Finland-Hong Kong White Paper
on AI and 5G
for Smart and Sustainable Cities

5 March 2019
Abstract

AI will be at the core of the future city and will become the enabler of new kinds of smart services designed to improve the well-being and the quality of life of citizens. On Tuesday 5 March 2019, the University of Helsinki and Hong Kong Science and Technology Parks Corporation (HKSTP), in collaboration with Business Finland, held the Finland-Hong Kong Summit on Artificial Intelligence and 5G for Smart and Sustainable Cities. This summit aimed at discussing the impact of AI on future cities through keynotes and panels centred around the following four topics:

- AI and 5G
- Human-AI Interactions
- AI, Software and Applications
- AI for Smart and Sustainable Cities

This white paper presents the challenges and opportunities that were identified during the summit and positions the vision that Hong Kong and Finland share on solving future challenges on AI and 5G
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Finland-Hong Kong Summit on Artificial Intelligence and 5G for Smart and Sustainable Cities

The University of Helsinki and the Hong Kong Science and Technology Parks Corporation (HKSTP), in collaboration with Business Finland, held on Tuesday 5 March 2019, the Finland-Hong Kong Summit on Artificial Intelligence and 5G for Smart and Sustainable Cities at the Charles K. Kao Auditorium, Hong Kong Science Park.

This summit gathered over 300 registered participants from various backgrounds to exchange on the topic of Artificial Intelligence (AI) and 5G enabled smart and sustainable cities, leveraging two unique strengths of Finland - AI and mobile communications. These participants, coming from various Finnish and Hong Kong industries, academia, and government, actively discussed the future of a 5G and AI-enabled smart and sustainable Hong Kong.

Honored guests included Dr. David Chung Wai-keung, JP (Under Secretary for Innovation and Technology), Mr. Albert Wong Hak-keung (CEO, HKSTP) Ms. Johanna Karanko (Consul General, Finland Consulate General Hong Kong & Macau) Mr Hon. IP Kin-yuen (Hong Kong Legco Member, Education Panel) and Dr. Sari Arho Havré (Consul, Innovation, Business Finland) Prof. Hanna Snellman (Vice-Rector, University of Helsinki). The opening remarks section was moderated by Dr. Anna-Maria Salmi (Head of Development, International Affairs, University of Helsinki).

To further support the agenda of this summit, the University of Helsinki, in partnership with University of Cambridge, Nokia Bell labs, and many Hong Kong collaborators, aims to establish the Hong Kong-Helsinki Oasis for Innovation and Technology (H2O Centre), a research centre dedicated to AI, Augmented Reality (AR), 5G, and their applications for citizens, industrials and government within future cities.

“Both Hong Kong & Finland have strong government support, I&T is the key priority, high-quality R&D, Smart Cities Consortium, two cities can be complementary in technology development”
Finland-Hong Kong Summit Opening Remarks Highlights and Implications

- **Dr. David Chung Wai-keung** mentioned that the successful development of smart cities in Finland will bring a valuable experience for Hong Kong since both are leaders in the development of AI and smart cities. To show its support, the Hong Kong government has allocated 10B HKD to establish the two research clusters at Science Park: “Health@InnoHK” that focuses on healthcare technologies and “AIR@InnoHK” that focuses on artificial intelligence/robotics technologies. This will proactively attract top-notch universities, research institutions and technology enterprises in the relevant technology areas from local, Mainland China and overseas origins to establish presence at the two clusters, pooling together R&D talent to undertake more collaborative research. The deployment of AI in Hong Kong includes the enhancement of city management and streamlining the decision making process. Hong Kong observatory used AI to better forecast the weather and provide more timely warnings for Hong Kong citizens. Hong Kong Home Affairs Department will use a chatbot to enhance the Public Enquiry Service. Recently HKSTP held a smart city showcase during the AI+U event. The Hong Kong government also demonstrated a strong support to improving the existing infrastructure, including the assignment of spectrum for 5G, opening suitable government premises for mobile operators’ base stations, and using subsidy schemes to extend fibre based networks to remote villages.

