AI Application of Cardiovascular Imaging

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Disclosure

- Jihoon Kweon, PhD

    - Consultant of Medipixel Corp.

Topics

1. Database for AI: A-ICAnet

2. AI-AI integration: Post-PCI evaluation of stent expansion

3. AI technical advance: General AI for cardiovascular imaging

Topics

1. **Database for AI: A-ICAnet**

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AI-QCA

MPXA-2000B (Medipixel Inc.)

- AI trained with about 10k patients' data
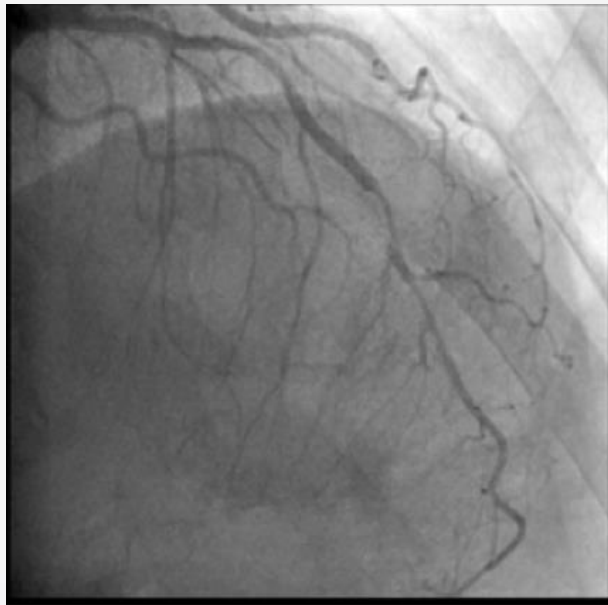- Dataset used for learning reflect the real patient pool

⬇

- **Challenges for better robustness using larger database**
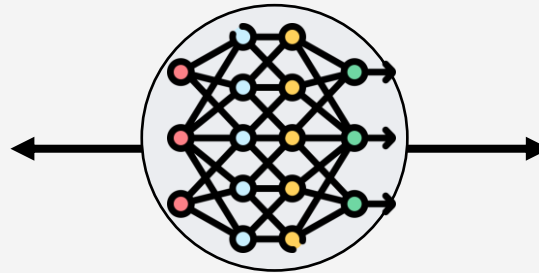
A-ICAnet

A large-scale coronary angiography database

• **Asan invasive coronary angiography network**

current: 3M frames
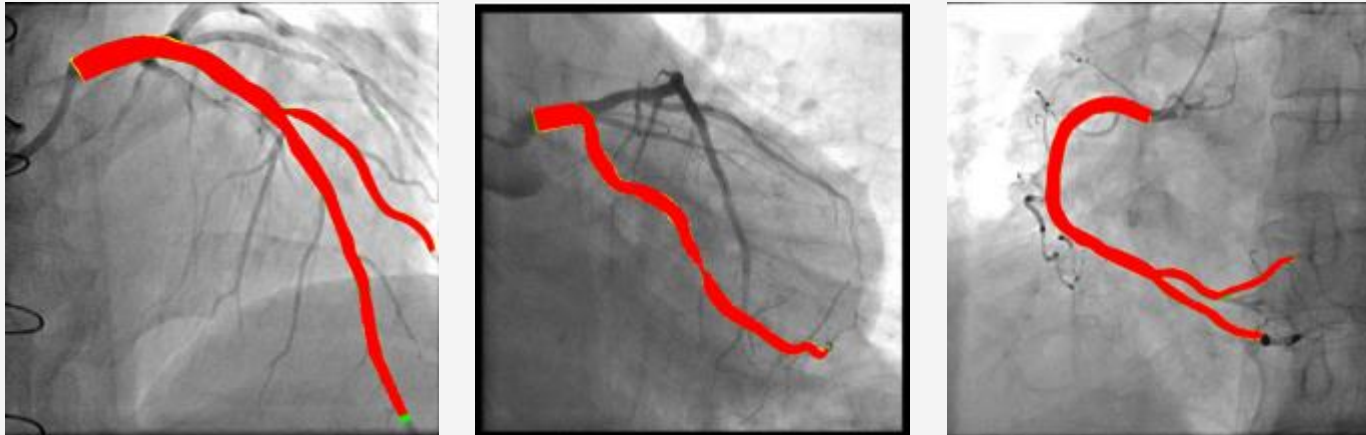**future: 100M+ frames**

