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Cost-Effective AI for Health

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Cost-Effective AI for Health

A bottleneck in clinical AI is the expensive cost of equipment, data, and compute.

e.g., the expensive digital tissue scanner a local hospital does not have,
the excessive compute a local clinical research lab cannot afford

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Cost-Effective AI for Health

A **bottleneck** in clinical AI is the expensive cost of equipment, data, and compute.

How to develop **cost-effective AI-for-health** algorithms to work around this bottleneck?

A representative set of **practical use-inspired studies**

Colorectal Pathology Classification	Whole-Slide Image (WSI) Summary

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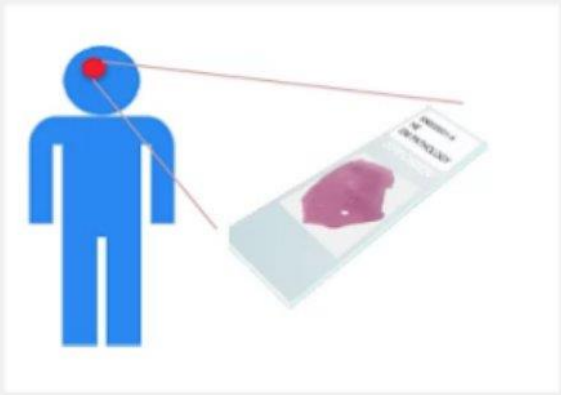
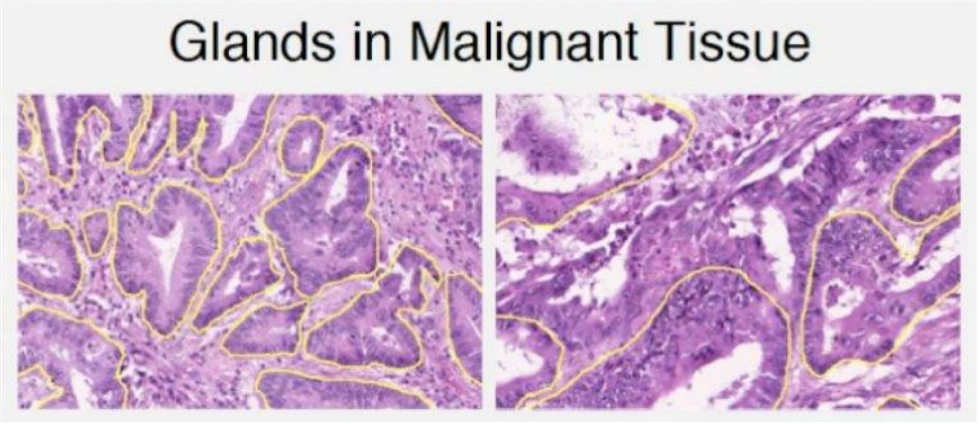
Colorectal Pathology Classification

Cancer Diagnosis and Prognosis





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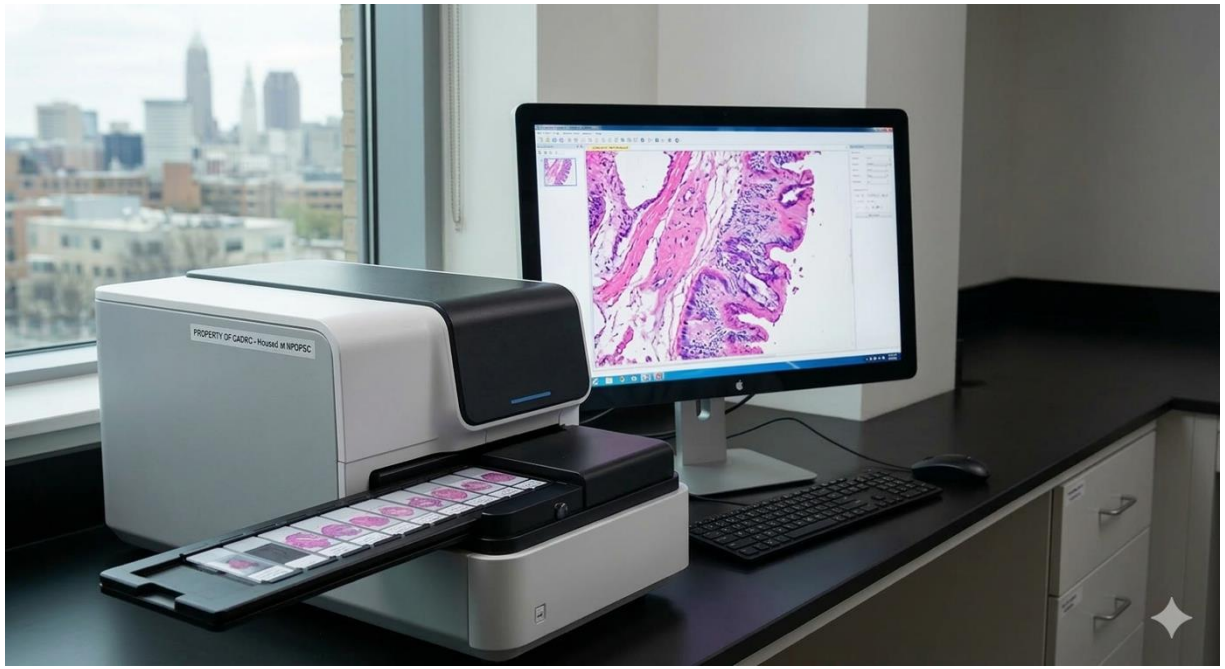
Colorectal Pathology Classification