- **Mr. Albert Wong Hak-keung** highlighted that HKSTP is proud to be the biggest R&D institute in Hong Kong, which is the best place to test innovation technologies, and provides a communal space for the development of InnoHK as well as the Robotics Catalysing Centre (RCC) 2.0 industrial testing facilities for robotics. The Greater Bay Area initiative and government support will drive HKSTP to be the world class innovation & technology hub.

- **Ms. Johanna Karanko** pointed out that Finland is similar to Hong Kong in many ways: a population of 5.5 million, a developed economy, a strong government support, and high quality R&D. In Nov. 2017 a Memorandum of Understanding (MoU) was signed between the Hong Kong Smart City Consortium and Business Finland. This MoU will bring more innovative companies to Hong Kong. Ms. Karanko concluded by reminding that while encouraging technological development, it should not be achieved at the expense of human rights and democracy.

- **The Hon. IP Kin-Yuen** remarked that innovation and technology is a high priority topic on Hong Kong government’s agenda. The government is putting a large amount of funding in innovation and technology. Many secondary schools are developing STEM courses to provide more opportunities for students to access innovation and technology. While seeking the opportunities, the society also needs to pay attention to the side effects, including ethical issues,
rapid changes, keep the right directions, treasure freedom, and protect its core value. He emphasized on the connection between Finland and Hong Kong, announcing that a delegation from the Hong Kong Legislative Council will visit Finland in September.

- **Dr. Sari Arho Havrén** highlighted that Finland is ranking high in innovation and technology. Education to new technologies is a high priority in Finland. Regarding AI, the free online course “The Elements of Artificial Intelligence” is a success, being taken by more than 100,000 persons over Finland, including the President of Finland. Business Finland considers 5G and AI as part of the digital infrastructure, including electricity, water supply, automation, robotics, smart homes and many more. Business has a MoU with the Hong Kong Smart City Consortium to work on these initiatives and hopes to establish an AI ecosystem with H2O in Hong Kong, a highly supported initiative.

- **Prof. Hanna Snellman** echoed with Dr. Sari Arho Havrén and added that University of Helsinki opened HiData and FCAI, two major data science and AI centres. It is a high priority for Finland to work with Hong Kong to provide cross-continental collaboration. H2O will support open access to science for the society. This openness was demonstrated through the “Think Corner” in University of Helsinki. This space, open to the public held an average of 75 events/month and welcomed 40,000 visitors since 2012. A “Hong Kong think corner” would provide sharing opportunities for government officials, AI technical companies, citizens and students from high schools to universities.

- **Prof. Sasu Tarkoma** concluded the opening remarks, with the University of Helsinki Computer Science Department vision, by emphasizing the collaboration between Hong Kong and Finland on AI and 5G for smart cities. This collaboration, symbolized by the H2O centre will permit to leverage the similarities in research and education between the two countries to achieve breakthroughs and high-impact research. Although AI and 5G are currently being deployed, they are only the stepping stone towards more research and development for new solutions. These technologies allow for a clearer vision of the sixth generation of mobile communication. The synergy between AI, 5G and IoT will be beneficial for future cities, whether in terms of management, environment preservation or well-being.
Finland-Hong Kong’s AI Vision

AI will be at the core of the future city and will become the enabler of new kinds of smart services designed to improve the well-being and the quality of life of citizens. Nowadays, more than 7 billion IoT devices are deployed within cities around the world. This number is expected to increase exponentially over the coming years. Future AI will therefore rely on a strong communication medium such as 5G. In order for AI to expand, this communication medium will not only have to provide high bandwidth and low-latency for real-time propagation of information, but also the building blocks for distributed AI at the edge of the network, as close from the user as possible. For instance, applications such as mobile Augmented Reality would strongly benefit from such a communication medium due to their dependency on bandwidth, latency and computing resources.

Both Finland and Hong Kong strongly believe and support the deployment of AI within cities for providing innovative services to their citizens. Both regions envision AI and 5G as the prominent technologies to build the next generation of intelligent services for smart cities. The Finland-Hong Kong Summit on AI and 5G for Smart and Sustainable Cities, conjointly organized by University of Helsinki and the Hong Kong Science and Technology Parks Corporation (HKSTP) and in collaboration with Business Finland, was the opportunity to join the expertise and resources of both regions on developing innovative applications on top of these technologies.

