PANEL #2

PORTO
July 2024

IARIA Congress 2024 & DigiTech 2024

Theme: AI-based IoT Systems Optimization

CONTRIBUTORS

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July 2024

Moderator

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Panelists

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Issues on the AI-based IoT Systems, and its optimization

- Big data
  - How to collect and to keep?
  - How to extract important data and discard unimportant data?
- Digital twins
  - Do simulations reflect real-world correctly?
  - How to extract regularities and rules?
- Security
  - How to prevent, and how to detect?
  - How to keep balance between availability and confidentiality (integrity)?

- **PANELIST POSITION on**
  - **AI-based Network Optimization for IoT networks**
    - IoT functional architecture
    - IoT in 6G networks
    - AI/ML in 6G-IoT networks

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- **IoT layered functional architecture**
  - **Perception Layer (PL)** (a.k.a *Device Layer*)
    - Physical objects (e.g., sensors, actuators), collects info and executes commands
  - **Network Layer (NL)**
    - **Many wired/wireless technologies/protocols: IEEE 802.11/15 Infrared, ZigBee, 4G/5G/6G, LPWAN, etc.**
  - **Middleware Layer (MdL)**
    - Service management, database, info processing, decision based on the results
  - **Application Layer (AL)**
    - Global apps management (health, farming, home, smart cities, industrial, intelligent transportation, etc.)
  - **Business Layer (BL)**
    - IoT system overall management
- **AI/ML - in principle, it can be used in any layer for different purposes**

IoT in 6G networks

- **6G-IoT Applications-examples**
  - Industrial Internet of Things
  - Internet of Healthcare Things
  - Vehicular Internet of Things and Autonomous Driving
  - Unmanned Aerial Vehicles
  - Satellite Internet of Things

AI/ML in 6G-IoT networking

- AI/ML – proposed to be intensively used in 6G networks and services
- *AI Action types: sensing, mining, optimization, prediction, reasoning, etc*

- **6G Macro architectural planes** (on top of networking infrastructure)
  - *Network Function Plane* (control base station (cNB), service base station (sNB))
  - *Data Plane* (data - collection, storage, processing, provisioning)
  - *Intelligent Plane* (planning, deployment, optimization, monitoring)

AI/ML in 6G-IoT networks

- **AI-supported framework - 6G functions and activities**
  - **Network AI Management and Orchestration**
    - Network AI Service Orchestrator
      - Service orchestration and scheduling for: Data traffic, AIaaS
    - Network AI Service Manager
    - Infrastructure (connectivity + computing) Orchestrator/Manager
    - AI Model Library Hub

- **AI activities for service orchestration, management and scheduling**
  - Data collection
    - Network channel quality, resource utilization, network topology, security data
    - Sensing, localization, THz imaging
    - Industry, 3rd party, IoT, Terminal, holographic, Cloud X, XR
  - Data processing
    - Models of algorithms, dimension, labels, indicators, graphs
    - Pre-processing, post-processing, policy enforcement, …
  - Storage: Distributed, centralized
  - Data provisioning: Access control, Capability exposure

Adapted from: J.Wu, R.Li, X.An, C.Peng, Z.Liu, J.Crowcroft, and H.Zhang
Toward Native AI in 6G Networks: System Design, Architectures, and Paradigms
arXiv:2103.02823v1 [cs.NI], 2021

Panelist Position

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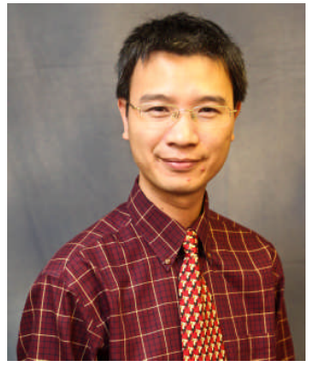
- **AI Based Anomaly Detection in Cybersecurity**
  - Data Representation
  - Classification
  - Machine Learning Techniques such as SVM
  - Cluster Analysis for Anomaly Intrusion Detection
  - Deep Learning for Anomaly Intrusion Detection
- **Secure Mobile Software Development (SMSD)**
  - Develop teaching materials on secure mobile software with a collection of hands-on materials that will improve the ability of students to develop mobile software securely and avoiding common security vulnerabilities
  - Eight Learning Modules and Four API Plugin has been developed (https://sites.google.com/view/projectsmsd)
  - Pre-Lab, Hands-on Labs, and Post-Labs



