

## Secure and High Performance Data Analytics in HPC/Data Center

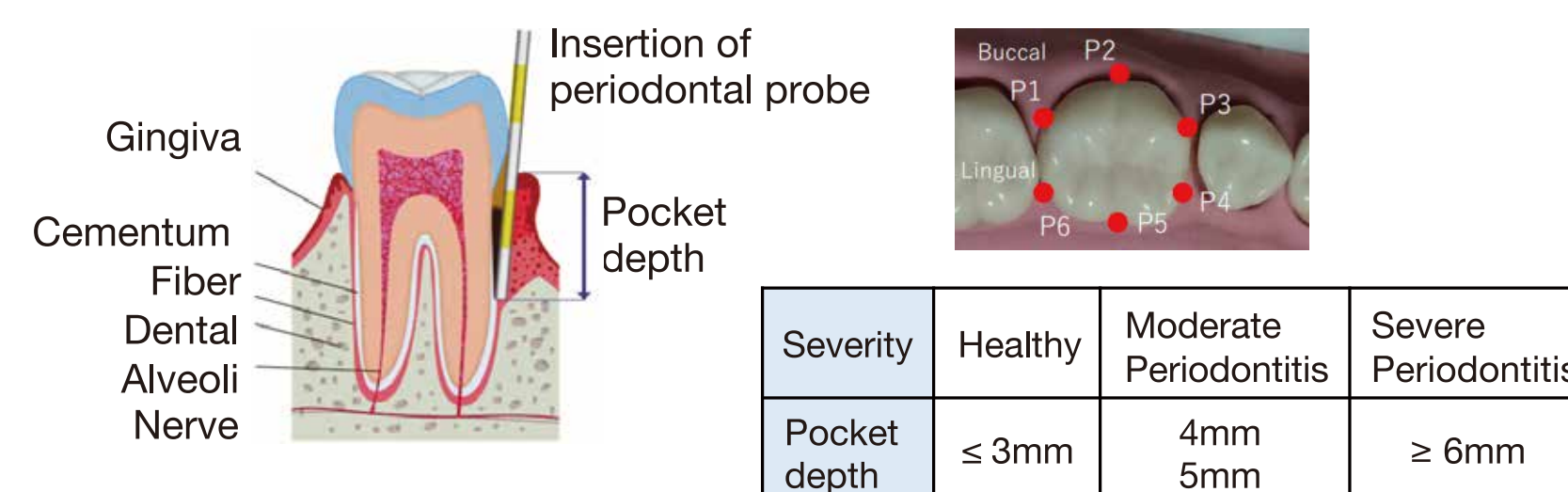
### Data Analytics of Highly Confidential Medical Data

#### Example Application

##### Periodontal pocket depth estimation

- Periodontal disease or Pyorrhea may be a cause of diabetes and stroke. However, it is hard for people to notice the disease in the early stage because an apparent, subjective symptom rarely appears.

- This application facilitates regular self-check of the severity of periodontal disease and urges people to see dentists at the right timing.



