AmIIoTE: Ambient Intelligence in IoT Environments

Special track along with UBICOMM 2020

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Special Track Chair: **Dmitry Korzun**, PhD

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AmIIoTE Organizer

Special Track Chair:

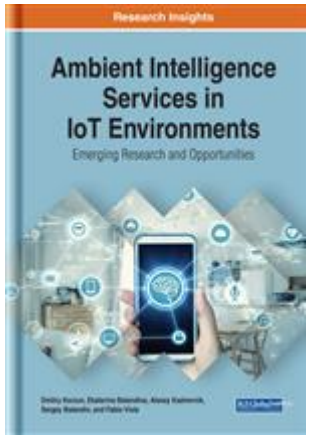
Dmitry Korzun received his B.Sc. (1997) and M.Sc (1999) degrees in Applied Mathematics and Computer Science from the Petrozavodsk State University (PetrSU, Russia). He received a Ph.D. degree in Physics and Mathematics from the St.-Petersburg State University (Russia) in 2002. His educational activity started in 1997 at the Faculty of Mathematics of PetrSU (now Institute of Mathematics and Information Technology). He is an Adjunct Professor at Department of Computer Science of PetrSU (since 2003 and ongoing).

He was a Visiting Research Scientist at the Helsinki Institute for Information Technology HIIT, Aalto University, Finland (2005-2014). In 2014-2016 he performed the duties of Vice-dean for Research at Faculty of Mathematics and Information Technology of PetrSU. Since 2014 he has acted as Leading Research Scientist at PetrSU, originating research and development activity within fundamental and applied research projects on emerging topics in ubiquitous computing, Internet technology, and Ambient Intelligence. Since 2019 he is head of Data Mining Lab at PetrSU.

Dmitry Korzun serves on technical program committees and editorial boards of 100+ of international conferences and journals. He is an author and co-author of 200+ research and educational publications. Published several monographs in Springer and IGI Global. Guest Editor of special issues in Q1&Q2 journals.

UBICOMM TPC member since 2011. Presenter at UBICOMM in 2010, 2015, 2016, 2020

About the AmIIoTE Special Track

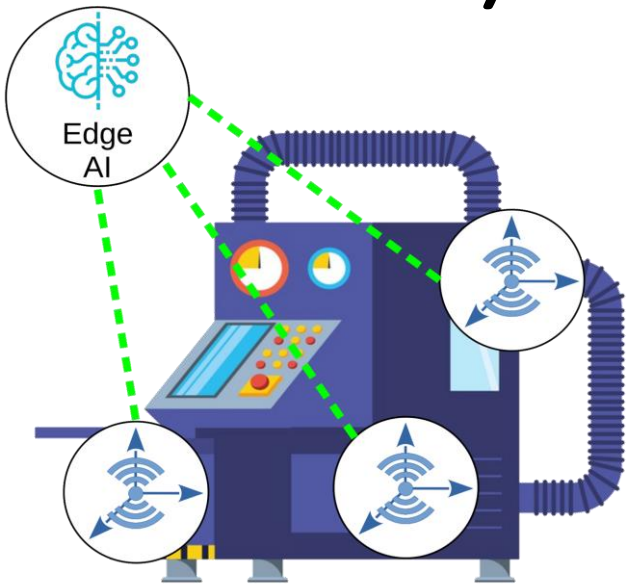


Book by
- Dmitry Korzun (PetrSU),
- Ekaterina Balandina (TUT),
- Alexey Kashevnik (SPIIRAS),
- Sergey Balandin (FRUCT),
- Fabio Viola (UniBo)

published in IGI Global

- Many digital devices (mobile or embedded) appear near people due to the Internet of Things (IoT). Such a device can be utilized to serve humans. Devices enable cooperative service construction. Any IoT environment can be considered as a smart or intelligent environment, since the goal is to produce smart services for its users.
- Smart service is characterized by such properties as context-awareness, personalization, information assistance, ubiquitous access, adaptation, pro-active delivery, and others. Service intelligence can be created based on the Ambient Intelligence (AmI).
- IoT environment provides multisource data and sensing possibilities. Data sources are people, information systems, Internet services, smart IoT objects, and embedded and mobile sensors. The data are fused and analyzed to derive the proper information to assist the user.