Unsupervised
learning

Trained to
estimated missing
information

Better performance with A-ICAnet

Initial weight to accelerate training and improve training

- AI prediction examples for major vessels

- **Using A-ICAnet, the F1 score has improved by 2% in average (vs ImageNet).**

- Applications
  - Spider view
  - Catheter
  - Guidewire
  - Stent

$\rightarrow$ **Support for human and robotic intervention**

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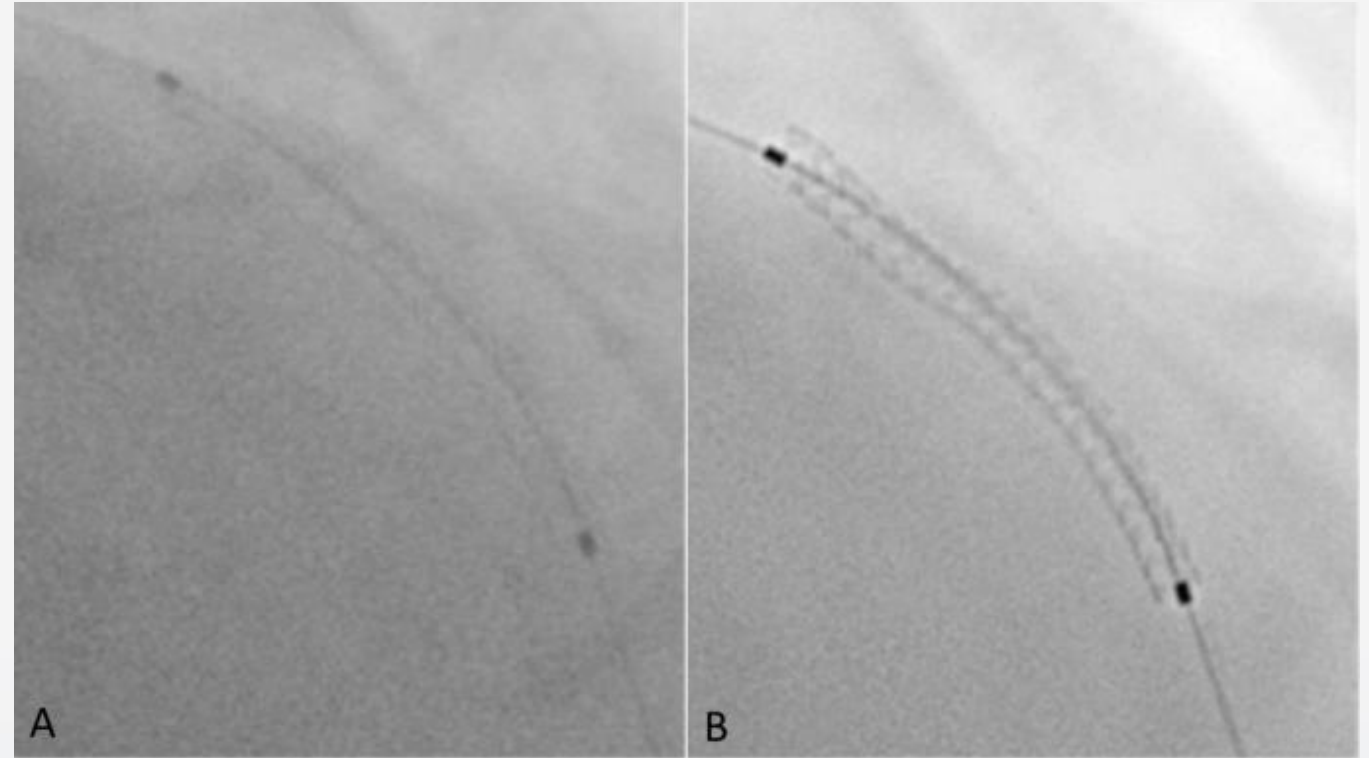
Post-PCI Evaluation using Stent Enhancement