AI approach:

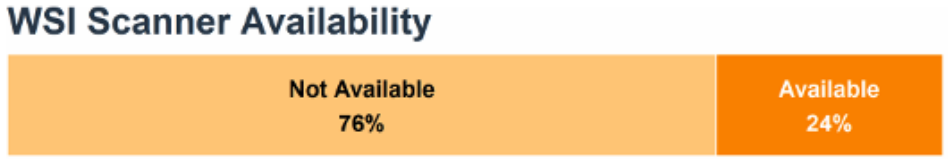
Tissue ➡ digital scanner ➡ whole-slide image (WSI) ➡ AI models ➡ prediction



high-resolution whole-slide image (WSI)

Highly effective but expensive (equipment-wise)

Standard in large centers,
but rare in rural facilities
developing countries



(among clinical centers in Vietnam)

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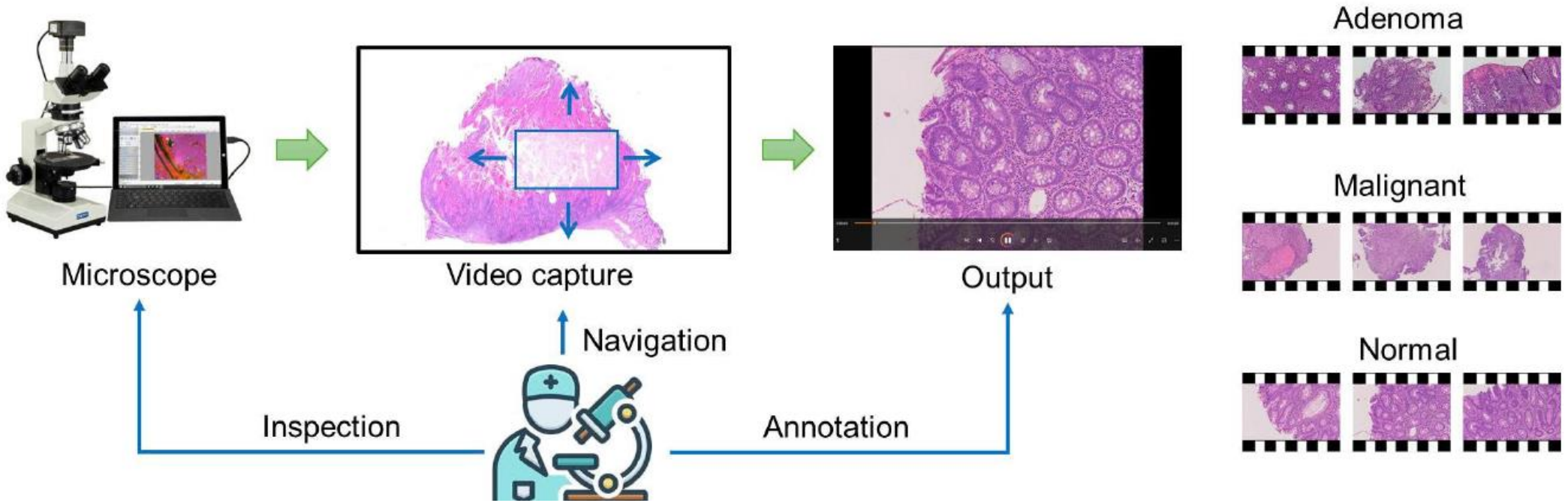
Colorectal Pathology Classification

