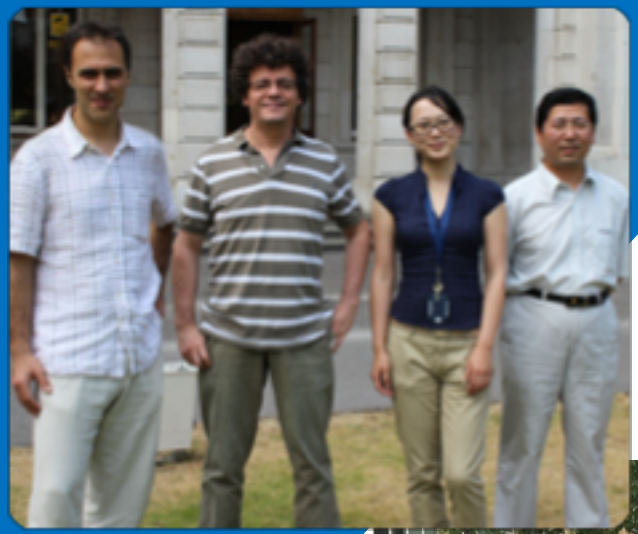
Queen Mary
University of London



Academics:
Prof Ebroul Izquierdo
Dr Ioannis Patros
Dr Qianni Zhang
Dr Pengwei Hao

Dr. Tomas Piatrik

MULTIMEDIA & VISION RESEARCH GROUP

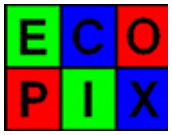
RESEARCH OUTPUT & FUNDING

- Achievements
  - **UK's leading research-focused university**
  - **Leading research in Computer Science and Electronic Engineering research**
  - **Currently over €1 million of active research grants**

- Since 2010:
  - **€15 million of grant funding**
  - Graduated **over 25 PhD students**
  - Published **over 150 papers** primarily in high impact factor **IEEE** specialist journals
  - **Over 500** refereed conference papers

- Funding bodies include:
  - The European Union: FP6, FP7, & H2020m EPSRC, Royal Society, the British Council, Royal Academy of Engineering,

KEY PROJECTS



KEY SECURITY PROJECTS

MAGNETO

Multimedia Analysis and Correlation Engine for Organised Crime Prevention and Investigation

PERSONA

Privacy, ethical, regulatory and social no-gate crossing point solutions acceptance

SafeShore

Bringing Maritime border security to new dimension

LASIE

Large Scale Information Exploitation of Forensic Data

ADVISE

Advanced Video Surveillance archives search Engine for security applications

VIDEOSENSE

Virtual Centre of Excellence for Ethically-guided and Privacy-respecting Video Analytics