##### The proposed model overcomes two difficulties

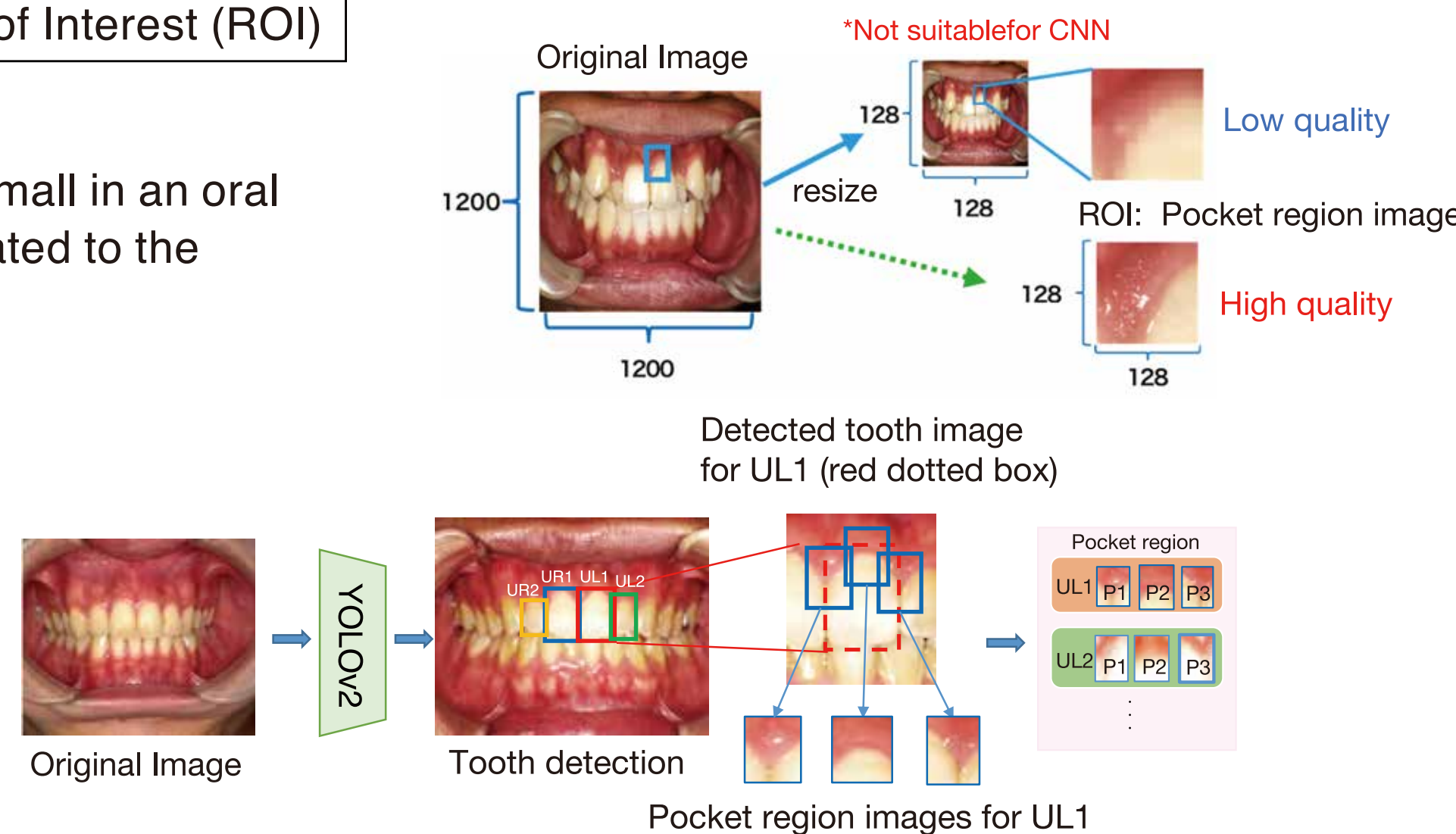
Low quality of Region of Interest (ROI)

##### Problem:

Each pocket region is small in an oral image, the noise unrelated to the estimation is large.

