

# Automation and Artificial Intelligence

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Artificial Intelligence (AI) and Machine Learning are essential technologies to scale with the exponential growth of IoT generated data. They enable to learn not only time series data, but, also enable new levels of audio, image, and video analytics. The devices to autonomously derive actionable insights through contextual reasoning. In combination with novel speech and gesture-based user interfaces they can support users in a new natural way in their tasks. The compact factor of IoT devices allow to add value to new application areas and the added value of AI enable novel applications and business models. This all makes this a quickly evolving area in research and industry.

The track on Automation and Artificial Intelligence investigated in multiple aspects ranging from the current technologies and trends, to the challenges and opportunities as well as the application and ethics.

## TECHNOLOGIES AND TRENDS

In the first session we discussed the current technologies and trends. Joern Ploennigs from IBM Research - Ireland gave an introduction on how AI technologies like semantic reasoning can be used to automate machine learning in IoT systems to address the challenge of large datasets. His presentation concludes that this leads to Digital Twins that enable complex AI solutions in IoT. This was exemplified by Andy Chun from City University of Hong Kong for optimizing transportation systems in smart cities. He illustrates how modern optimization technologies can be used to operate subway systems at their highest efficiency at the example of case studies from Hong Kong and Singapore. Simon See, Director of Nvidia AI Technology Center Singapore, provided a good overview of how AI has been progressing very fast in the last few years. He demonstrated not only how modern deep learning systems can be empowered by graphic cards in the cloud, but, also how they empower computer vision at the edge in embedded systems for medical, automotive, robotics, finance and many others.

## CHALLENGES AND OPPORTUNITIES

We continued the discussion on challenges and opportunities. Jiewen Wu, from A\*STAR AI group, showed how machine learning and knowledge representation can be leveraged in analyzing traffic systems and helping elder people in healthcare. He highlighted a few challenges and opportunities for AI in IoT. K. Vishwakarma presented his position as entrepreneur in the field. He raised in particular not only the application opportunities, but, contrasted them also with the business questions and the challenges in data security and privacy for the industry. Laura Wynter from IBM Research – Singapore illustrated at the example of Singapore how AI technologies help optimizing the operation of a large smart city. She gave insights into the

possibilities of science in optimizing complex systems in transport, but, also the challenges in applying these technology like blockchain in practice.

## ETHICS IN APPLICATION

The last session investigated into the ethical questions of applying IoT to practice. Hironobu Takagi from IBM Research Japan illustrated very well the potential of IoT and AI technologies in helping people with disabilities. He demonstrated at the example of a Cognitive Assistant for blind persons how complex AI technologies can be that assist people in their life and how non-invasive technologies can assist them. Pamela Finckenberg-Broman and Morgan M. Broman picked up the topic and discussed the challenges in law to address the rapid development in AI for IoT. At the example of robotics, they elevated various questions of what rights and obligations an AI can and needs to have to perform autonomous decisions. Yong Liang Guan from the Nanyang Technological University showed at the practical example of a test bed for autonomous vehicles and vehicle communication. He identified the challenges in scaling such technologies at city level and showed the importance of standardization in the field.

## CONCLUSION

The session illustrated the potential of AI in IoT in practical applications from public transport to healthcare and automotive. During the discussion multiple aspects where constantly highlighted.

- 1) Many applications exist for AI in IoT. The challenge there is that many IoT systems cannot be seen in isolation, but, their cyber-physical nature needs to be considered.
- 2) Novel approaches like blockchain and digital twins enable new solutions and business models in IoT by applying AI technologies.
- 3) Many challenges remain in rolling out lab solutions in practice. Standardization is necessary to enable semantic interoperability and collaboration of distributed AI systems.
- 4) Data privacy is a large challenge in many applications and often overlooked by researchers and practitioners in favor of developing new features.
- 5) The ethics in applying AI in IoT are challenging. There is a tradeoff between the added value of assistive AI technologies in helping people, the autonomy of AI systems in making critical decisions, and the potential threads created by the collection of sensitive data.