National Research University Higher School of Economics - Nizhny Novgorod (HSE-NN)

Laboratory of Algorithms and Technologies for Network Analysis (LATNA)

– **Academic supervisor: P. Pardalos**, distinguished professor, University of Florida.
Research interests: optimization, data analysis

– **Laboratory head: Prof. V. Kalyagin**.
Research interests: applied mathematics, decision making

– **Point of contact: Prof. A. Savchenko**. Head of research group in analysis of multimedia data (AMD).
Research interests: CV, voice, statistical pattern recognition

Faculty of Informatics, Mathematics and Computer Science
– **Deputy dean: N. Karpov**.
Research interests: NLP, speech processing

List of research projects & resource capabilities

- **Research topics and projects in our lab:**
  - Optimization of image recognition algorithms for real-time applications:
    - face identification in low-resource setting
    - image categorization for small training samples
    - emotion recognition
    - voice analysis
  - Clustering and Search Techniques in Large Scale Networks:
    - market networks, biological networks, social networks
  - Discrete optimization and applications in retail

- **Resources:**
  - Equipment: LATNA computational cluster
  - HR:
    - 20 full-time CS researchers
    - common PhD school with HSE-Moscow: 5 PhD students in LATNA
    - 5 MS students at LATNA, 3 MS engineers and 4 BS students at AMD group
  - Students potential:
    - 50 MS students: 25 students of each year, Data mining programme
    - 200 BS students: 25 students of each year, 'Applied mathematics" and "Business informatics" programmes

Core competency in AI

TEAM NAME	Accuracy (%)
SIAT	80.886427
UD-GPB	80.609418
BNU	79.778393
AMD	78.531856
AmritaEEE	75.069252
Nanjing_university	74.792244
Omega_3	70.637119
CVI_SZ	69.66759
THAPAR UNIVERSITY	66.34349
CRNS	64.681
UoN	63.434903
jci_garage	57.894737

- **Contests:**
  - Group-level emotion recognition (EmotiW 2017)
  - Sentiment analysis in Twitter (SemEval 2016, 2017)
  - Data Science Game 2017
- **Technical experience:**
  - Deep learning frameworks: Caffe, Tensorflow/Keras
  - 5-10 year experience in industry (embedded systems, OSS, DBMS, CV, NLP, etc.)
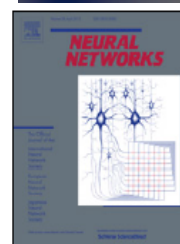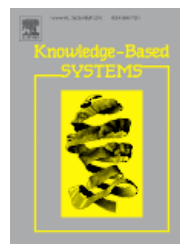
- **Cooperation with industry**:
  - CV – Intel (NN branch), IntelliVision
  - Data Analysis – Seldon, Magnit, KPMG (NN)
  - Voice – IstraSoft, Roskomnadzor
  - Recommender systems: Neuron (NN), Ntd.tv (New York)
- **Grants:** RSF 14-01-00039, RF President МД-306.2017,
RF Ministry of Science 11.G34.31.0057, 07.514.11.4137,
FASIE 9771p/16570, 20958, 10287,
HSE 17-05-0007, 15-01-0019, 12-01-0003
- More than 50 **publications** about **optimization of recognition algorithms in low-resource settings:**
  - approximate nearest neighbor search
  - highly-optimized deep CNNs
  - sequential analysis of deep features

Cooperation Model

Both options are possible:

- **Joint International R&D Lab (preferred):**

- **Concept: from research to production!** Integration with Samsung products is fast: former HARMAN center is located in NN
- **Cost**: at the level of International laboratories of HSE
- **Human Resources**:
  - Expected structure: 4 senior researchers, 1 senior developer, 5-10 researchers, 10-20 junior researchers and interns
  - Existing AI staff: 3 senior researchers, 5 researchers, 10 junior researchers
  - Extendable community (special academic prizes for research results in HSE):
    - attraction of HSE Moscow, UNN, NNSTU and RAS institutes
    - 100/25 BS/MS graduate annually
- **Intellectual property rights**. Publications with HSE and Samsung affiliations are highly preferred. Samsung retains patents for particular solutions

- **R&D projects.** Team of 5-10 experts focused on topics:
  - optimization of image recognition algorithms
  - practical vision, voice, NLP applications in low-resource settings
  - massive network analysis

Possible cooperation areas

- **Possible cooperation areas related Samsung's interest – AI modules for embedded systems based on Common Framework (Tensorflow, Caffe):**
  - **Offline CV**
    - Optimization of offline image recognition algorithms for embedded devices in low resource settings
    - fast video analysis/identification
    - accurate image recognition for small training samples
  - **Offline analysis of data from wearable sensors for personal assistant**
    - Personal monitoring in healthcare using voice, hat rate, etc
  - **Data intelligence for networks of embedded devices** (IoT, etc.)
    - Pre-processing, network structures analysis and optimization
    - Time series sensor data analysis and prediction

- **Action item next meeting with Top manager level:**
  - Tasks for the joint projects & KPI
  - Choice of cooperation model
  - Long-term co-work plan: from small AI group to large international lab
  - Short-term co-work schedule