##### Approach:

ROI feature extraction



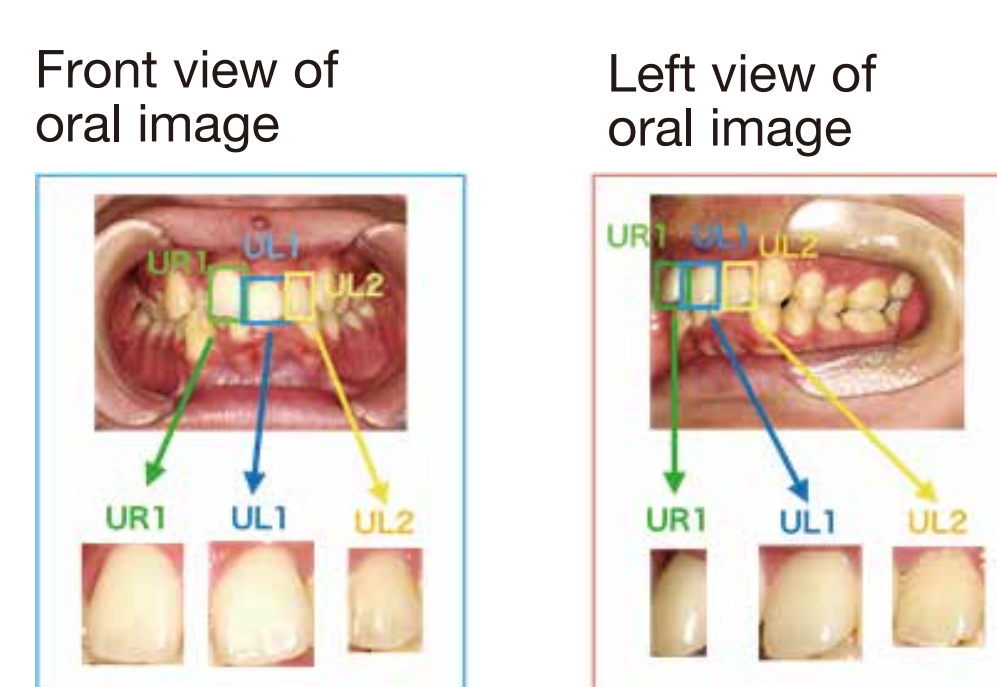
Teeth Heterogeneity

##### Problem:

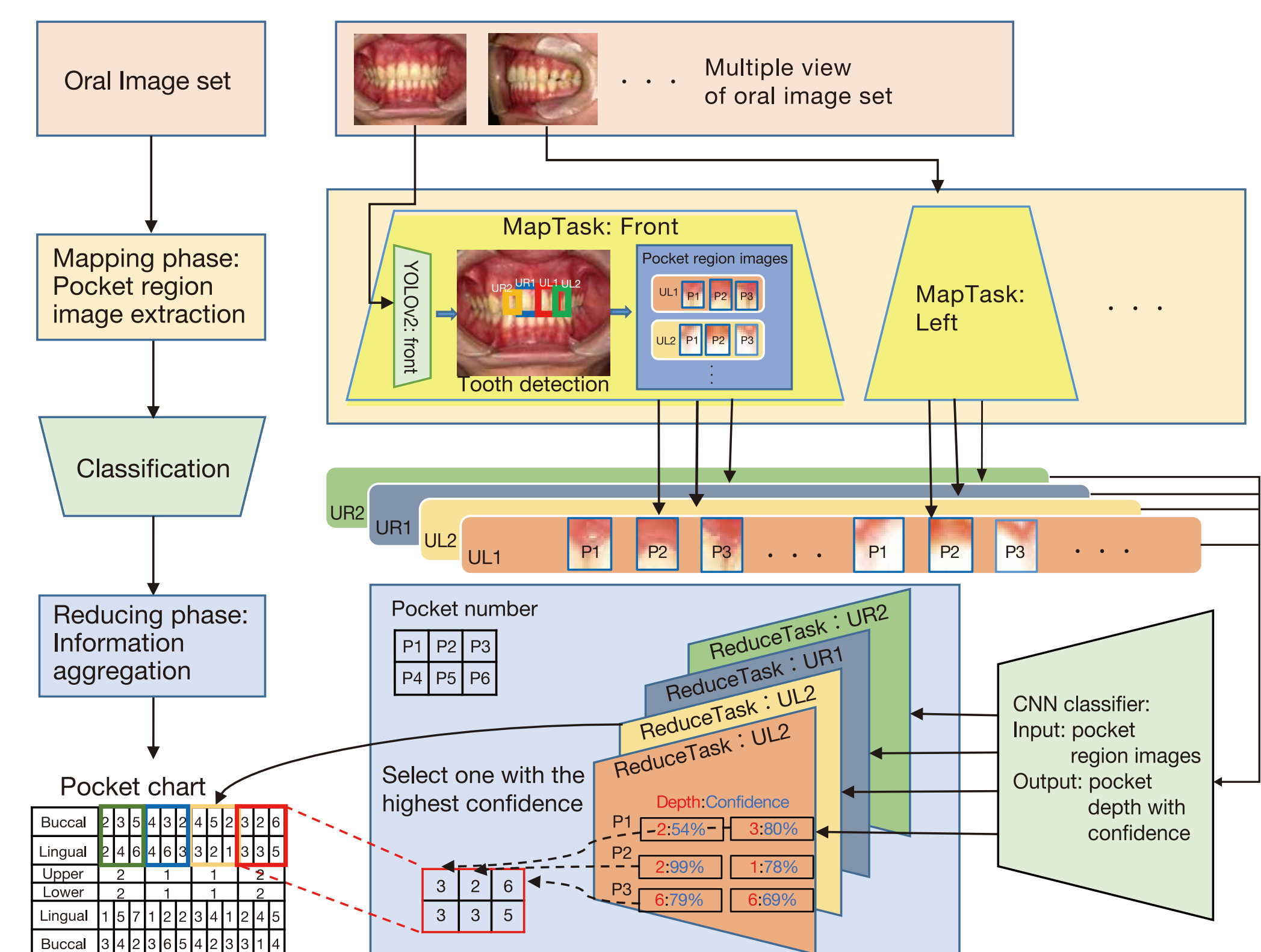
The training dataset contains a set of oral images with different views. It is hard to recognize the identical teeth due to its shape, size, etc.