Manual workflow: Clinicians inspect patch by patch with a microscope



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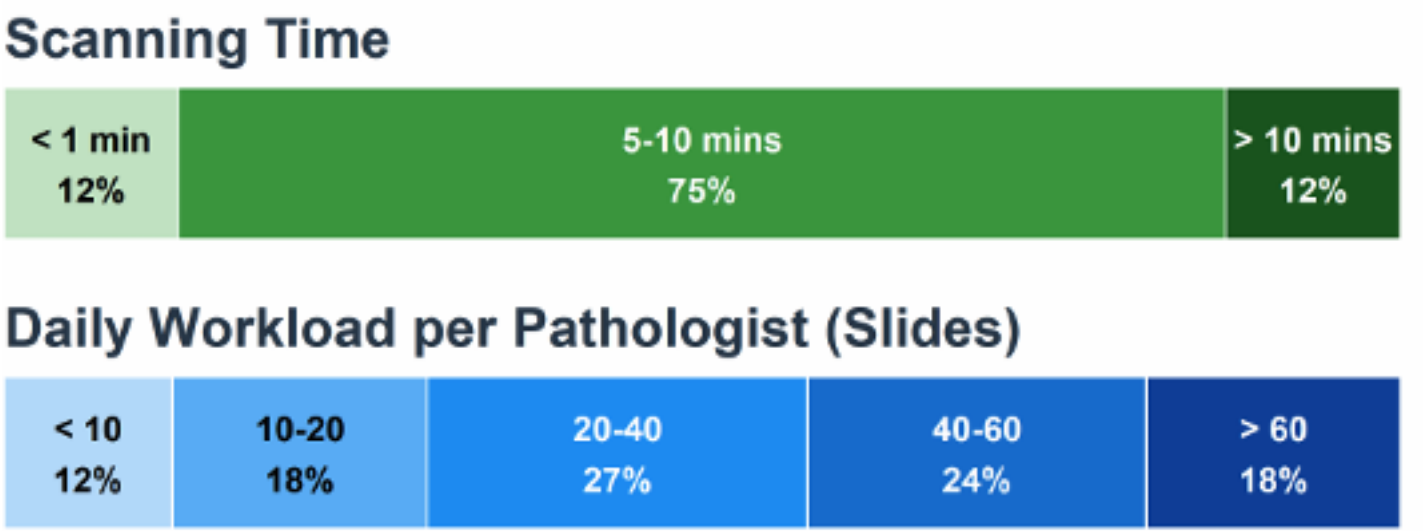
Colorectal Pathology Classification

Manual workflow: Clinicians inspect patch by patch with a microscope

More affordable (equipment-wise) but slow, human-labor intensive



survey across a diverse population of pathologists (seniority, age, locations) across hospitals in Vietnam

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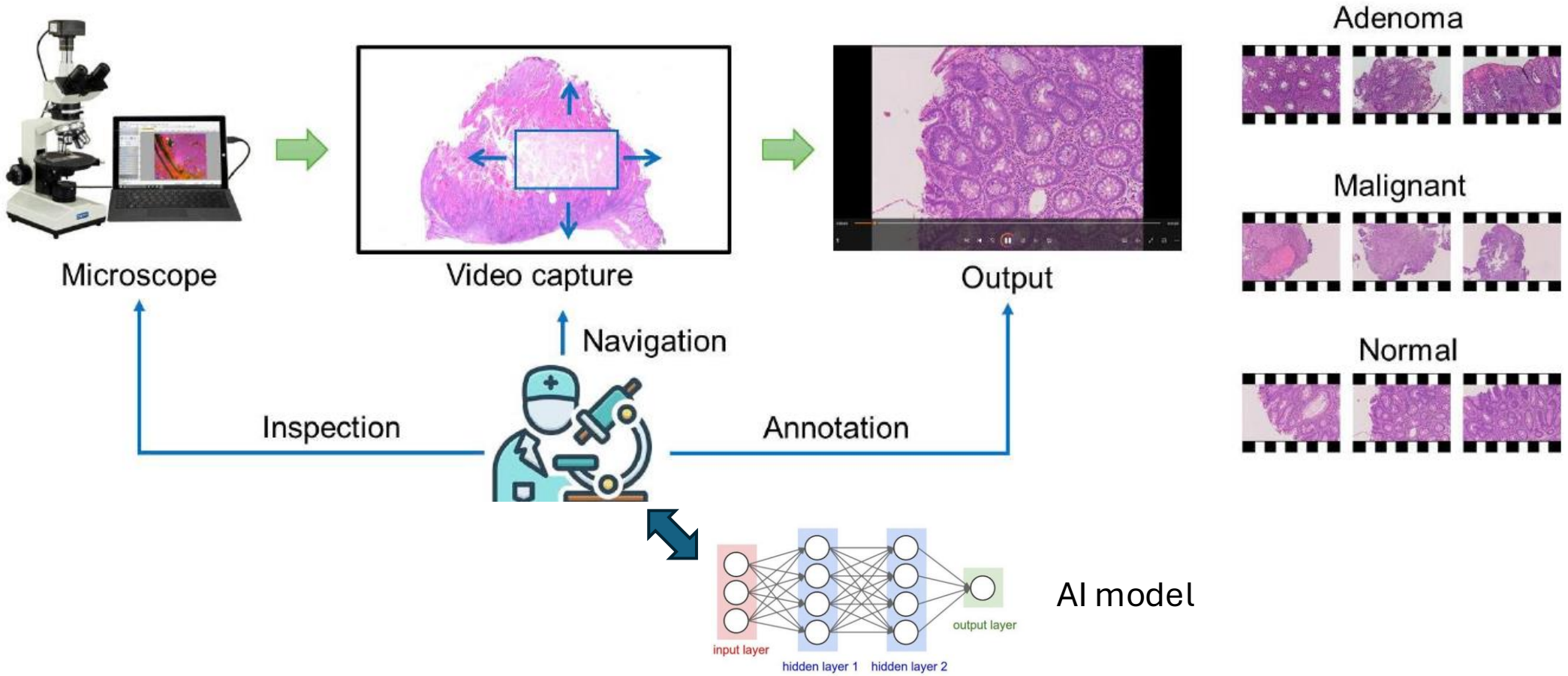
Colorectal Pathology Classification

