection. • Design, demonstrate, and validate AC3 assays for KRAS mutations in lung, colorectal, and pancreatic cancers. • Train several PhD students and one Postdoc Scholar.	N/a
17	Hiệu Phạm	Smart Indoor Air Quality Control System for Healthier and Greener Buildings	Vishal Verma (UIUC), Helen Nguyen (UIUC), Jinhui Yan (UIUC). Le Duy Dung (VinUni), Kok-Seng Wong (VinUni), and Andrew Taylor-Robinson (VinUni).	• Deploy air samplers at different locations in hospital facilities (e.g., Vinmec Times City in Hanoi) and other buildings (e.g., VinUni and TechnoPark building in Hanoi) to collect bioaerosols and reactive volatile and particulate matter (PM) components. • Generate full-scale full-geometry predictive tools to understand airflow and aerosol transport in indoor environments. • Privacy-preserving analysis of air quality data and user profiling by federated learning. • Design an AI management platform for controlling air quality. • Train several PhD students and one Postdoc Scholar.	N/A

18	Hiệu Phạm	Envisioning Urban Environments Resilient to Vector-Borne Diseases: A One Health Approach to Dengue Management	Praveen Kumar (UIUC), Helen Nguyen (UIUC), Jinhui Yan (UIUC), Lei Zhao (UIUC), and Brian Allan (UIUC), Andrew Taylor-Robinson (VinUni), Doan Mai Phuong (VMEC) , Khoa Doan (UIUC), and Le Duy Dung (UIUC).	• Develop a comprehensive modeling framework to predict the risk of Dengue infection in Vietnam. • Create digital twins of the urban environment, which receive sensor data for factors influencing Dengue transmission, such as temperature, humidity, and CO2 concentration. Our model will predict infection risk level in real-time and make corresponding public health recommendations for risk reduction. • Train several PhD students and one Postdoc Scholar.	N/A
19	Bắc	Digital Materials Science	Laurent El Ghaui	Material Science is nowadays concerned with the discovery of new materials that can address important societal-scale problems. Today, the discovery process is mostly done via a laborious trial and error fashion. Digital material science (DGM for short) is an emerging field that aims at shortening the path from idea to discovery, using AI technology. Prof. Yaghi and his collaborators have discovered a set of new ground-breaking materials, referred to as metal-organic frameworks (MOFs), which have the potential to greatly help in combating climate change and sustainability issues, via carbon capture for example. In VinUni, a group of us at CECS have started collaborating with him on a digital material science approach to the AI-powered discovery of MOFs, where AI tools are used to identify experimental conditions under which MOFs can be successfully made.	This project is under the Center of Intelligent Environment, in collaboration with Prof. Omar Yaghi, UC Berkeley

20	Bắc	Intelligent charging and navigation solutions for electric vehicles	Giuseppe Calafiore	The proposed research project will focus on the development of intelligent charging and navigation solutions for electric vehicles (EVs) that can handle crowded scenarios such as urban environments and mixed teams of manned and unmanned vehicles. On the one hand, we will develop novel robust optimization methodologies and uncertainty models for minimizing the cost of charging electric vehicles under the uncertainty of fluctuating electricity prices and drivers' behaviors. On the other hand, since the charging cost is not the sole criterion of relevance, we will additionally complement traditional optimization approaches with advanced AI techniques based on models of complex phenomena, such as human behavior, weather factors, battery state of health and navigation goals, with the objective of realising multi-factor charging/navigation strategies that can handle human-centred environments.	In collaboration with EDF, Politecnico di Torino (Italy)
21	Bắc	Biodiversity and Carbon Stock Monitoring in Vietnam Forests Based on Remotely Sensed Spectral Diversity	Nidal Kamel	The focus of this research is to develop apps that provide useful environmental information to various decision-makers, including local, indigenous stakeholders concerning the following two themes: Theme 1 (spaceborne). Continuous assessment of the changes in carbon stock and forests biomasses over the various forest regions in Vietnam using deep learning model and satellite data. Though the efficiency of satellite data in covering wide areas, its relatively low spatial resolution and its high cost are of great concern. In Theme 2 we develop an alternative system to Theme 1 but using drones equipped with LiDAR and video cameras. Theme 2 (airborne). Continuous monitoring of biodiversity and biomass using drone’s Lidar and video processing data combined with AI system. The effectiveness of the spaceborne and airborne systems in biomass and biodiversity assessment will be compared in term of accuracy and cost of implementation.	In collaboration with Kayross

22	Bắc	360o View of Air Pollution	Kyunghwa Chung	This project helps to solve the air pollution problem and improve the well-being of residents by applying the latest GIS and NLP technology. This project utilizes knowledge from various academic fields for a comprehensive understanding of the air pollution problem and develops creative solutions by applying diverse research perspectives. Therefore, this project adopts an interdisciplinary research approach and jointly involves multiple researchers from CECS, CBM, and CHS, as well as external partners. This project is a preliminary project focusing on air pollution and serves as a cornerstone for the Environmental Intelligence Center.	In collaboration with VNU, Kayross
23	Bắc	Smart Indoor Air Quality Control System for Healthier and Greener Buildings	Dr. Le Duy Dung	The quality of the indoor environment has a critical impact on people's health because on average, we spend more than 90% of our time indoors. Providing a healthy and safe indoor environment can save lives, reduce diseases, and increase our quality of life. Elevated levels of indoor air pollutants such as black carbon and particulate matter in different buildings in urban areas of Vietnam are similar to or sometimes even higher than the level of those pollutants outdoors exceeding the WHO guidelines and thus posing an elevated risk for the occupants. Better management of indoor environmental quality and saving energy consumption at the same time is of critical national and international significance. This project aims at building a virtual platform that offers interactive interfaces for infection control and facility managers to make informed and optimal intervention strategies as per different intended uses of the multi-used indoor environments.	https://smarthealth.vinuni.edu.vn/project/smart-indoor-air-quality-control-system-for-healthier-and-greener-buildings/