Evaluation of stent expansion

3Dstent
(Collet, EuroPCR2023)
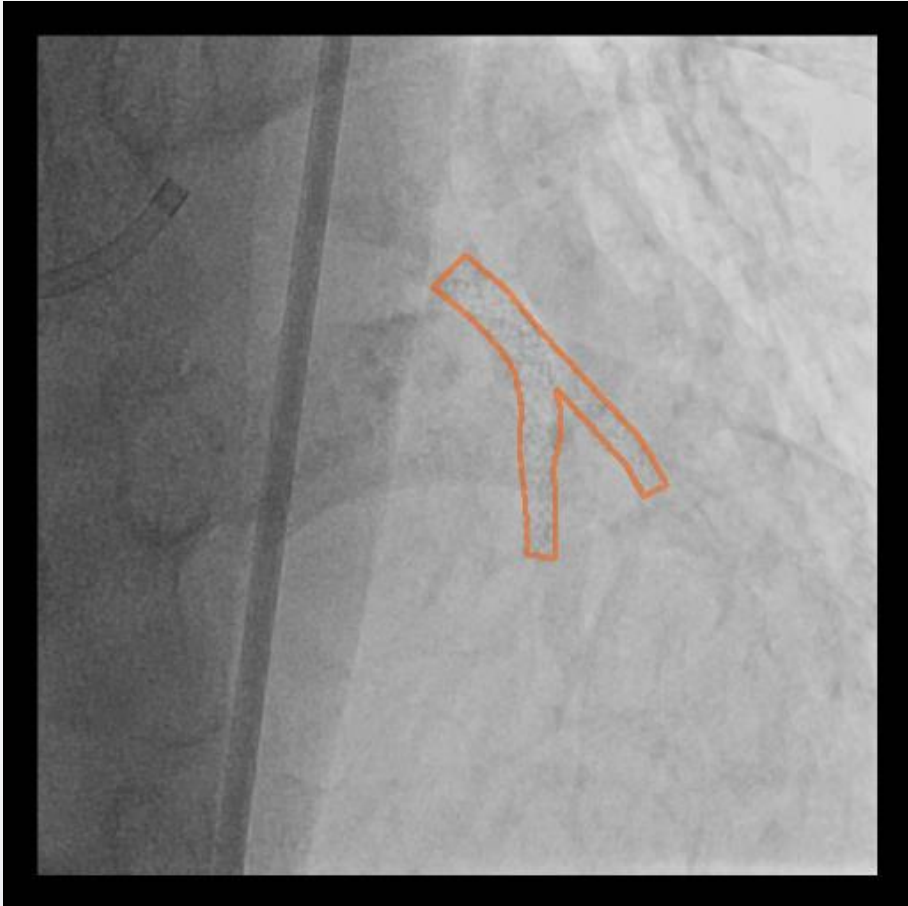

StentBoost
(Mansour et al, 2023, Int. J. Card. Imaging)