KEY COLLABORATIONS

Queen Mary
University of London
MMV
Multimedia & Vision Research Group

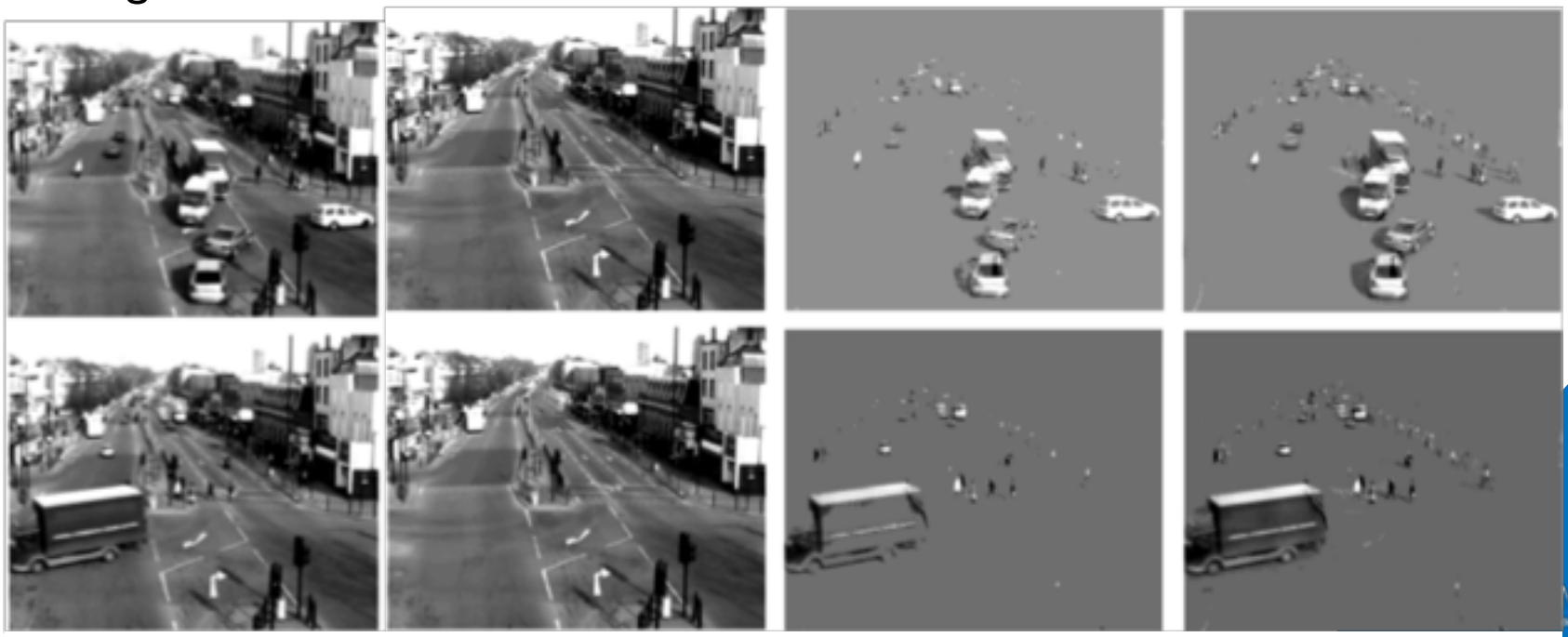
KEY COLLABORATIONS IN SECURITY

ACTIVE RESEARCH AREAS

- Video and image analysis for Security Applications
- Semantic Classification & Clustering
- 3D Reconstruction & Graphics
- Video Coding
- Analysis of (Human) Motion
- Human Sensing for Human-Media Interaction
- Colour Vision

Foreground/Background subtraction

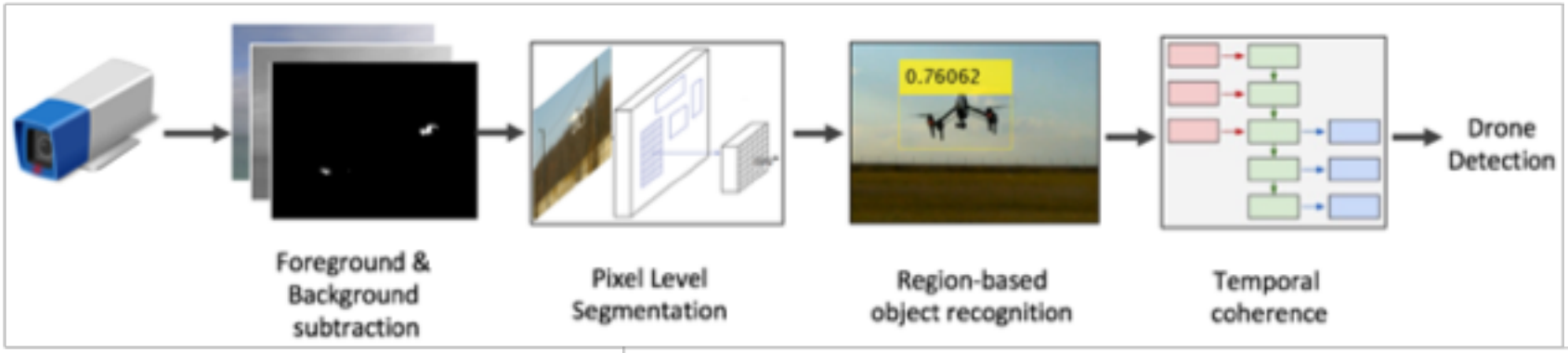
- Real-time solution building on recent developments in the field of Robust Principal Component Analysis (RPCA)
- Robust for handling camera movement, various foreground object sizes, slow-moving foreground pixels, as well as sudden and gradual illumination changes in a scene