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Panelist Position

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Chia-Mei Chen
NSYSU

- AI adaptation everywhere
  - Impacts of IoTs' 3V properties
  - Big Data from IoTs
  - CIA: Convenience, Intelligence, Automation
  - Safety issues of applying IoTs
  - CIA in cybersecurity: Confidentiality, Integrity, Availability

Panelist Position

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Chia-Mei Chen
NSYSU

- Security is as strong as the weakest link
  - IoT devices are everywhere
  - Asset management -> risk assessment
  - IoT malware attacks
    - IoT malware attacks up by 37% in the first half of 2023
  - Attack surface
    - Each IoT device increase new attack surfaces and risks

Panelist Position

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Robert Laurini
University of Lyon, France
IARIA Fellow
KSI Fellow

- **Panel #2: AI-based IoT Systems Optimization**
- **Internet of Urban Objects**
- **Examples**
  - **Bootle banks**
  - **Trees and automatic watering**
  - **Traffic**
  - **Pollution**
  - **Waste management**

Panelist Position

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Robert Laurini
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- Digital twins based on sensors and IoT
- Fixed, mobile, and semi-mobile objects
  - Managed/followed by city
  - “ by other companies
- AI and big data
  - Extracted knowledge ➔ rules
  - Optimization of services

Panelist Position

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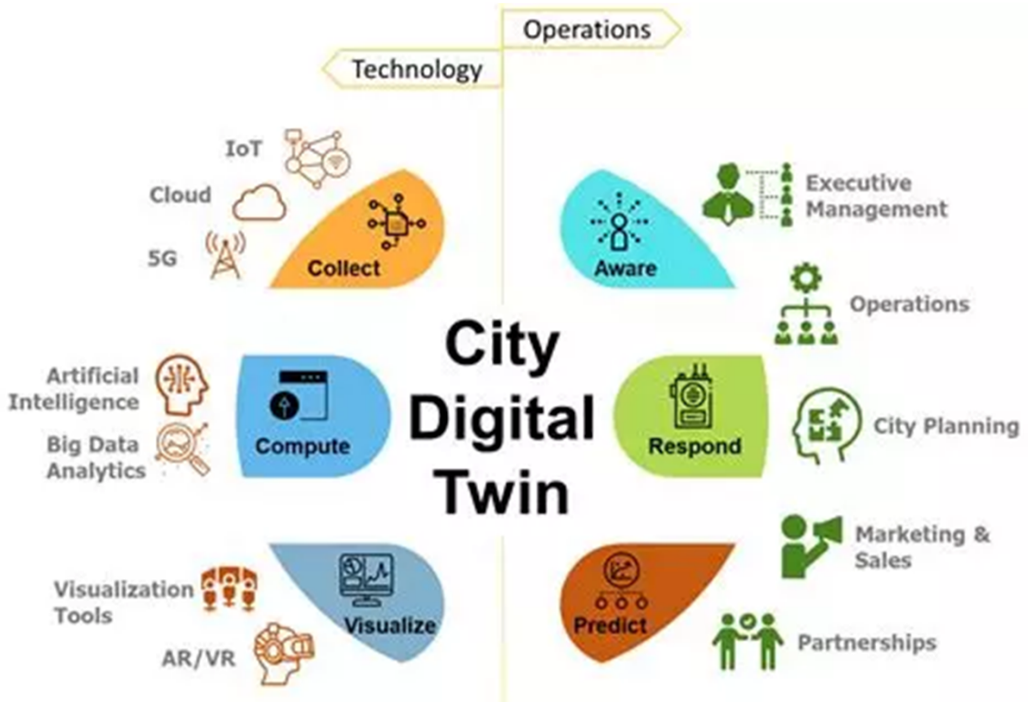
- **Digital twins based on sensors and IoT**



