

Introduction to Katto Lab Network Group

Katto Laboratory,
Department of Communications and Computer Engineering,
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About Network Area

— Main research Area —

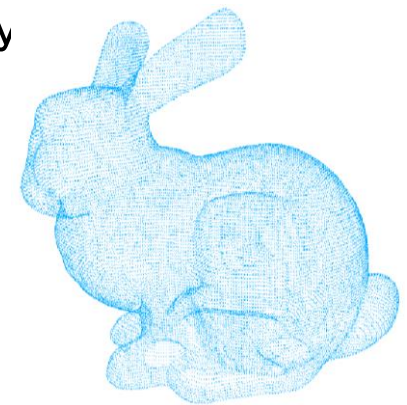
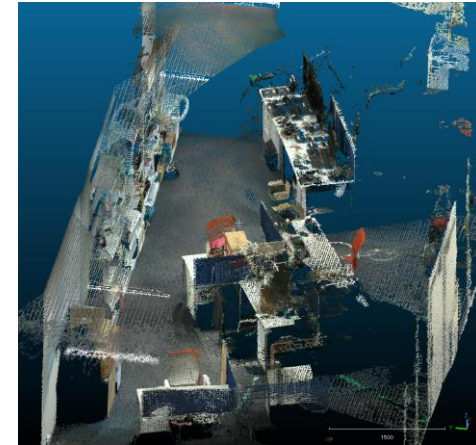
- ✓ Point Cloud Steaming
- ✓ Point Cloud Compression
- ✓ Video Streaming
- ✓ Information Oriented Network
- ✓ Hart Rate Estimation

— Recent Key Word —

Sensor , Point Cloud Streaming ,Point Cloud compression, Point Cloud Classification, Indoor Location estimation , point net, Hololens, Lidar, unity, 360-degree streaming, MPEG-DASH, AR, VR, Hart Rate estimation , IoT etc...

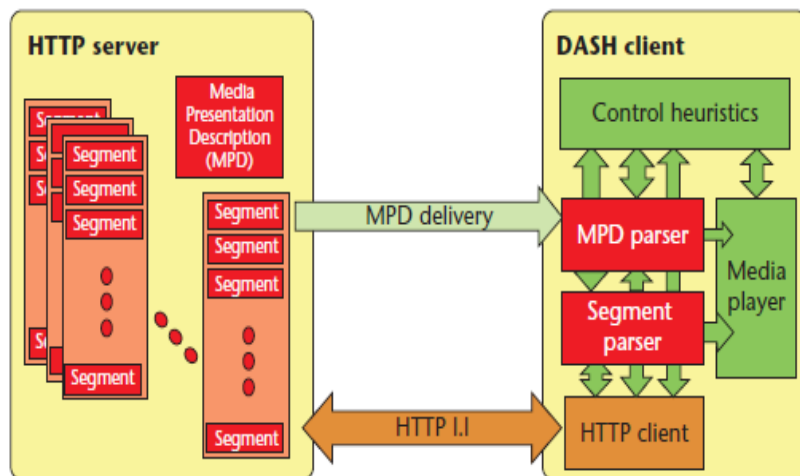
Point Cloud

- What is point cloud
 - Point cloud refers to data composed of a collection of points
 - 3D data with basic positional information in X, Y, Z and color
- What point cloud can do?
 - Wide area surveying combined with drones and other equipment is possible.
 - Easy to understand visually due to its three-dimensionality
 - Simulations can be performed using 3D models.



What is Video Streaming?

- **Streaming using HTTP is common**
 - HTTP Live Streaming
 - MPEG-DASH
- **MPEG-DASH**[1]
 - Encode a single video content at different bitrates
 - Divide into segments
 - Change the bit rate of the delivered video to reduce video interruptions



[1] “The MPEG-DASH Standard for multimedia streaming over the internet”, Anthony Vetro, Mitsubishi Electric Research Labs.

What is IoT?

Internet of Things : Connecting things to the Internet and exchange information

- ✓ Using cloud computing and mobile networks
- ✓ It has many issues such as security, network configuration, and power

Application

- Perform various tasks such as anomaly detection

Cloud Computing

- Data storage, analysis, visualization

Wireless Sensor Networks

- Data collection and transmission

Ex1:Indoor of moving objects using LiDAR Location Estimation

- LiDAR Sensor

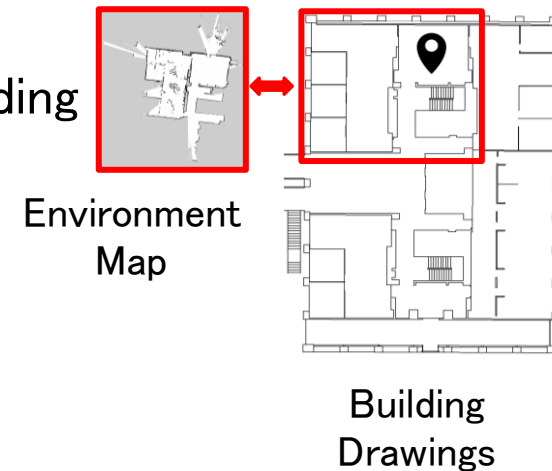
Measures distance to an object by emitting a laser beam and measuring the time of flight until the reflected light returns.