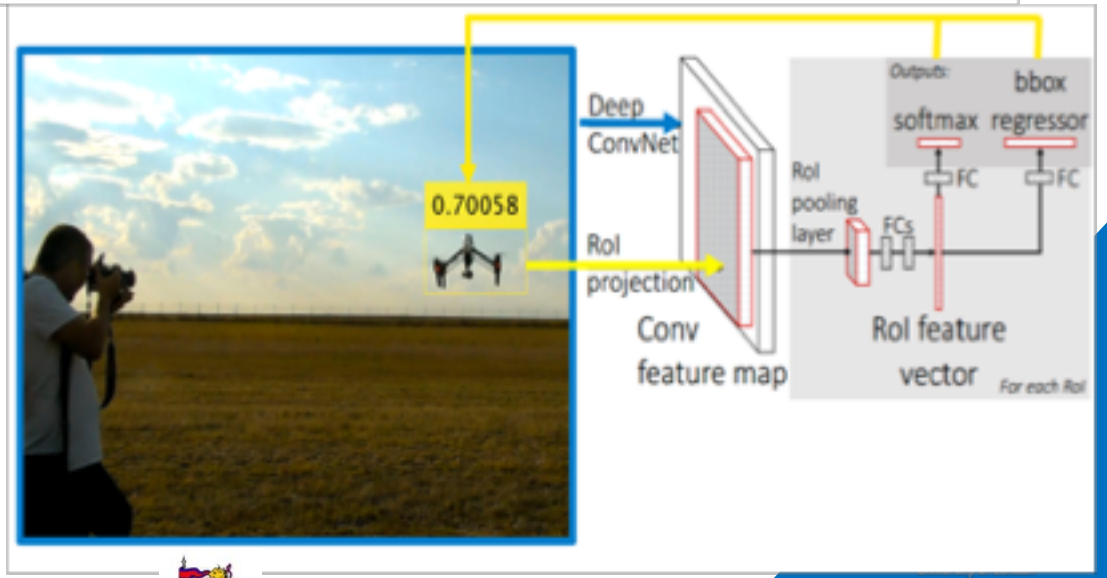
Original | BG (our) | FG (state-of-the-art) | FG (our)

Drone detection and tracking

- Real time detection and tracking of drones for maritime border security



- Tailored **Region-based Faster Convolutional Network** (Faster R-CNN) was implemented with **Recurrent Neural Network** (RNN) in order to pass the temporal information via feed forward and recurrent neurons

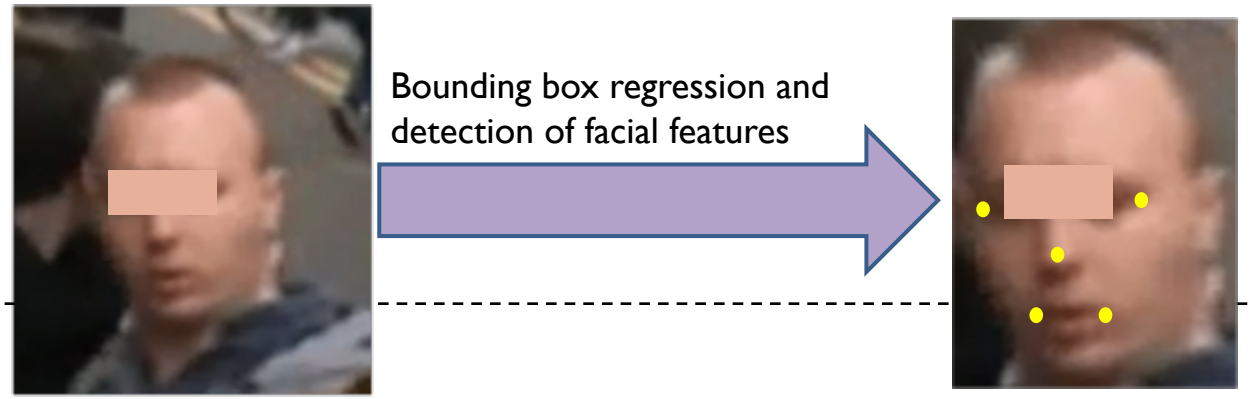


Politie Police משטרת ישראל POLIȚIA ROMÂNĂ

Face Detection, Alignment and Recognition

Face detection and recognition

- Big gap between research and real data
- Implementation of tailored Convolutional Neural Network for (1) generation of candidate stage, (2) filtering out non-face windows, and (3) further processing the filters results and output facial landmarks positions.
- Robust deep learning algorithm based on Inception model for face recognition