Semi-automatic analysis

Manual reference setting with AI-QCA
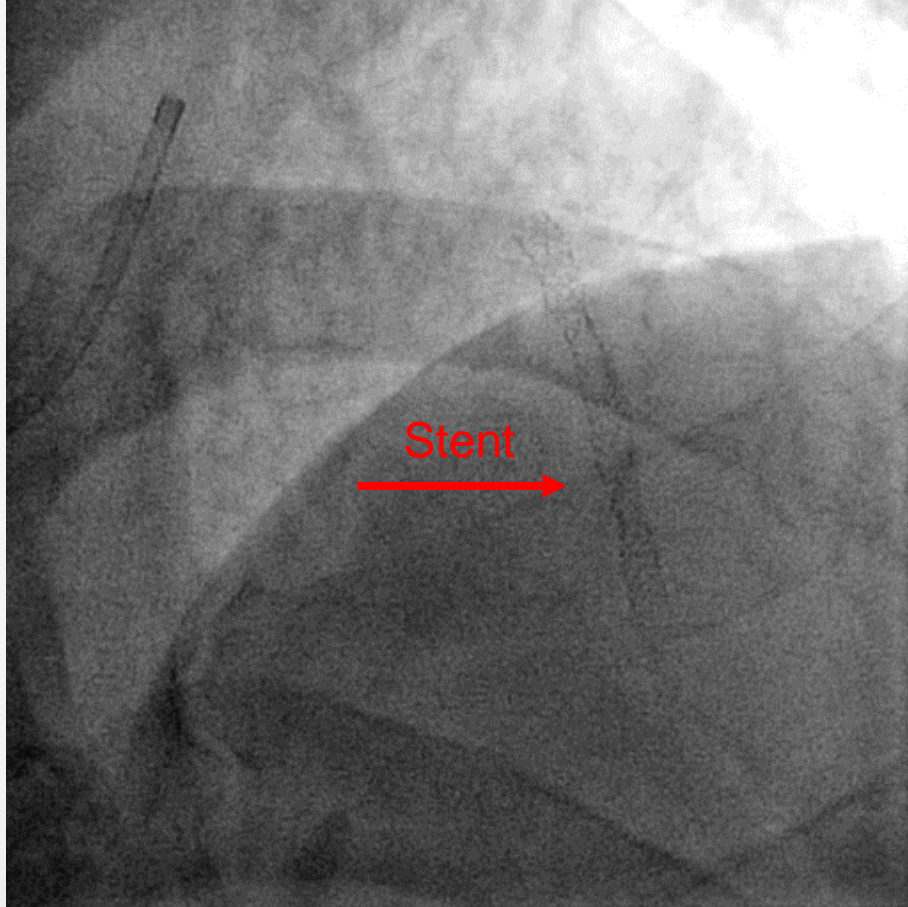
Stent Segmentation in Fluoroscopy
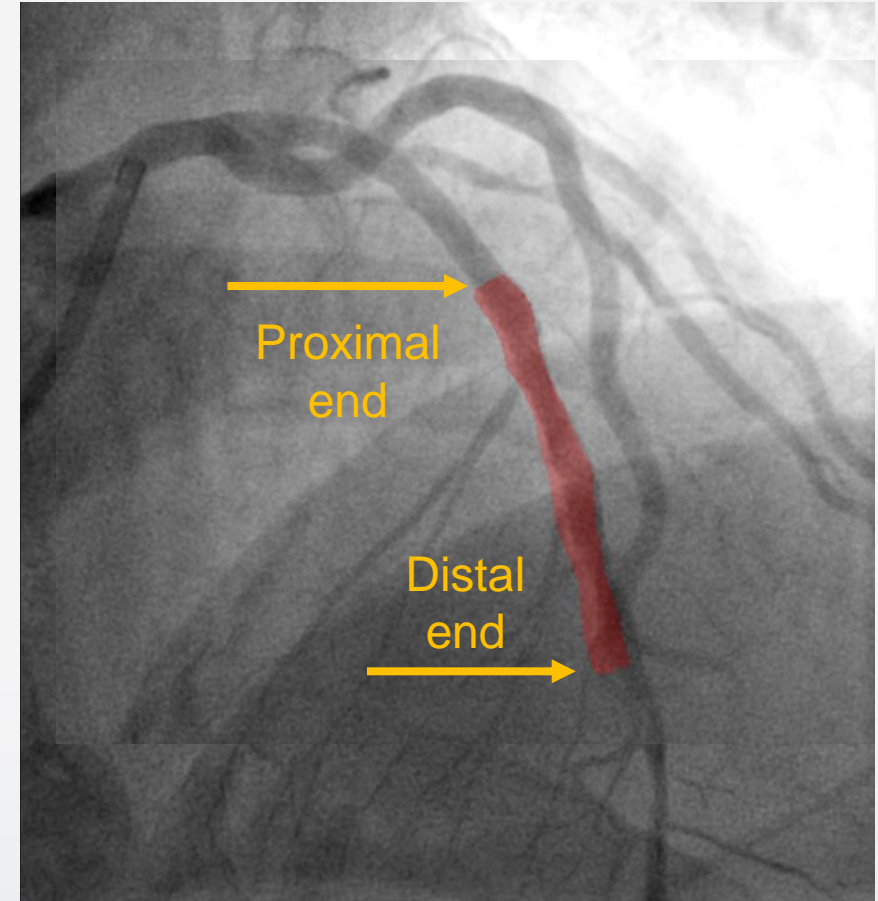
AI model training

- Study population
  - 1044 images from 880 patients (Male 662)
  - Single site (Asan Medical Center)
  - RCA 301, LAD 559, LCX 184

- Labeling
  - Manual labeling using ImageJ
  - 3 radiographers with over 10 years of experience

