1. Raziskovalna organizacija (*Research organisation)*:

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| Univerza v Ljubljani, Fakulteta za računalništvo in informatiko |

2. Ime in priimek mentorja (*Name and surname of a mentor*):

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| Erik Štrumbelj |

3. Področje znanosti iz šifranta ARRS (*Primary research field*):

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| 2.07.00 - Tehniške vede / Računalništvo in informatika |

4. Kontaktni e-naslov mentorja (*Contact of a mentor)*:

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| erik.strumbelj@fri.uni-lj.si |

5. Kratek opis programa usposabljanja (*Short description of the program)*:

SLO

Program bo osredotočen na Bayesovo statistiko in statistične pristope v strojnem učenju, še posebe na razvoj novih pristopov k modeliranju podatkov in razvoju računskih metod, ki so potrebne za uspešno praktično rabo.

V zgodnjih fazah programa bo MR deležen usposabljanja iz temeljev, ki so potrebni za uspešno raziskovanje na področju programa: verjetnost, matrična algebra, Bayesova statistika in sodobni računski pristopi, kot so strukturna aproksimacija (Laplace, varijaciski Bayes,...) in aproksimacija z vzorčenjem (Gibbs, Metropolis-Hastings, Hamiltonski Monte Carlo,...). Usposabljanje bo sestavljeno iz organiziranih predavanj, individualnega dela z mentorjev, aktivnega sodelovanja pri ustreznih predmetih na magistrskem študiju in samostojnega dela.

Eden izmed glavnih izzivov na področju je, kako sodobne neparametrične ali delno parametrične pristope, kot je modeliranje z Gaussovimi procesi, narediti dovolj učinkovite za praktično rabo, še posebej, če modeliramo podatke, ki niso porazdeljeni normalno. Trenutno se osredotočamo na razvoj modelov za multivariatne kategorične in multivariatne števne podatke in aplikacije na področjih nevroznanosti, športne analitike, geografije, financ, medicine, meteorologije in drugih. MR bo vključen v raziskovalno delo skupine, končno temo doktorske disertacije pa bo izbral v skladu s svojimi interesi.

Preko projekta ARRS, ki ga vodi mentor (L1—7542: Napredek računsko intenzivnih metod za učinkovito sodobno splošnonamensko statistično analizo in sklepanje), bo MR imel dostop do znanja in strojne opreme, ki sta potrebna za paralelizacijo računskih metod v statistiki na sodobnih grafičnih karticah.

MR-ja bomo aktivno spodbujali in podpirali, da del usposabljanja opravi v tujini pri eni izmed raziskovalnih skupin, ki so v svetovnem vrhu na katerem izmed področij, ki so povezana s programom usposabljanja.

ANG

The program will focus on Bayesian statistics and statistical machine learning. In particular, on developing novel modeling methods and underlying computational algorithms required for successful application.

In the early stages of the program, the MR will receive training aimed at filling-in any gaps in the fundamentals required for succesful research in this field: probability, matrix algebra, Bayesian statistics, and modern computational approaches, such as structural (Laplace approximation, variational Bayes,...) and sampling-based approximation methods (Gibbs sampling, Metropolis-Hastings, Hamiltonian Monte Carlo). The training will be in the form of organized courses, individual work with the mentor, active participation in relevant MSc-level lab sessions, and self-study.

One of the main challenges in the field is making modern non-parametric or semi-parametric approaches, such as Gaussian process-based models, computationally feasible for practical use, in particular, when the distributions of interest are non-Gaussian. Our focus is currently on the developement of flexible models for multivariate categorical and multivariate count data and their application in the fields of neuroimaging, sports analysis, geography, finance, medicine, meteorology, and others. The MR will be included in the group's research and the final topic of the dissertation will be chosen according to the MRs interests.

Through the ARRS project led by the mentor (L1—7542: Advancement of computationally intensive methods for efficient modern general-purpose statistical analysis and inference), the MR will have access to the know-how and the hardware required to parallelize statistical computation on modern GPUs.

The MR will be actively encouraged to and supported in spending a part of the program abroad at a research group at the cutting edge in one of the areas relevant to the program.