Summary of Contributions (paper ID 18001)



Title: Fault Diagnosis and Prognosis for Industrial Rotary Machinery based on Edge Computing and Neural Networking

Authors: Valentin Perminov (perminov@cs.petrsu.ru),
Vladislav Ermakov, Dmitry Korzun
Petrozavodsk State University (PetrSU), Petrozavodsk, Russia

Problem: Real-time analytics on the IoT edge
(for a particular application domain in Industrial IoT)

- Recent progress in Sensorics and Internet of Things (IoT) enables real-time data analytics based on data from multiple sensors covering the target industrial production system and its manufacturing processes. Diagnostics and prognosis can be implemented using the neural network approach on top of vibration and other sensed data.
- On one hand, neural network methods lead to high accuracy in fault detection and fault evolution.
- On the other hand, transferring a neural network model to edge devices leads to performance issues and platform limitations.
- Discussion on the edge computing opportunities for diagnostics of industrial rotary machinery using well-known neural network methods.

Summary of Contributions (paper ID 18002)

Title: Robotic and smart service for people with disabilities

Authors: Sergey Zavyalov, Anton Kogochev,
Lyudmila Shchegoleva (schegoleva@petrsu.ru)
Petrozavodsk State University (PetrSU), Petrozavodsk, Russia

Problem: Effective applying AI methods in robotic systems (for a particular domain of developing the robotic system for the care and supervision of people with disabilities)

- The main functions of the robotic system are telecommunications between patient and his guardian, automatic management of platform movement, manipulator movement and gripper.
- An overview of existing solutions (devices) on the robotics market that implement similar capabilities is presented.
- In order for a robotic system to be widely accessible to all people, it is necessary to reduce the cost of its components. Inexpensive mechanical components have disadvantages in terms of movement accuracy.
- The hypothesis is about the possibility of using artificial intelligence to improve the accuracy of actions performed by a robotic system.
    - In particular: analysis of the video image of the manipulator movement can allow to adjust the speed and angle of rotation of the motors in the joints of the manipulator, thereby making the movements more accurate.

Summary of Contributions (paper ID 18003)

Title: Edge-Centric Video Data Analytics
for Smart Assistance Services in Industrial Systems

Authors: Nikita Bazhenov (bazhenov@cs.petrsu.ru),
Artur Harkovchuk, Dmitry Korzun
Petrozavodsk State University (PetrSU), Petrozavodsk, Russia

Problem: Smart assistance services based on applying AI methods
for video data streams (for a particular application domain in Industrial IoT)

- Video data analytics become now essentially oriented on Edge-Centric computing in Internet of Things (IoT).
- Consider video services that provide analytics to smart assistance in industrial IoT systems. We identify the opportunities of industrial video data analytics. We present an edge-centric architecture for constructing smart assistance services.
- Based on this architecture we implemented several pilot services that demonstrate the opportunities of industrial video data analytics. The services are deployed and experimented in a real enterprise for monitoring industrial production equipment (technical state and its evolution, ongoing production processes, equipment operating conditions).

Summary of Contributions (paper ID 18004)

Title: Automated Code Generation of Multi-Agent Interaction for Constructing Semantic Services

Authors: Sergei Marchenkov (marchenk@cs.petrsu.ru)
Petrozavodsk State University (PetrSU), Petrozavodsk, Russia

Problem: Rapid development of smart services based on semantics of information-driven interaction in IoT environment

- Simplifying the development and maintenance of smart space applications by creating tools for automated code generation of multi-agent interaction for constructing semantic services.
- The general scheme of automated code generation process of multiagent interaction for constructing semantic services is introduced. By expanding the OWL-S ontology, a unified ontological description of the semantics of service constructing processes is introduced. The code generation procedures for agent data object model and interaction processes are presented.
- The efforts in automated development of semantic services through the use of the proposed unified service ontology and the code generator are investigated based on estimation of time to generate program code and the quality metrics of generated code

Future Challenges

Open problems to study:

- Services provide analytics in real-time using edge IoT devices
- Applying AI methods to robotic movement analysis with very fast response
- Assistance services based on event recognition in video data
- Programming smart services for IoT environments as an information system of agents

Do You have an idea? Contact dkorzun@cs.karelia.ru, and we find a way to show the idea to the World