- Deep learning
  - Ensemble of 3 prediction models
  - **F1 score = 88%**

CVRF

Stent Segmentation Integrated with AI-QCA
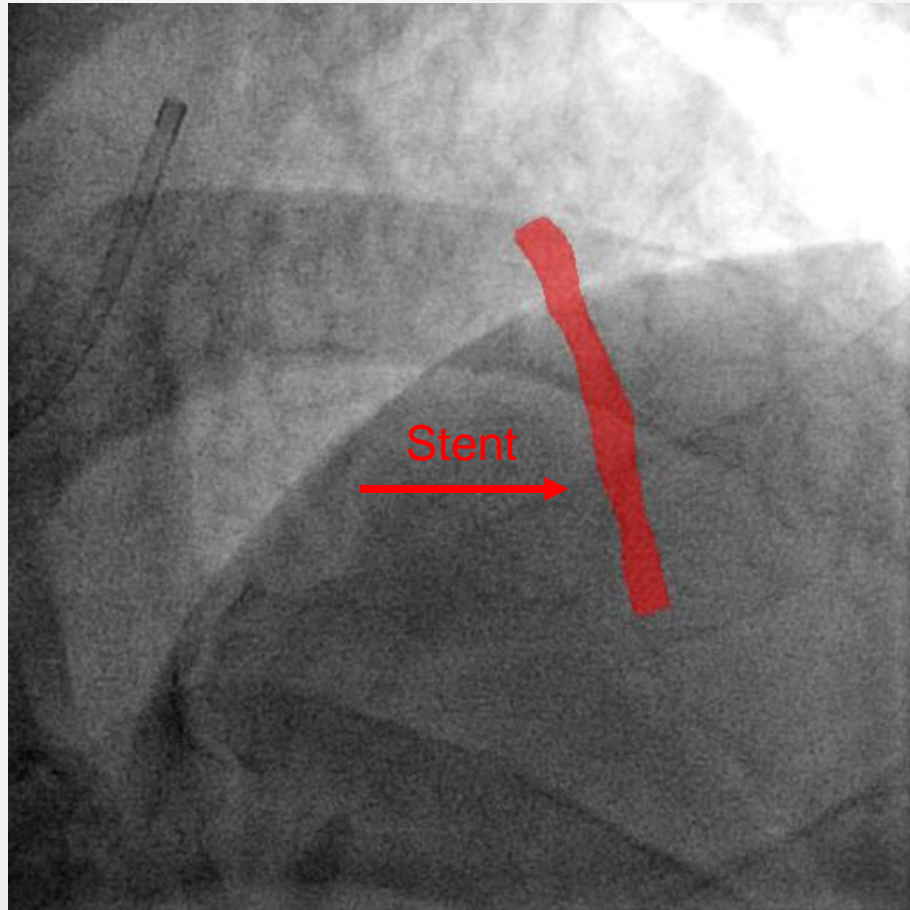
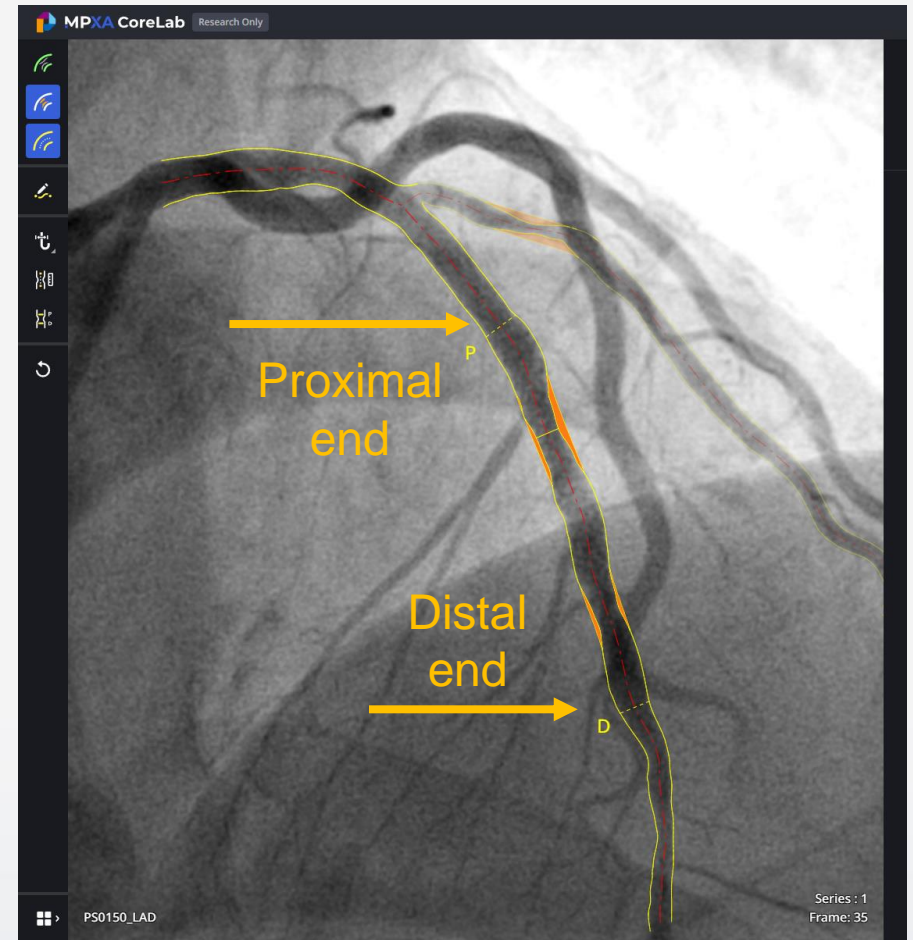*Stent segmentation and registration to angiography*