##### Approach:

Perform the pocket region extraction with respect to each view in parallel.



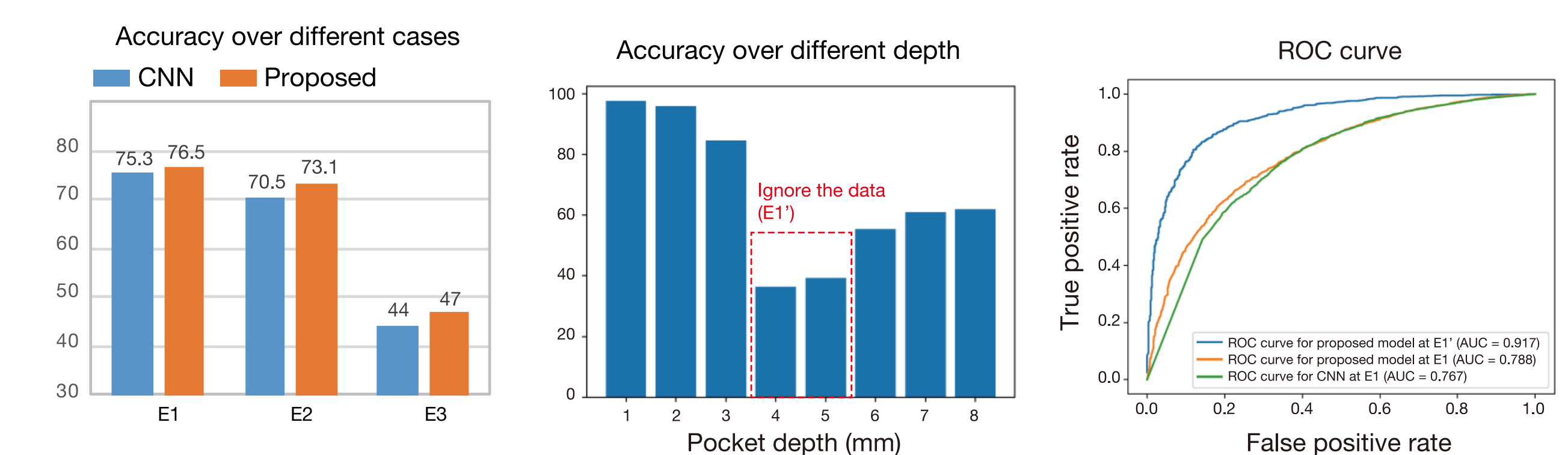
#### Design of the proposed MapReduce-like model



#### Evaluation

##### Experimental settings

- E1: *Screening by 2 stages*, e.g., “Healthy” (3mm or less) and “Unhealthy” (4mm or more).
- E2: *Severity measurement by 3 stages*, e.g., “Healthy” (3mm or less), “Moderate periodontitis” (4mm or 5mm), and “Severe periodontitis” (6mm or more).
- E3: *Depth estimation by 15 stages* (pocket depth in millimeters between 1 and 15mm).