How do we use AI to automate (speed up) this manual microscopic workflow?



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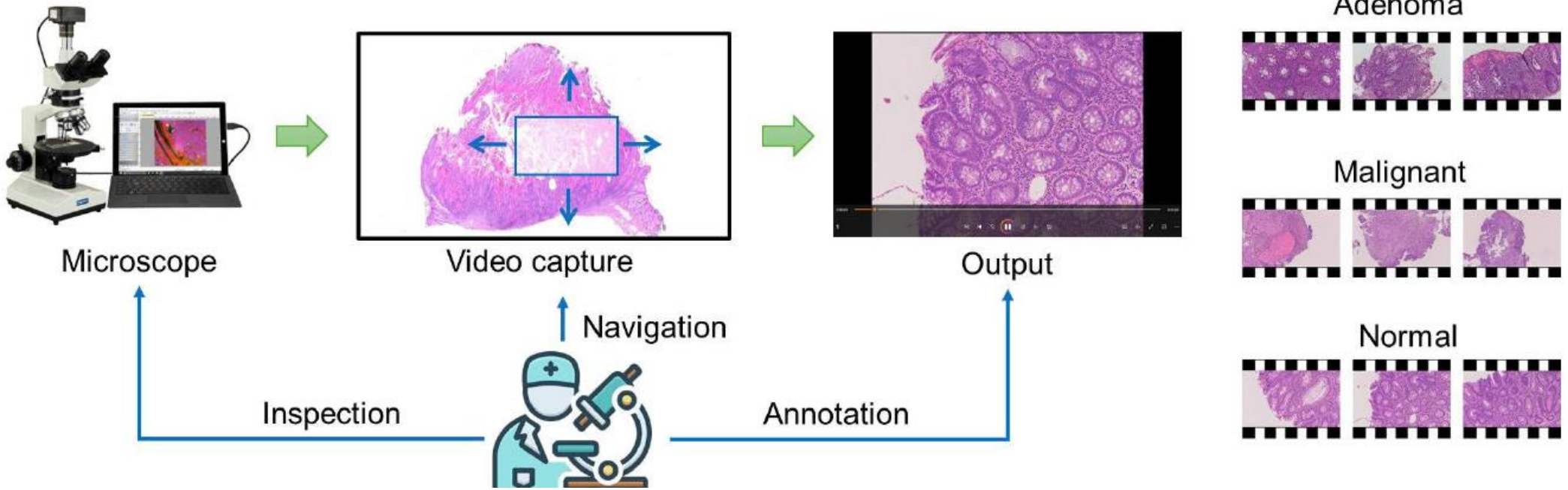
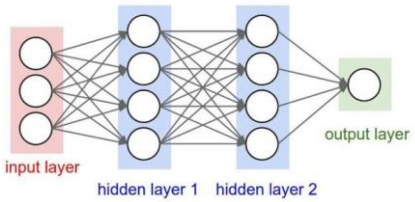
A pathologist already navigate the tissue slides on a microscope with camera attached
We can collect the video feed to teach AI how to navigate microscopic video



