Cross-Modality mIF Generation from H&E Slides

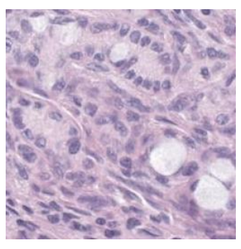
- I. Vitoria, A. Galdran, I. Arganda-Carreras y C. L. Saratxaga

FACTS & FIGURES

Start date:	1 October 2024
End date:	30 September 2028
IHI funding:	7 916 214 €
Industry contribution:	2 753 005 €
Other:	3 733 843 €
Total Cost:	14 403 062 €
Project website:	ihi-search.eu
Social media:	@IHISEARCH

CHALLENGE

SEARCH project: generate high-quality, privacy-preserving synthetic health data.

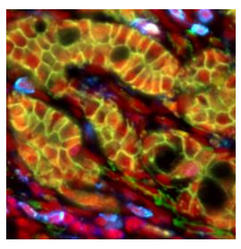


H&E Staning

Universal

Low-cost / Fast

3 Channels



mIF Staning

16 Biomarkers

Expensive Antibodies

Complex Processing

New modality generation by synthesizing 16 mIF markers directly from routine H&E slides

APPROACH & METHODOLOGY

1 **ORION-CRC dataset**

2 **22 Models Benchmarked**

- Pathology VFM
- Natural VFMs
- CNNs
- Spatial Proteomics VFMs

3 **Fine-tuning**

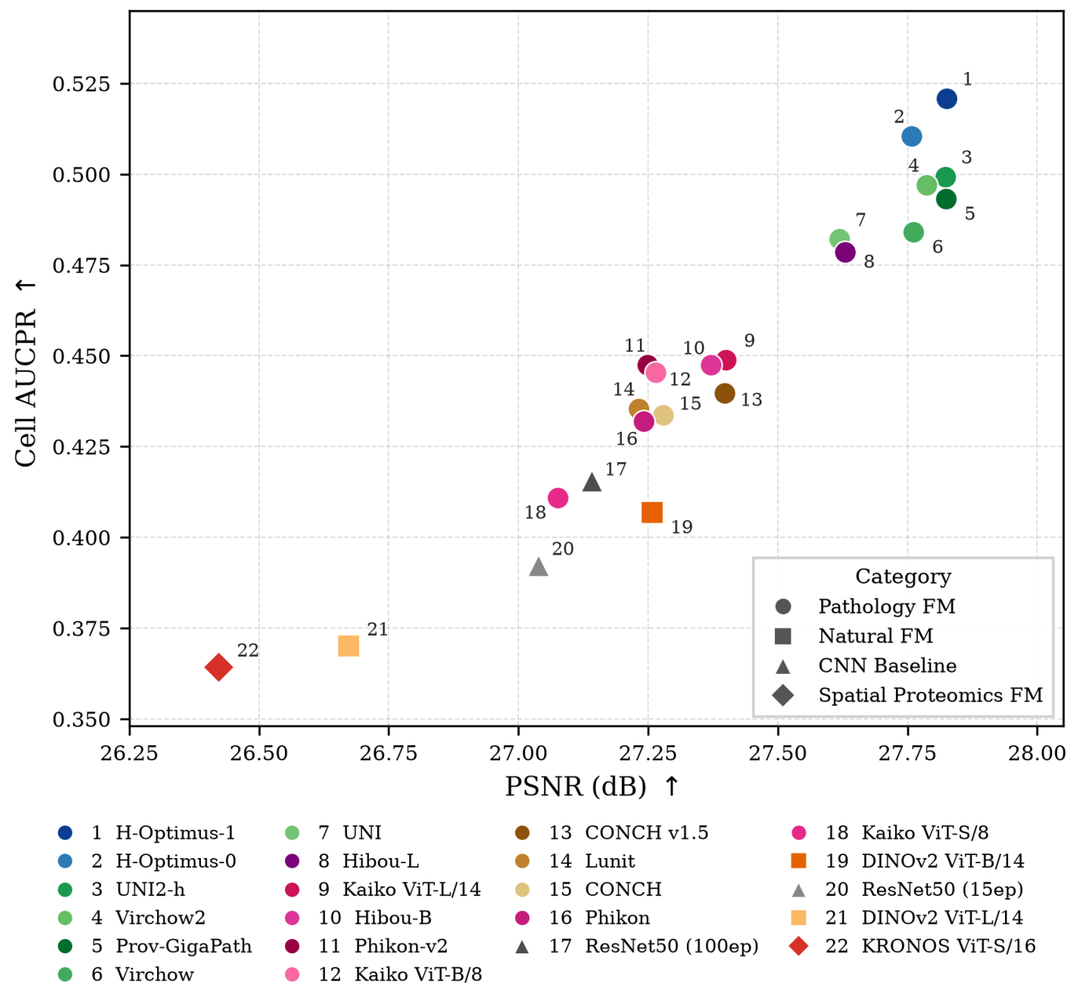
LoRA → VFM Encoder + MIPHEI-ViT Decoder