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Yasushi
Kambayashi
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- **Disaster Prevention and Disaster Mitigation**
  - **IoT powered by AI is a strong tool to prevent and mitigate disasters**
  - **Sensor networks give us early warning**
  - **UAVs plays good roles for evacuation route finding**
  - **UAVs are useful for guiding evacuating people**
  - **UAVs can provide Ad-hoc network**

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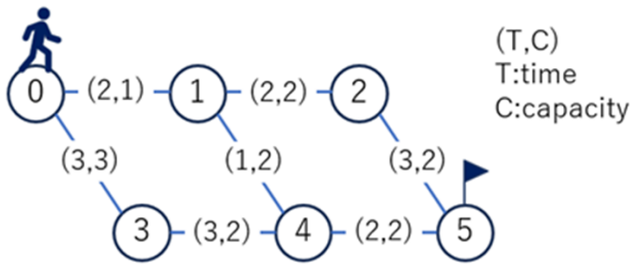
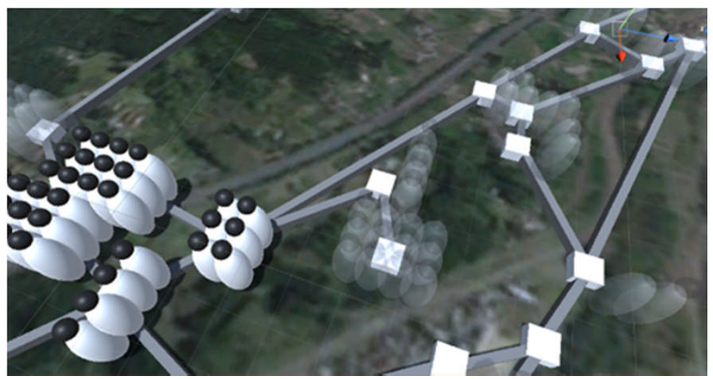
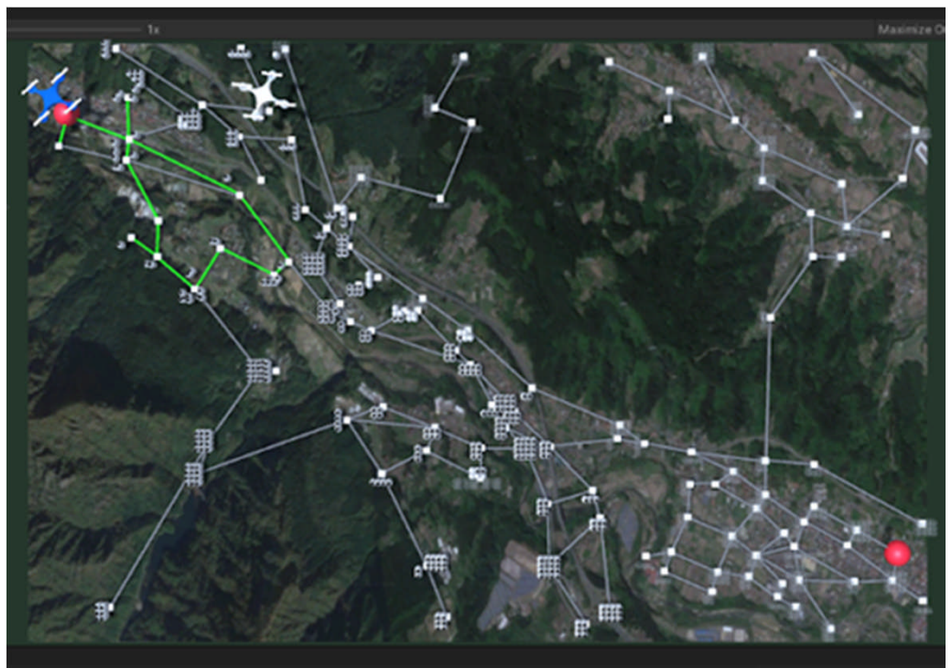
- **We need to count the number of evacuees, and their flows.**







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