Data: 7 hospitals, 43 hours of footage
1379 videos, 3 labels



AI model

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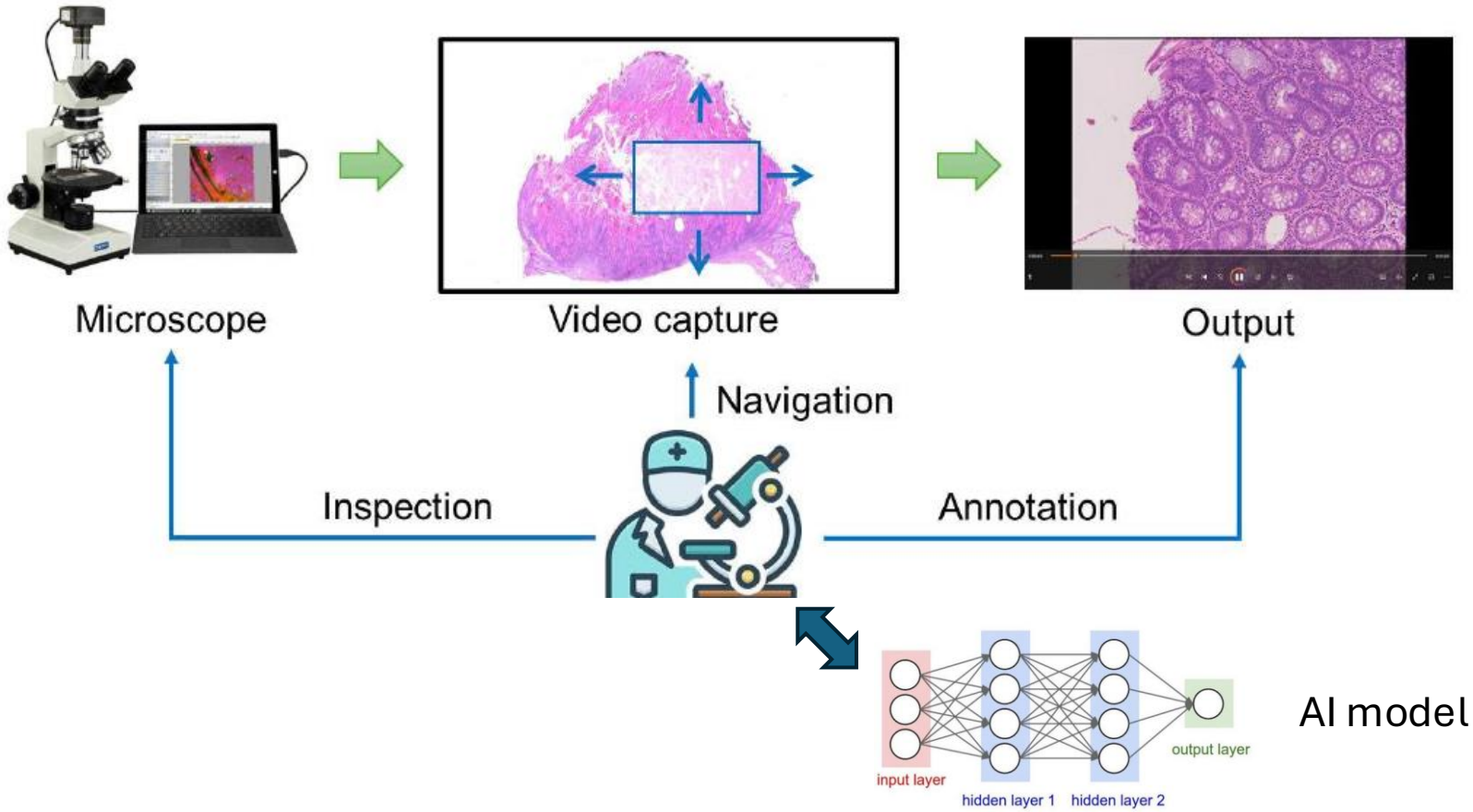
Colorectal Pathology Classification



91.9%
accuracy on the held-out benchmark

92%
accuracy in hospital deployment

~50%
reduction in review time

2–5 min
per case, end to end (was 5–10 min)