The first session of the summit focused on how AI can be integrated within the future 5G developments, with a strong focus on embedding intelligence within sustainable cities. Following the synergy between AI and 5G, the summit addressed the software implications of AI. This session not only discussed how to improve the existing AI software, whether in terms of robustness, performance and accuracy, but also how to incorporate AI in the software development process, for instance, within code analysis, testing, and security. This session also discussed the novel applications made possible by AI, with a focus on social advances in terms of education, health, elderly care and disabilities, and privacy-preservation in a data-hungry AI world. The following session focused on the implications of AI for the user, and more particularly how AR and AI interfaces can improve the AI-human interaction. Lastly, the summit targeted the consequences of the current, seemingly uncontrollable urban sprawl. Traffic congestion and pollution in continuously growing cities can be tamed through fine monitoring of metrics such as the air quality around the city. To this purpose, massive networks of sensing devices need to be deployed and orchestrated remotely, which will lead to considerable identification of challenges during at the end of the summit.
AI and 5G

5G is the next generation of wireless mobile data communication that promises ultra-high speed with data transfers below 1 ms delay (Marko Tiesmaki, Nokia). 5G will enable numerous innovative applications across various domains, such as augmented and virtual reality, autonomous transportation systems, healthcare, robotics and Internet of Things (IoT).

5G is already being commercially deployed based on a Non Stand-Alone architecture, which builds on the current 4G networks. Ultimately 5G networks are expected to migrate into a Stand-Alone architecture, which is based on a cloud-native edge computing architecture with fully automated network slicing capabilities supported by AI.

Both Finland and Hong Kong see AI as a core opportunity to overcome the challenges of 5G deployments, which in turn will accelerate the adoption of the technology and foster a new culture of intensive data consumption to its users.

Below are the research gaps that were discussed to study extensively.

1. **Service-oriented architecture**: Network slicing is a new technology introduced by 5G that will allow to allocate resources from a single physical network to several logical networks (slices) automatically. The logical slices are used to support different types of new use cases or services, forming “islands of services”.

2. **Multiple networks**: 5G can bring network connectivity to areas which are currently not covered by mobile networks. By combining elements of 3G/LTE and 5G, the network connectivity can be easily propagated through multiple networks. As the slicing process is influenced by many factors, e.g. dedicated applications, network usage, data transmission; AI can reduce the cost of creating and maintaining these networks by performing optimal capacity planning.

3. **Computing power on the edge**: While the high speed of 5G will enable to move large amounts of data through the network, computational power is essential for processing the data. Given that a single device is unable to process huge amounts of information with high levels of responsiveness by itself, collaborative device to device computing will be key to enable big data processing with a low energy footprint for the devices. However, as end devices tend to be too heterogeneous, it is possible to encounter problems such as resource fragmentation. This can impede sharing resources between devices. AI can establish proper sharing policies to engage into beneficial device to device collaborations.

4. **Next generation services and applications**: 5G is expected to change the landscape of service provisioning by introducing new elements in the network. Services will be hosted not just in the central cloud but also on the edge. Migration of services from central cloud to network edge and vice versa is a key enabler for accessing services in 5G islands. In addition, the cloudification of AI services to tune the network is critical for service adaption.
The picture below depicts the challenges and interactions with AI for future mobile networks:

![Diagram of Multiple Network Slices, Sensors, Vehicles, and Smartphones with AI automation for Network Slicing and 5G infrastructure for next generation services and applications.]