[3]

- Indoor Location estimation

- ① Creation of environmental maps from LiDAR data and odometry information
- ② Estimates current location by checking against building plans, etc.

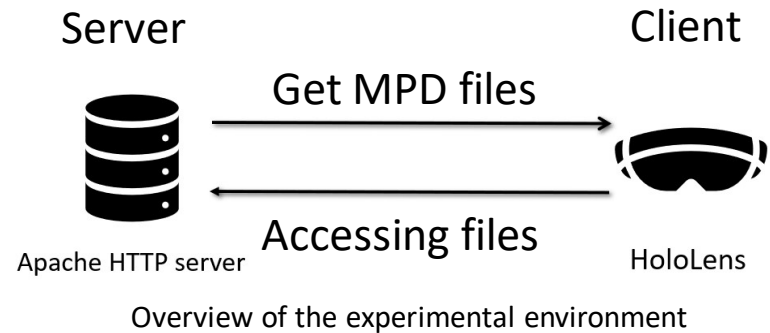


Ex2: Evaluation of live video distribution characteristics on MR devices

- MR(Mixed Reality)
 - : Integrate AR and VR
- Adaptive control with MPEG-DASH
- Live 360-degree video streaming
- QoS, QoE Evaluation



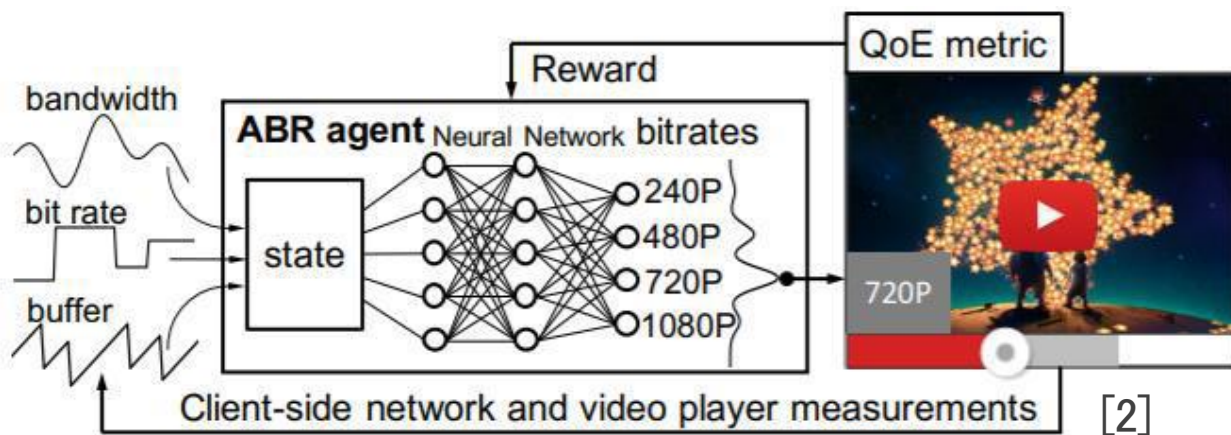
Conceptual diagram of a meeting utilizing MR applications



MR device (HoloLens)

Ex3: Video Streaming control using reinforcement learning

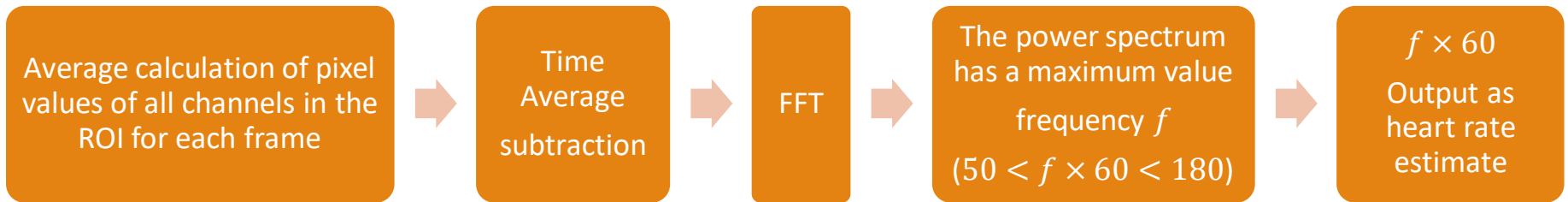
- Android application to collect communication quality data
- Learning efficient video distribution control using reinforcement learning based on collected data
- Implementation of video delivery control using reinforcement learning in a real environment