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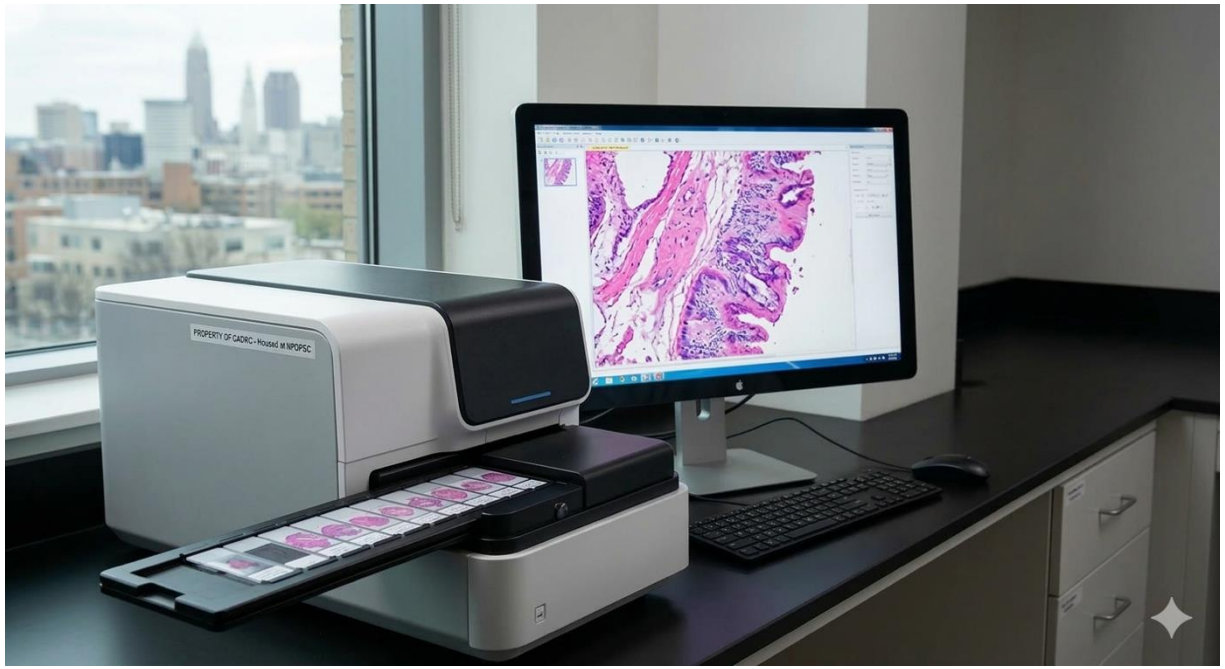
Whole-Slide Image Summarization

AI approach: Even with scanner, inputting WSI into AI models is difficult

Tissue ➡ digital scanner ➡ whole-slide image (WSI) ➡ AI models ➡ prediction



high-resolution whole-slide image (WSI)

