Vyacheslav Kungurtsev is a Researcher at Czech Technical University in Prague in mathematical programming and numerical optimization with a focus on machine learning applications.

VK is part of the **Intelligent Data Analysis** group at the Department of Computer Science as well as a key senior researcher on two **Horizon Europe** projects. He has supervised University of Padua interns for the last two years, with one successfully defended Masters thesis in early 2022, and one currently ongoing.
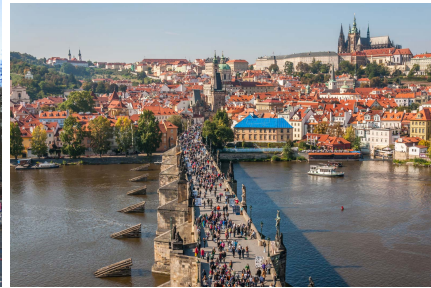
Czech Technical University (CTU) is the oldest non-military technical university in Europe. `CSRankings.org`currently ranks the Department of Computer Science at number 6 in Europe within AI and Computer Vision, after Technion, ETH Zurich, Imperial, Max Planck Society, and EPFL.The Czech capital regularly ranks among five European cities within the world's best cities in the world to live in (cf. Time Out Magazine index for 2021) and CTUs offices are in a centrally-located palace with a view of Prague Castle. For more information, please see`https://en.wikipedia.org/wiki/Prague`

Topics Associated with Horizon Europe (meaning, extra funding for the internship)

1. Fairness-enabled Machine Learning training. Both from public pressure as well as European regulation, AI systems are now scrutinized for their *fairness dimensions*, i.e., whether due to implicit biases in the training data or unknown cofounders, the AI system ends up introducing discrimination and hence perpetuating systemic inequalities. The Horizon project **AutoFair** intends to develop tools for both a priori and a posteriori certification of fairness. From the perspective of optimization algorithms this involves carefully designed training procedures that incorporate fairness metrics into the training procedure.

2. Causal inference on longitudinal time data. The Horizon project **CoDiet** seeks to find causal relationships between nutrition and non-communicable diseases. Taking the exciting developments in combining the strengths of probabilistic graphical models together with survival analysis, we seek to develop techniques for investigating such relationships, and soundly recommending nutritional habits that lead to long term declines in morbidity and mortality risks.

3. Data-driven System Identification of Legacy Turbines (funded by the Czech National Energy company CEZ). Using a combination of data driven inverse black box approaches together with principled PDE models, we seek to understand the mechanisms of turbine operation in a nuclear reactor so as to successfully model the procedure and then control the system for optimal power output.

Other possible topics (without funding beyond what Padua and Erasmus offers)

- Federated Learning

- Stochastic Control

- Bayesian Federated Learning

Requirements and Further Actions

Preferences for candidates with:

- Aptitude in statistics, probability, machine learning, numerical optimization

- Aptitude in Python (and/or Julia, C++) and the use of HPC hardware (provided for by CTU)

To Do:

Write `vyacheslav.kungurtsev@fel.cvut.cz` expressing your specific interest and attaching your CV