Current efforts:

- Nokia is committed to develop and deliver 5G end-to-end technology covering all necessary architecture layers. Large-scale commercial 5G networks are currently being commercially launched in lead markets globally. Small scale 5G testbeds and prototypes are also widely used in academia for research and testing. 5G is expected to be adopted fast, but like LTE, it will evolve over time. It is thus expected for 5G deployments to evolve in phases gradually reaching full coverage and migrating from connection to service based networks where Stand Alone cloud-native architecture supports AI-assisted, fully-automated network slicing. *(Marko Tiesmaki, Nokia)*

- 5G developments will benefit from the consolidations of standards between entities. In addition, developing strong collaborations between industry, academy and other sectors is key in order to build innovative AI services on top of 5G technology. H2O aims to create that space to foster innovation between Finland and Hong Kong. *(AI and 5G Panel discussions)*

- The inherent large-scale workload capacity and programmability of cloud-native architectures combined with AI will foster new business opportunities in which AI is utilized to deliver end-
user enriched experience and facilitate integration of services at low cost. *(AI and 5G Panel discussions)*

**Key contributors:**

- Keynote talk on “Artificial Intelligence in 5G Future X Networks” by Marko Tiesmaki (Head of Nokia 5G end to end sales, Nokia Greater China)
- Panel discussion on “AI and 5G”
  
  Moderator: Prof. James Kwok (Professor, Hong Kong University of Science and Technology)
  Panelists: Dr. Justin Chuang (VP, Next Generation Networks, ASTRI), Prof. Valtteri Niemi (Professor, University of Helsinki), Mr. Marko Tiesmaki (Head of Nokia 5G End to End Sales, Greater China Region, Nokia) and Prof. Sasu Tarkoma (Head of Computer Science and Director of Helsinki Centre for Data Science, University of Helsinki)
Human-AI Interactions

AI methods are now several decades old. Recent improvements in computational power, tools and frameworks allow to easily create new application centred around the user. However, AI is still far from being ready for mass adoption.

We identify three major shortcomings that restrain its adoption:

1. **Trusts and ethics**: AI relies on massive amounts of data to operate, most of which contains private contents. Currently, data is collected, stored and processed in centralized processing centres. Centralizing data allows for customized personal services to be derived from a single large dataset by combining individual preferences to global inferences. However, this methodology raises several concerns, among which:
   - Who is collecting the data?
   - Who is using the data?
   - To which end is the data used?
   - What is derived from the data?

2. **Data efficiency and quality**: A solution to establish trust in data usage consists in bringing data storage and processing closer to the user. However, this strongly reduces the amount of data available to make inferences on. Current AI solutions rely on massive amounts of aggregated data to derive general insight, that are further refined with individual data. In order to develop a completely distributed AI system where each user retains control on his own data, data efficiency will become key.

   Another reason for data efficiency resides in preventing monopolies. Nowadays, the amount of data required for accurate prediction is so massive that only a few companies are able to provide. Without any action, this phenomenon will amplify over the years with the multiplication of applications. AI will therefore remain in the hands of a few providers, controlling both data and application. Improving data efficiency will improve not only the cost of developing AI systems but also the accessibility of such systems.

3. **AI awareness within society**: AI acceptance within society will go on par with AI awareness. To this purpose, educating citizens to AI is crucial. Another fundamental aspect for AI acceptance is its explainability. AI users need to understand the process behind the decision. This question is particularly important in the case of Neural Networks that behave, by nature, as black boxes.

Current efforts:

- In order for users to reclaim control on their data, it is possible to bring the data storage and computation closer to the user, ideally directly within their own network. Such a system\(^1\) can rely on distributed models that are refined locally with the user’s data, or completely replace the centralized data processing centres with fully distributed inference and learning. This

\(^1\) [https://www.databoxproject.uk/](https://www.databoxproject.uk/)
process minimizes data release to the outside and allows the owner of the data to retain control over processing. This solution allows to partially solve the issue of who collects and uses the data, as well as what the data is used for. However, it also raises new concerns, both social and technical. Most data have a social nature. As such, it does not only involve a single owner, but also his surroundings. The decision of sharing data may therefore be influenced by other protagonists in the collected data. How can one make informed decisions about who is involved in the data being shared and how to deal with the collected data? Furthermore, by distributing the data through a wide network, synchronization becomes an issue. How may one perform large-scale machine learning on such a system? (Prof. Richard Mortier, University of Cambridge)