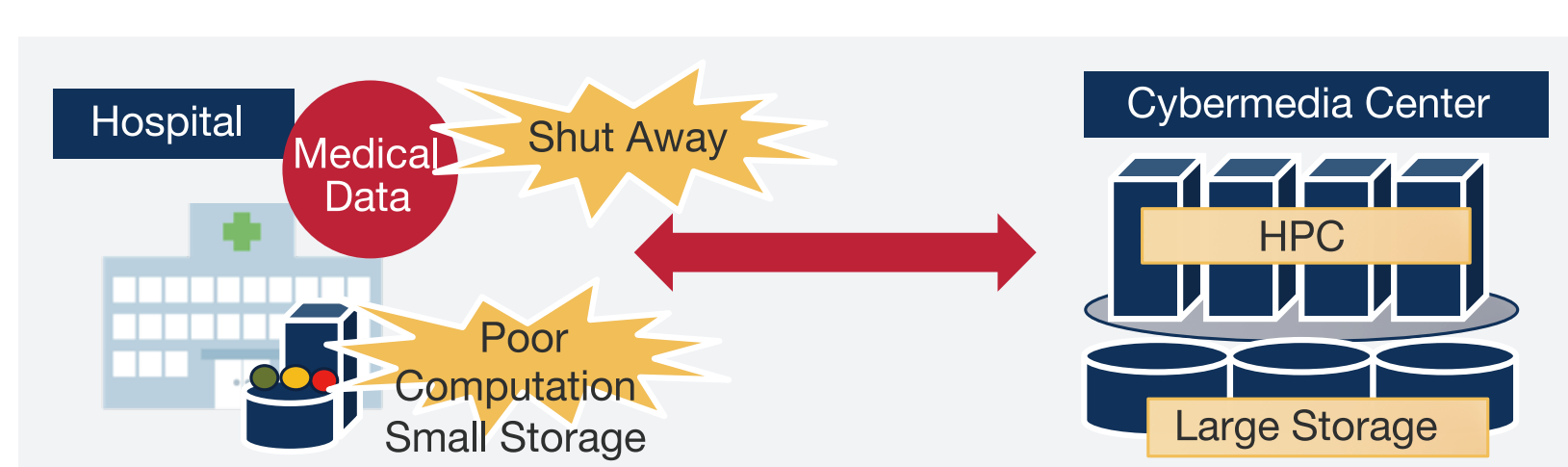


## Dynamic Secure Staging for Processing Highly Confidential Data

#### Problem & Goal

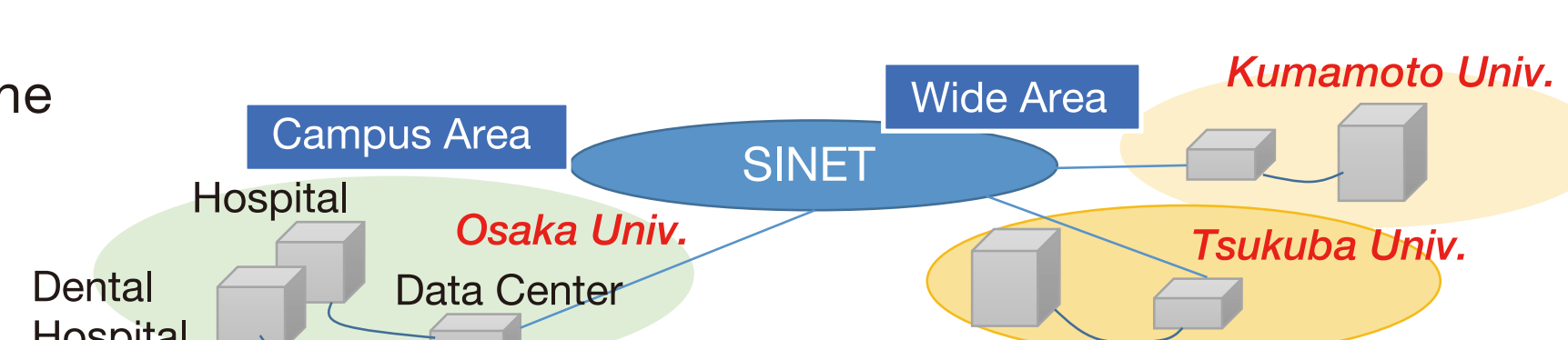
**Problem** Highly confidential data are forbidden to transfer.