Stent Segmentation Integrated with AI-QCA

AI-QCA application

Quantitative analysis
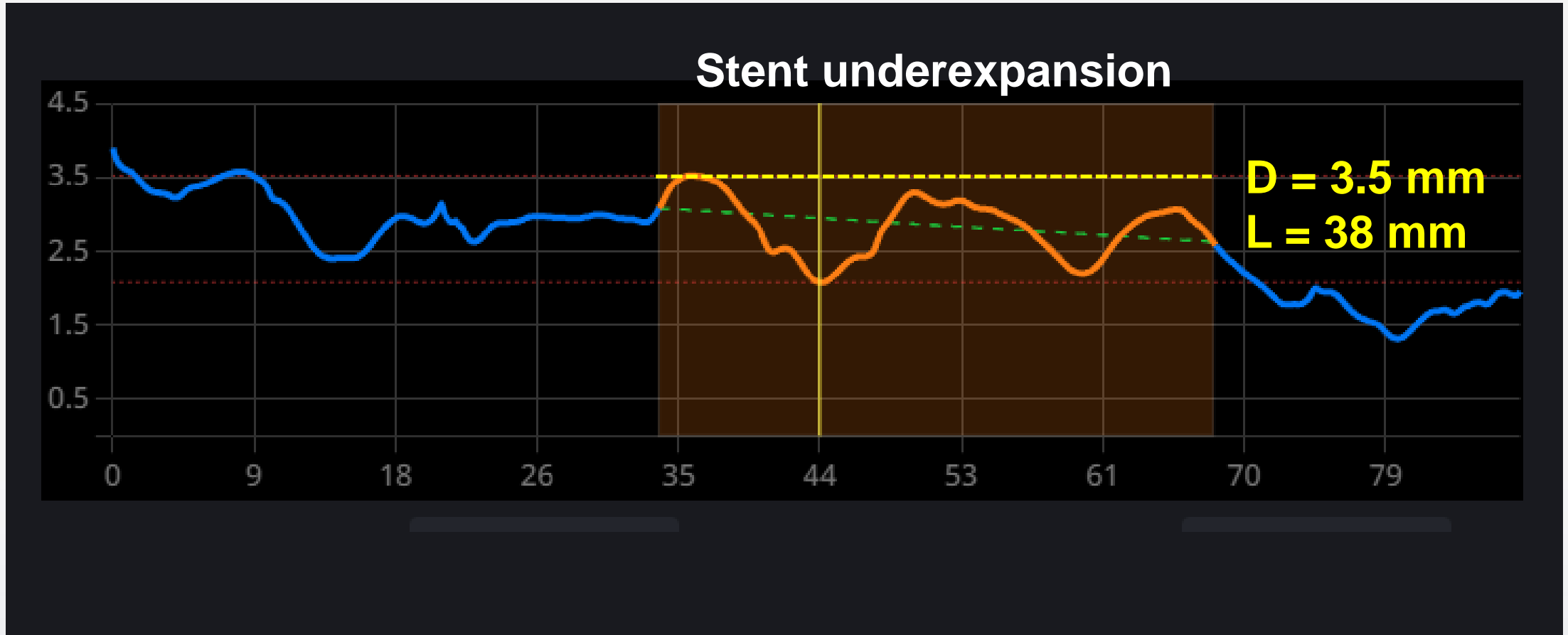
Comparison with stent size