1 WSI is 100000 x 100000 pixels

In HDR, 1 pixel requires 6 bytes

1 WSI = 55.8GB – huge size!

No AI model can afford this input bandwidth

➡ Need to summarize

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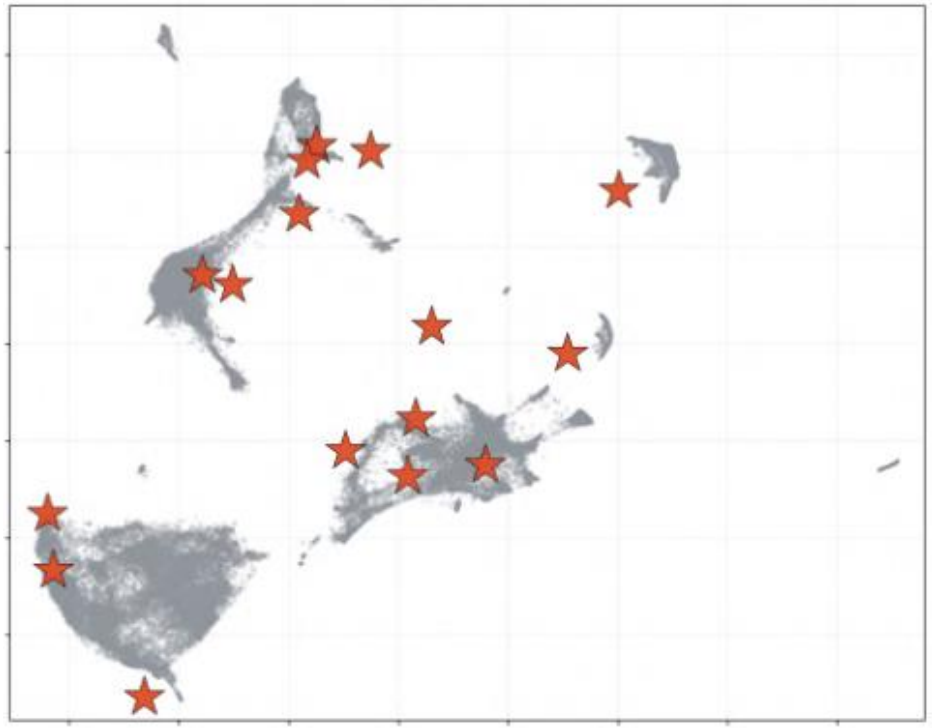
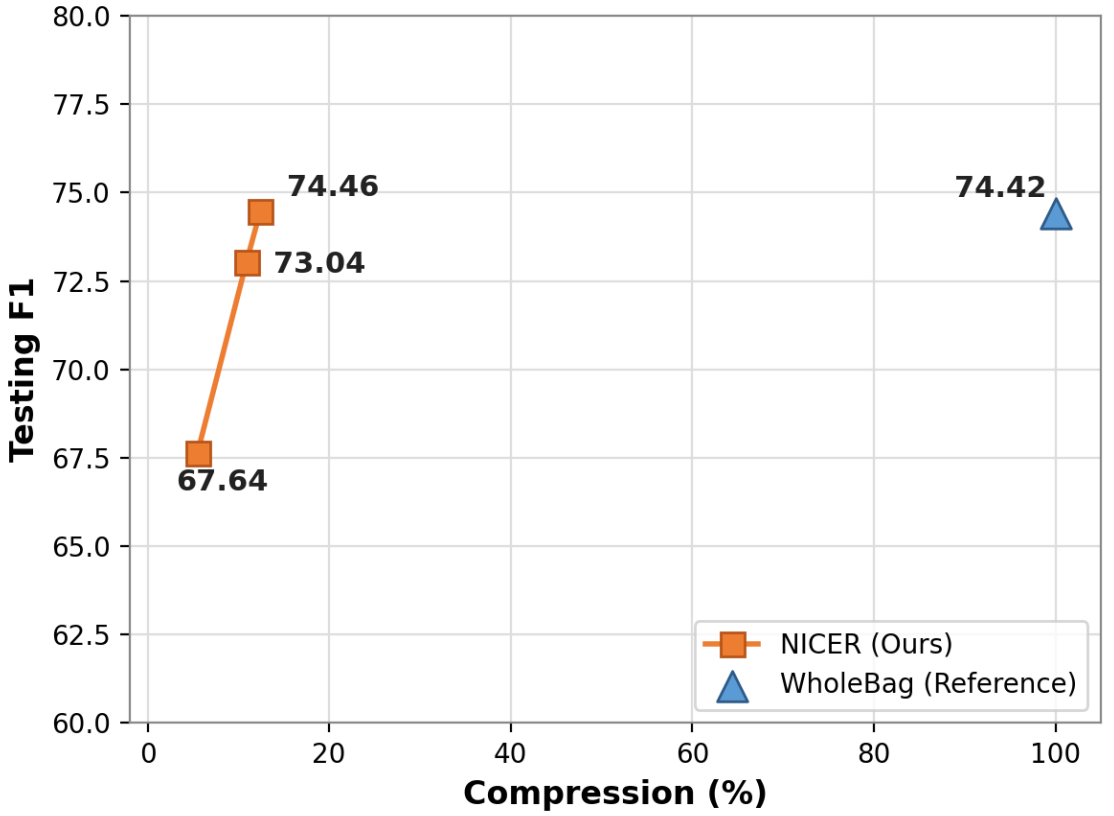
Whole-Slide Image Summarization

Divide a WSI into a large set of raw patches.
Condense them into a smaller set ➡ AI model will process this smaller set.