- Location of data and processing power are different
- Collecting data from multiple location to make big data is necessary
- However, data transfer suffers from security issues



**Goal** Making use of confidential data in distributed location

- Campus-scale via private line or campus LAN
- Multiple location via inter-university network

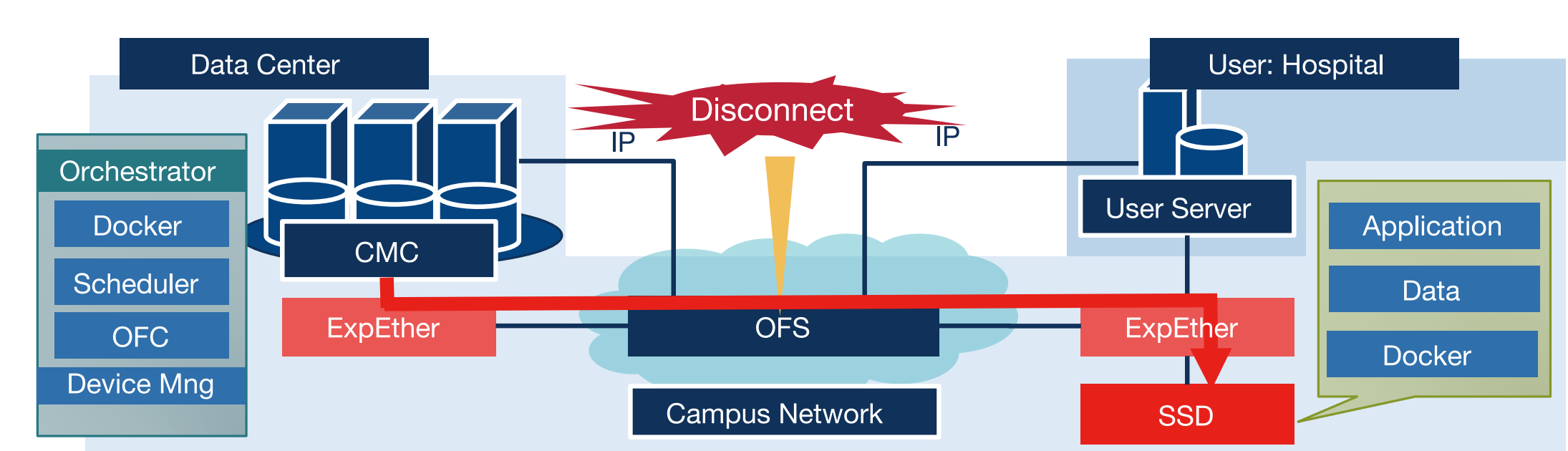


#### Different Location in Campus Area

Managing security level by secure partitioning in multi-layer

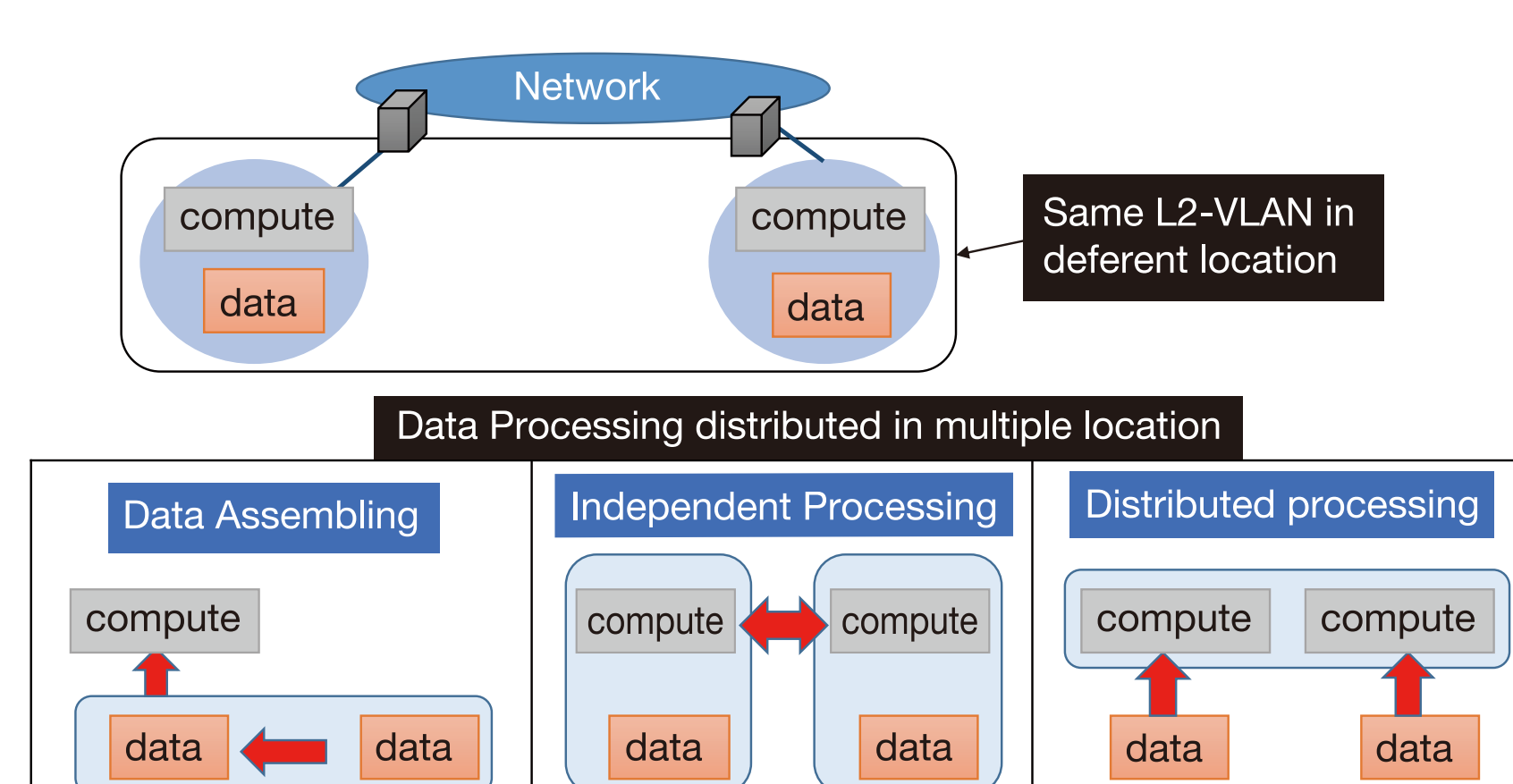
- Data and resource are set in minimum partition and time slot

- Open Flow Controller connects the server in the hospital to the DC.
- SSD w/ data and Docker is PCIe-hot-plugged from hospital to DC machine
- Scheduler run the Docker on the DC machine. Record result on the SSD.
- SSD w/ data and result is PCIe-hot-plugged from DC to hospital machine
- The hospital machine is dis-connected from the DC network



#### Different Location in Wide Area

- Not transfer chunk of raw data as much as possible
- L2-VLAN on Demand



#### Demonstration Setup

- Scheduler kicks resource provisioner w/ network controller.
- Distributed TensorFlow runs using workers and data on both location.