Stent underexpansion

D = 3.5 mm
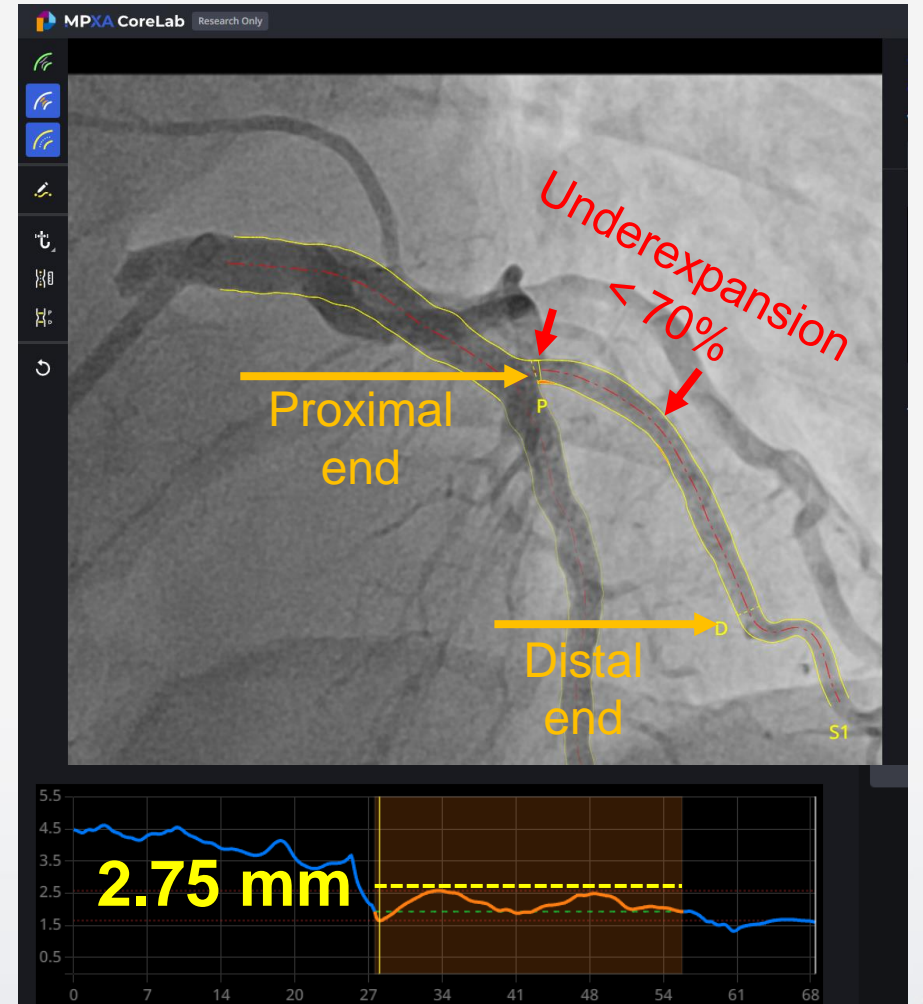L = 38 mm

Bifurcation Stenting
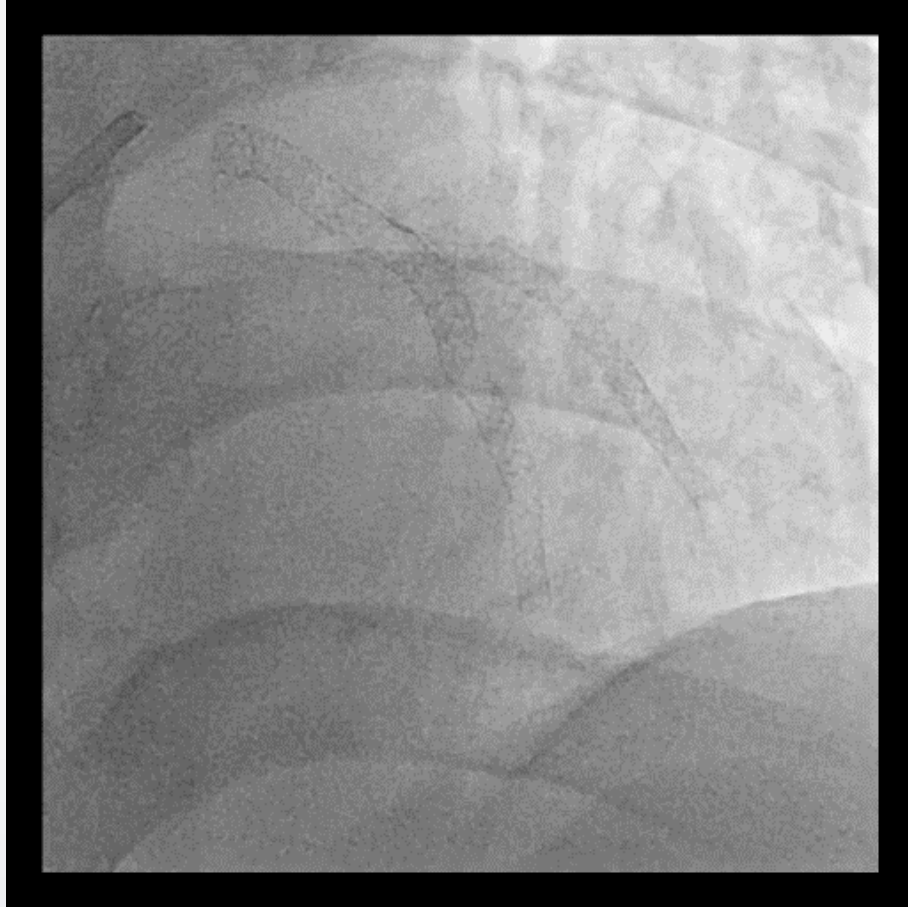
Mapping onto angiography

