D3 CENTER
Digital design, Datability, Decision intelligence

Cybermedia Center
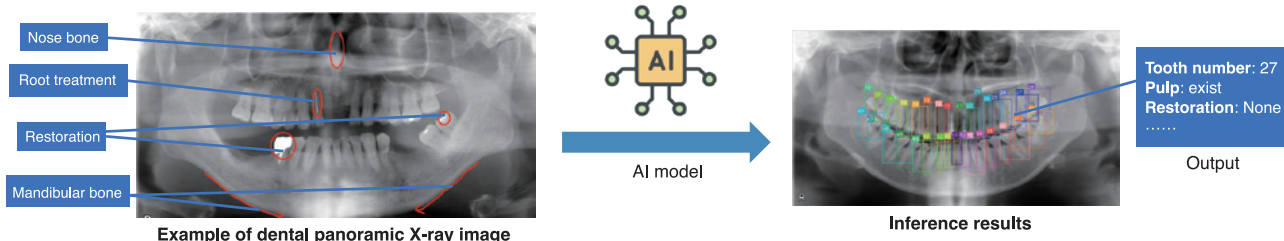### Osaka University, Japan

BOOTH 4049

Advanced High-Performance Computing Infrastructure Systems Research Division

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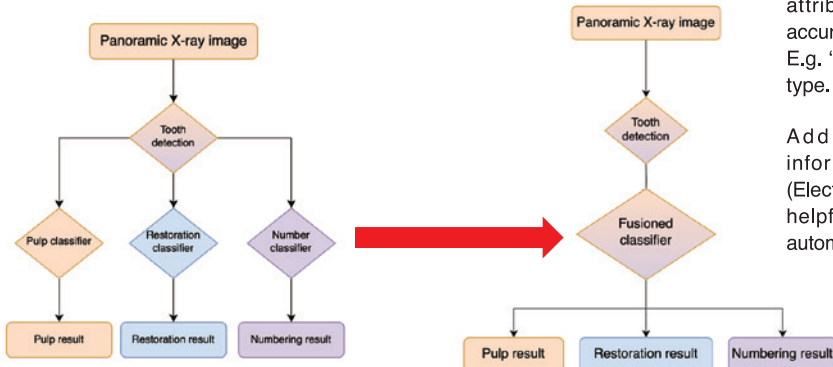## Development of AI models for analyzing dental panoramic radiographs

Background

Panoramic X-rays are commonly used in dental diagnosis. Panoramic X-ray images provide comprehensive oral information for assessing various dental conditions and pathologies. Automatically extracting tooth information (tooth number, pulp condition, restoration type etc.) from panoramic X-ray images is expected to assist diagnosis.

Nose bone
Root treatment
Restoration
Mandibular bone

Example of dental panoramic X-ray image

AI model

AI model

Tooth number: 27
Pulp: exist
Restoration: None
......

Output

Inference results

Proposal

We employed the SOTA object detection model **YOLOv8** for basic tooth detection. For each tooth attribute (tooth number, pulp condition, restoration type), different classifiers were adopted. Teeth were detected by YOLOv8, and then the detected teeth images were input into different classifiers.

Panoramic X-ray image
Tooth detection
Pulp classifier — Pulp result
Restoration classifier — Restoration result
Number classifier — Numbering result

Panoramic X-ray image
Tooth detection
Fusioned classifier
Pulp result | Restoration result | Numbering result

Future work

Separated classifiers cost **numerous computational resources** and **time.** Fusing multiple classifiers can be considered to reduce the computational cost and improve the efficiency of analyzing panoramic X-ray images.

Leveraging the relationship among different tooth attributes is expected to improve the classification accuracy.
E.g. 'teeth without pulp' must belong to one restoration type.

Additionally, combining the information extracted from EMR (Electronic Medical Records) can be helpful to improve the integrity of automatic analysis.
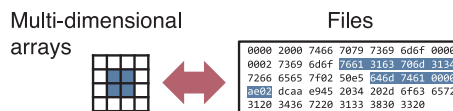
EMR information

We are going to process over 300,000 panoramic X-ray images and combine them with EMR information through **LLM** for further analysis on **SQUID.**

Toward a distributed scientific data exchange for exploratory data analysis

Background

· Traditional scientific data infrastructures have been file-based.
· However, in exploratory and interactive data analysis,
  · Only portions of the file might be needed for interactive analysis.
  · Reduced quality might be acceptable for preliminary exploration.

Multi-dimensional arrays

Files

```
0000 2000 7466 7079 7369 6d6f 0000
0002 7369 6d6f 7661 3163 706d 3134
7266 6565 7f02 50e5 646d 7461 0000
ac02 dcaa e945 2034 202d 6f63 6572
3120 3436 7220 3133 3830 3320
```

Mismatch of data repsentations

Goal

We aim to develop the key technologies for a **scientific data exchange** system that enables efficient, **on-demand data transfer across distributed computing resources**, with **adaptive quality** and resolution to match diverse analytical needs.

Site A
Server
Arrays
Cloud
Server
Arrays
Site B
Requests
Wide-Area Network
User
Subarrays
Client
Server
Arrays
Site C

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