CNN Baseline End-to-end training

4 **Dual Evaluation**

Pixel-level:	Biological-level:
PSNR	**Cell AUCPR**
Difference between GT and prediction	Detection accuracy

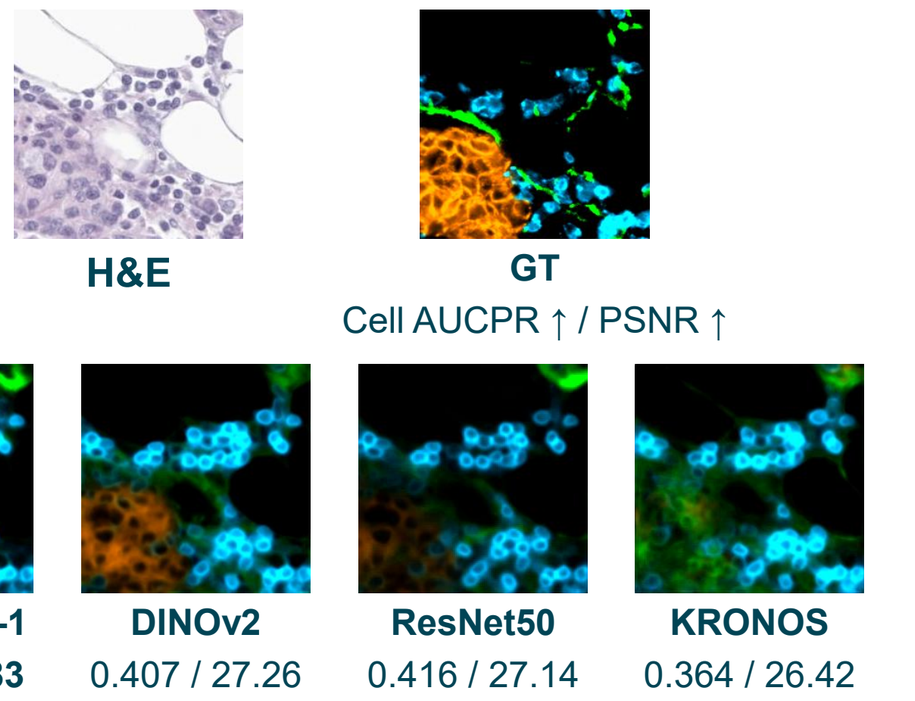
RESULTS



Pathology VFMs Dominate: H-Optimus-1 achieved top single-cell accuracy.

Metric Paradox: Pixel quality has low correlation with cellular biological validity.

Marker Hierarchy: Structural targets are accurately generated; sparse targets mark biological H&E boundaries



Structural markers (E-cadherin, SMA) and immune markers (CD3e)

VALUE OF IHI COLLABORATION

- Bridging AI with Clinical Reality
- Cross-Disciplinary Needs Assessment
- Enabling Targeted Research
- Advancing Precision Diagnostics

CAREER IMPACT

- Advanced Computational Skills
- Interdisciplinary Communication
- Expanded Scientific Network
- Steered Research Trajectory

This project is supported by the Innovative Health Initiative Joint Undertaking and its members.