- Data efficiency can be improved by targeting three key points: data collection, model training efficiency, and system design. Data collection can be improved to enhance the overall quality of the data being used for training models. For instance, data fusion allows for combining multiple smaller datasets towards training a single model. Models can be further developed to require less data to operate with acceptable accuracy. Finally, systems can be designed to exploit data from multiple users while still respecting each data owner’s privacy preferences. (AI Human Interactions and Interfaces Panel discussions)

- To spread AI awareness, University of Helsinki has set up the Elements of AI course, a MOOC designed to introduce AI to people from all backgrounds. Elements of AI has currently more than 100,000 students, including the current President of Finland and targets millions prospective AI students. (AI Human Interactions and Interfaces Panel discussions)

- Another step towards AI explainability consists in more transparency. Transparency in the data selection, as well as the impact of some elements of an input vector on the output, are fundamental to establish trust and understanding in future AI methods. (AI Human Interactions and Interfaces Panel discussions)

Below are represented the major issues related to trust and privacy for AI systems:
Key contributors:

- Keynote talk on Databox and the Art of Human-Data Interaction by Prof. Richard Mortier (Reader in Computing and Human-Data Interaction, University of Cambridge)
- Panel Discussion on AI Human Interactions and Interfaces
  
  Moderator: Prof. Richard Mortier (Reader in Computing and Human-Data Interaction, University of Cambridge)

  Panelists: Prof. Xiaojuan Ma (Assistant Professor, Hong Kong University of Science and Technology), Prof. Giulio Jacucci (Professor, University of Helsinki), Prof. Rosa Chan (Associate Professor, City University of Hong Kong) and Dr. Patrik Floreen (University Lecturer, University of Helsinki and Vice-Director, Helsinki Institute for Information Technology).
AI, Software and Applications

AI feeds up on data to capture complex patterns and behaviours. By doing so, AI equips systems and applications with the ability to learn continuously in a digital environment. AI can potentially improve the development of software by making services more smart and adaptive, and fulfil users’ requirements, which in turn leads to a better quality of experience for users.

The vision of Finland and Hong Kong towards using AI for development of software is oriented towards two major directions, 1) improve software quality and 2) enrich users experience.

The major challenges encountered by AI for software development are listed below:

1. **Data management**: Applications rely on users’ data to provide meaningful functionalities. However, data is being misused and exploited by third party services over the Internet. As a result, users do not have control over their data. AI can be utilized to establish intelligent boundaries to share data, such that applications are aware about when users want or not to share it. In addition, AI can become an explanatory source that can educate users about the value of data and how to interact with it.

2. **Digital replicas and assistance**: By learning complex behaviours from users, applications can be personalized to anticipate users’ decisions and preferences. AI opens a new plethora of applications in which users can rely on to delegate tasks without explicitly participating on their execution nor completions. AI also can support users by understanding a-priori social dynamics, such that users are aware about other users’ intentions.

3. **Automated software development**: The quality of the software is determined based on the perception that users have when interacting with it. Several factors can influence this perception. Thus, an iterative development is required to tune the software, such that it becomes acceptable to users. AI can improve the quality of the software by improving components across time automatically, such that bugs in applications are reduced, energy footprint is minimized and application functionality becomes more reliable.

**Current efforts**:

- Finland through the Academy of Finland (AoF) is strategically investing in AI. It has created a new institute FCAI (Finnish Center for Artificial Intelligence), which fosters the applicability of AI in all different fields of sciences. FCAI is now a leading hub in the nordics and counts with top level experts in AI. H2O will benefit greatly from AI experts coming from Finland. *(Prof. Petri Myllymaki, University of Helsinki and FCAI)*

- AI methods have not changed that much during the last decade. However, AI has become very popular as there are more powerful devices and frameworks that facilitate the development of AI solutions. AI methods still have many severe shortcomings that need to be solved before more widespread utilization. *(AI, software and applications Panel discussions)*
The vision of AI applicability to software is summarized in the following diagram:

Key contributors:
- Keynote talk on Finland’s AI Strategy and Flagship Programme by Prof. Petri Myllymaki (Professor, University of Helsinki, Director of Helsinki Institute for Information Technology and Vice Director of the Finnish Center for Artificial Intelligence)
- Keynote talk on Intelligent "Software Engineering" and "Intelligent Software" Engineering by Prof. Michael Lyu (Head of Computer Science and Engineering, Chinese University of Hong Kong)
- Panel discussion on “AI, software and applications”
  Moderator: Mr. Simon Wong (CEO, LSCM)
  Panelists: Prof. Petri Myllymaki (Professor, University of Helsinki, Director of Helsinki Institute for Information Technology and Vice Director of the Finnish Center for Artificial Intelligence), Prof. Shing-Chi Cheung (Professor, Hong Kong University of Science and Technology), Prof. Yong Li (Associate Professor, Tsinghua University) and Dr. Lin Ma (Principal Researcher, Tencent AI Lab).
AI for Smart and Sustainable Cities

Urban sprawl is inevitable. According to the United Nations, 1.6 to 2.1 billion people will be added to the urban population worldwide by 2030. In Hong Kong, the population has been increasing at a steady 0.5% annual rate since 2000. With this rapid expansion, sustainability becomes a challenging issue. Indeed, most infrastructures are not adapted to the current population, and this causes various problems including traffic congestion, increased pollutants emissions, escalation of waste production and insufficient recycling facilities, meanwhile increasing poverty, and inflation of housing prices.

Finland and Hong Kong’s agenda regarding urban sustainability relies on two major steps: first, improving the quality of air quality monitoring and forecasting. This improved data can then be used to tailor governmental decisions to improve the quality of life of citizens, as well as evaluate the impact of former decisions. This vision can be summarized with the following points:

1. **Social consequences of pollution**: Pollution inequality between the rich and poor in the world is widening. This phenomenon happens at every scale, from country to neighbourhood level. It appears that poor communities are more exposed to high air pollution levels, even in smaller areas such as Hong Kong.
2. **Increasing the resolution of air quality forecasting**: Currently, only 16 air pollution stations are deployed in Hong Kong. Although useful for city-scale air quality estimation, the measurements do not account for the actual air quality in a given point or neighbourhood of the city. Finer-grained resolution would
3. **Forecasting and evaluating the impact of governmental policies**: One of the major issues regarding governmental policies is the current inability to forecast their long-term impact. Such mechanisms would allow to choose the policy with the best possible outcome, and evaluate the improvements brought by each policy.
4. **Towards a single understandable air quality index**: The multiplication of air pollution index may lead citizens to become confused, and as such lose their impact. By using AI, it would be possible to set up a single air quality index, adapted to a user’s individual preferences, to clearly display the air quality, in a similar fashion to how citizens are informed of the weather. This personalized index would pave the way for a variety of applications, including health-conscious route planning or simply adding another metric for health tracking.

**Current efforts:**

- Air pollution is severe in Hong Kong and Mainland China. The current city infrastructure is inefficient in forecasting and preventing the air pollution. According to the Chinese Ministry of Health, industrial pollution has made cancer China's leading cause of death. Chinese environmental experts in 2005 issued another report, estimating that annual premature deaths attributable to outdoor air pollution were likely to reach 380,000 in 2010 and 550,000 in 2020. Despite the Chinese government's intervention, this situation is worsening alarmingly. Both Finland and Hong Kong universities are looking into air pollution and forecast methods to identify the causes of pollution, protect the citizens and take appropriate government measures. *(Prof. Victor O.K. Li, University of Hong Kong)*
- A study conducted by HKU-Cambridge Clean Energy and Environment Research Platform (CEERP) found a statistically significant positive relationship between ambient PM2.5 concentrations and the Social Deprivation Index (SDI) in Hong Kong. The SDI is a composite
measure of area level deprivation commonly used to quantify the social determinants of health. The study found that the higher the SDI, the higher the mean PM2.5 exposure. In other words, the postulation of air pollution-induced environmental injustice at the constituency area level in Hong Kong is justified. There is an emerging need for Hong Kong to develop more integrated, human-centric, location- and justice-based environmental policies, and the need to adopt evidence-based policy-decision-making to properly address air pollution-induced EI. The policy implications and recommendations can be extended to the rest of the world, particularly the Asian metropolis, as well as places where GDP growth is rapid, population density and pollution concentration (including particulate pollution) appear to be high, and the income gap between the rich and the poor is widening. *(Prof. Victor O.K. Li, University of Hong Kong)*