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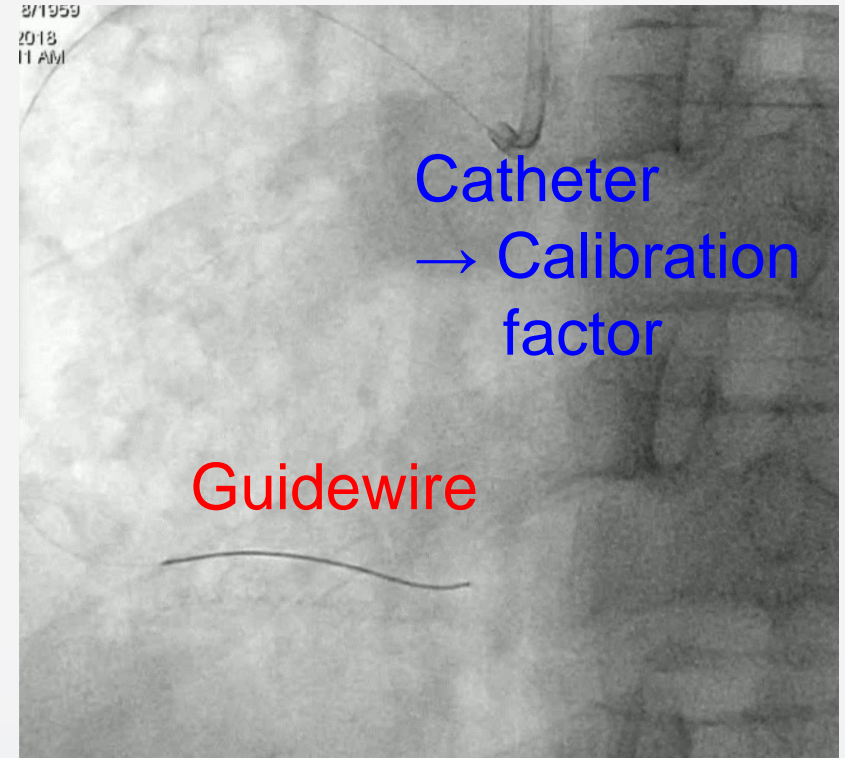3. **AI technical advance: General AI for cardiovascular imaging**

Application of General AI

No labeling, No training, No tuning

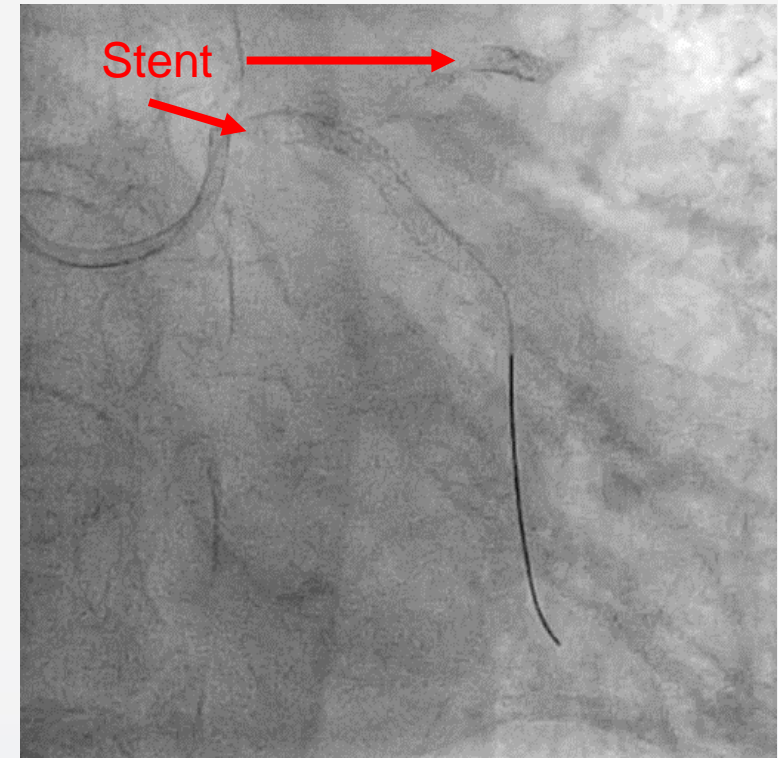SAM (Segment Anything Model) by Meta

Segment with a click

Application of General AI

No labeling, No training, No tuning

co-tracker by Meta

Stent tracking

Conclusion

- **A-ICAnet:** A large-scale coronary angiography database was built for the development of ICA-based AI technology.

- A fully-automated evaluation of stent expansion was developed by integrating stent segmentation with AI-QCA.

- Advancements in general AI technology will support the AI development dedicated for cardiovascular intervention.

Thank you for your attention