Ex4: Evaluation of the accuracy of non-contact heart rate estimation using video images

Detects faces from video images and sets a region of interest (ROI)

➤ Flow of heart rate estimation



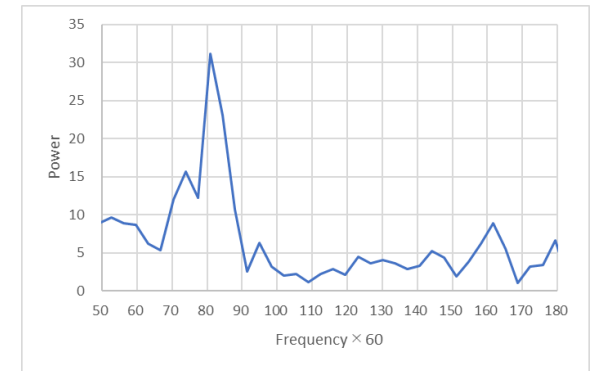
➤ Example of accuracy evaluation

➤ Evaluation of the effect of the environment at the time of video capture on estimation accuracy

- Angle of face, angle of camera
- Facial movement

➤ Assessing the impact of data used for estimation on estimation accuracy

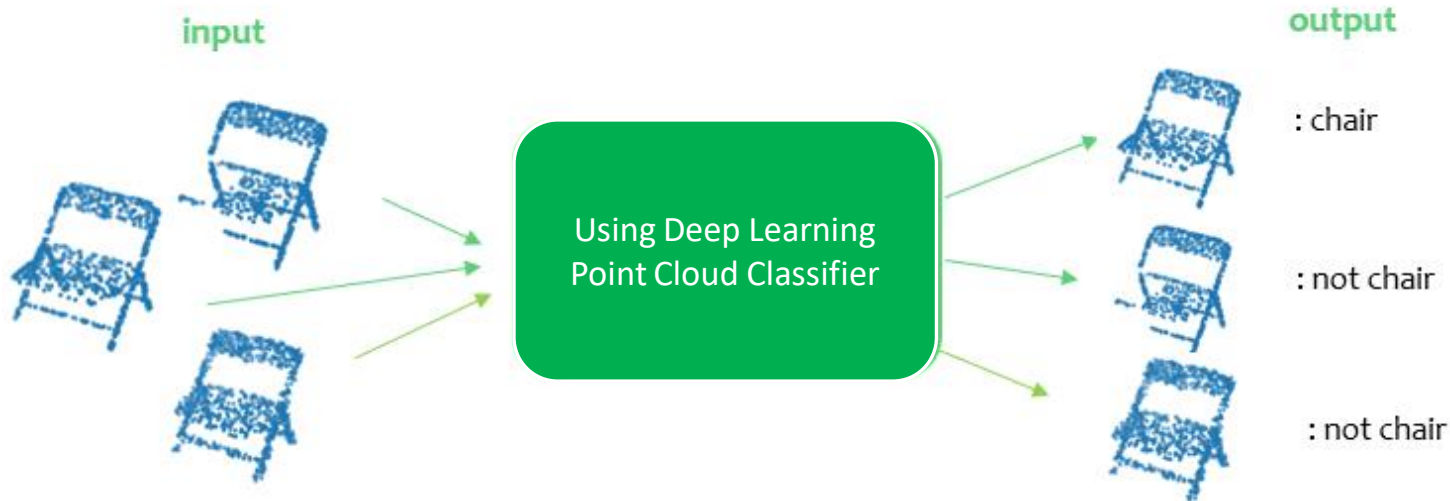
- Combination of each RGB channel to be used
- ROI Location
- Image compression



Heart Rate Estimate
80.9

Ex5: Classification of Point Cloud Data Using Deep Learning

- Utilization of Point Cloud Data
 - Automatic operation, digital twin, etc.
 - Investigation of a learning method that enables classification of incomplete data (data with noise and occlusion) from actual sensors.
- Evaluation of classification accuracy by applying various processing to training data



Let's study together in the network group!

- ✓ **Examples of Research Themes in the NW Field Last Year**
- ✓ Characterization of live distribution of video in MR devices
- ✓ Evaluation of non-contact heart rate estimation accuracy in various situations
- ✓ Examination of adaptive rate control method using Q learning
- ✓ Characterization of live distribution of video in MR devices
- ✓ Evaluation of non-contact heart rate estimation accuracy in various situations
- ✓ Efficient transfer method of sensor information using ICN and its evaluation
- ✓ Evaluation of the accuracy of extended methods that take occlusion into account point cloud classification models