- Machine learning can help improving the accuracy as well as the resolution of these measurements. By combining vehicular traffic, meteorology and urban morphology, it is possible to generate trained predictions based on input with missing values. This strategy allows to collect the data from the 16 stations scattered around Hong Kong and expand it to several thousands of geographical points. As such, citizens can get street by street air quality report, forecast and alerts. *(Prof. Victor O.K. Li, University of Hong Kong)*

- AI algorithms have been successfully employed to analyse the effects of regulatory intervention in China. *(Prof. Victor O.K. Li, University of Hong Kong)*

- The UMeAir project aims at providing a single Happiness index adapted to the preferences of the user to quickly and accurately inform about air quality. *(AI for Smart and Sustainable Cities Panel discussions)*

- Finland is also active in Air pollution monitoring, through the Megasense² project, that aims at deploying thousands of low-cost sensors to improve the resolution of air quality measurement in the city. *(AI for Smart and Sustainable Cities Panel discussions)*

The multiple components of AI applicability to Air quality and their interactions are summarized below:

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Key contributors:

- Keynote talk on AI to Advance Well-being and Society by Prof. Prof. Victor O.K. Li (Chair Professor, University of Hong Kong)
- Panel discussion on “AI for Smart and Sustainable Cities”
  Moderator: Prof. Jimmy Fung (Professor and Head of Division of Environment and Sustainability, Hong Kong University of Science and Technology)
  Panelists: Dr. Kim-Fung Tsang (Vice President, Smart City Consortium), Prof. Sasu Tarkoma (Head of Computer Science and Director of Helsinki Centre for Data Science, University of Helsinki), Prof. Zhi Ning (Associate Professor, Hong Kong University of Science and Technology) and Prof. Jacqueline C.K. Lam (Associate Professor, University of Hong Kong).
Closing Remarks

**Prof. Pan Hui (Nokia Chair Professor, University of Helsinki).** This summit brought together many participants coming from Finland, Cambridge, Beijing, and other cities to Hong Kong. HKSTP and more particularly Dr. Claudia Xu’s strong team support was a major aspect in the success of the summit. In the future, H2O, University of Cambridge, Nokia Bell labs, and many Hong Kong collaborators including HKSTP will work together to create more collaboration opportunities between Finland and Hong Kong. Thanks to all participants for their insightful talks and bright ideas about the future. We hope you enjoyed the event.

**Dr. Claudia Xu (Chief Commercial Officer, HKSTP).** As Prof. Myllymaki showed earlier, the collaboration between Finland and Hong Kong can be seen as bridge that reminded her a Chinese saying “珠聯璧合”. This saying symbolizes the fact that Finland and Hong Kong are a perfect pair, sharing a lot of similarities and common interests. HKSTP is now looking forward to a deep collaboration in the future. Thanks everyone for participating in this summit.
Summary

AI and 5G are key enabler technologies to foster new set of possibilities and creating smart services to future cities.

During summit between Finland and Hong Kong that gathered top experts in different fields, the most critical gaps that require attention to accelerate the innovation process of AI and 5G solutions were identified. The agenda of this summit focused on four different research themes ranging from system architectures to human-AI interaction. The summit allowed to envision a synergy between academy, industry and government to promote new business opportunities that can boost the development of the region and position it as leader on AI and 5G research. In addition, the summit provided relevant key insights regarding the current state of the technologies and ongoing effort and research directions.

To further support the agenda of this summit, the University of Helsinki, in partnership with University of Cambridge, Nokia Bell labs, and many Hong Kong collaborators, aims to establish the Hong Kong-Helsinki Oasis for Innovation and Technology (H2O Centre), a research centre dedicated to AI, Augmented Reality (AR), 5G, and their applications for citizens, industrials and government within future cities.

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