2D embeddings raw patches



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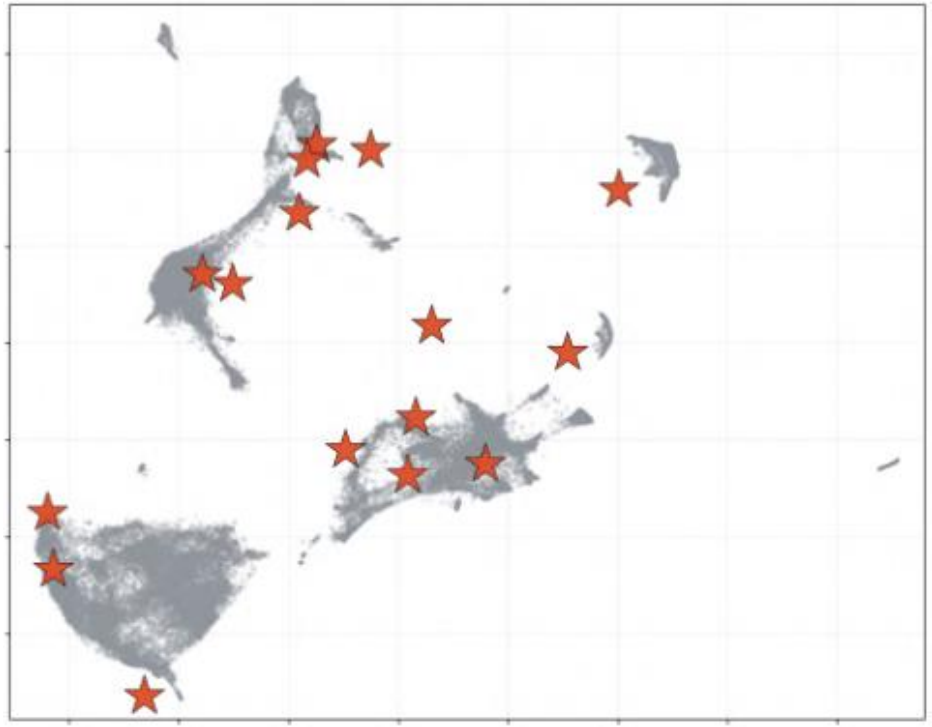
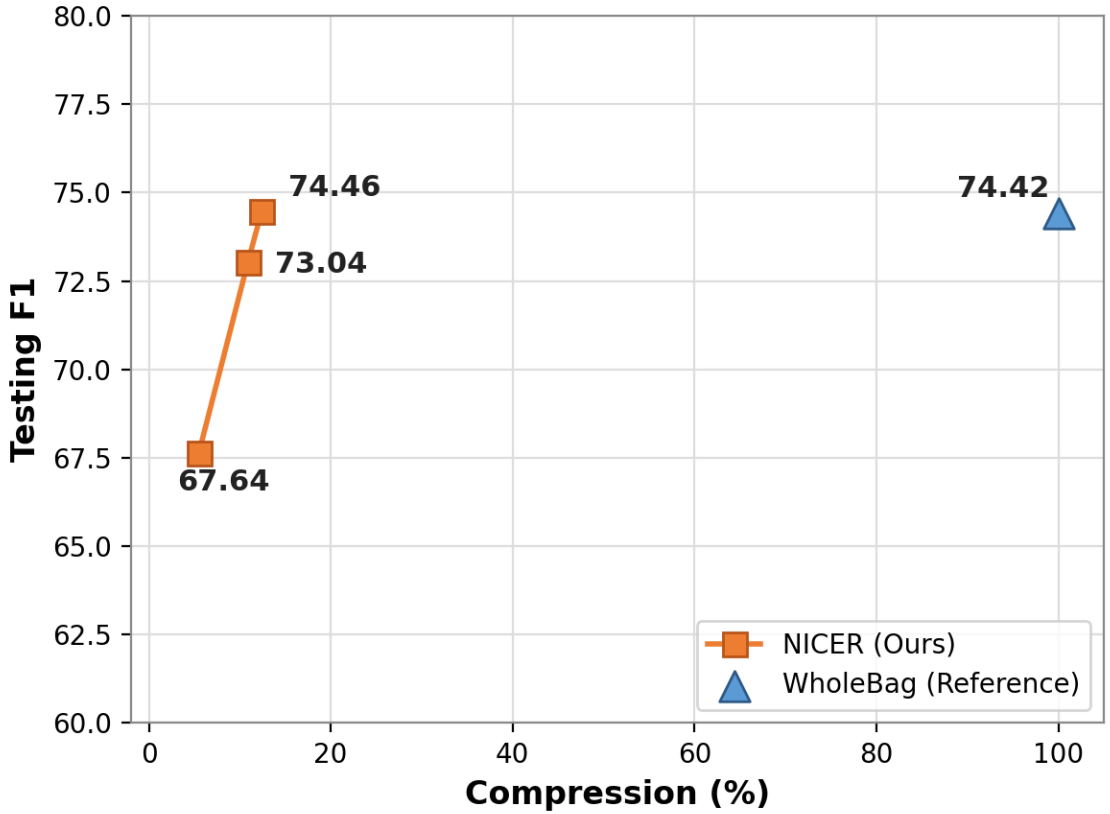
Whole-Slide Image Summarization

2D embeddings raw patches
orange stars: condensed patches



At 10x compression:
performance is preserved



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Conclusion

A **bottleneck** in clinical AI is the expensive cost of equipment, data, and compute.

We are developing **cost-effective AI** to work around this bottleneck?

practical use-inspired studies

Colorectal Pathology Classification

Whole-Slide Image (WSI) Summary