Face Detection, Alignment and Recognition

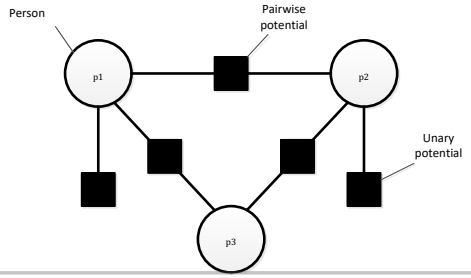
Face alignment

- Approximated Robust Principal Component Analysis for batch image alignment, recovery of face images from corrupted or low quality data, and face recognition

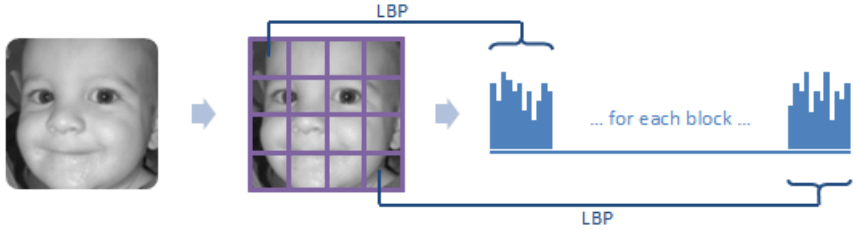
Average of (a) Average of (b) Average of (c) Average of (d)

JOINT CROSS-DOMAIN RECOGNITION

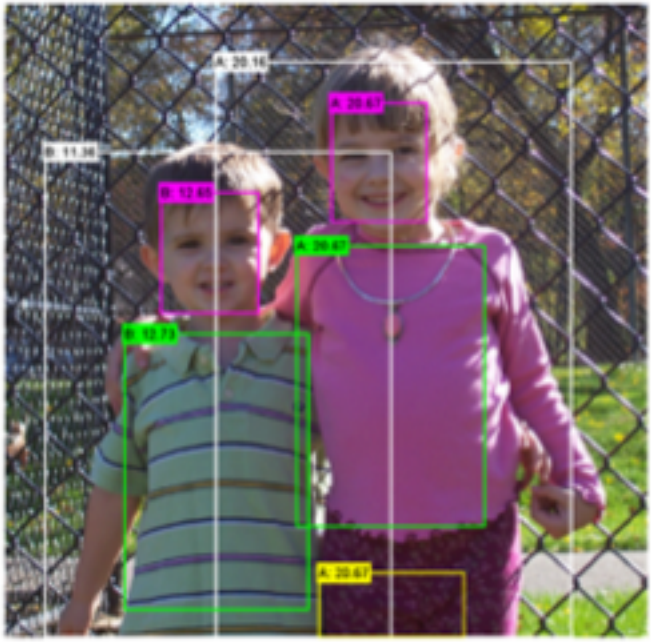
Graph-based approach modeling exclusivity and co-appearance

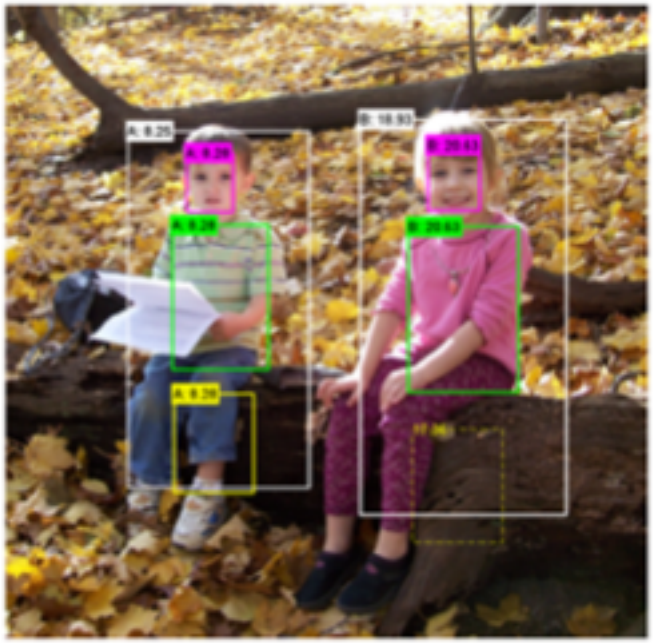


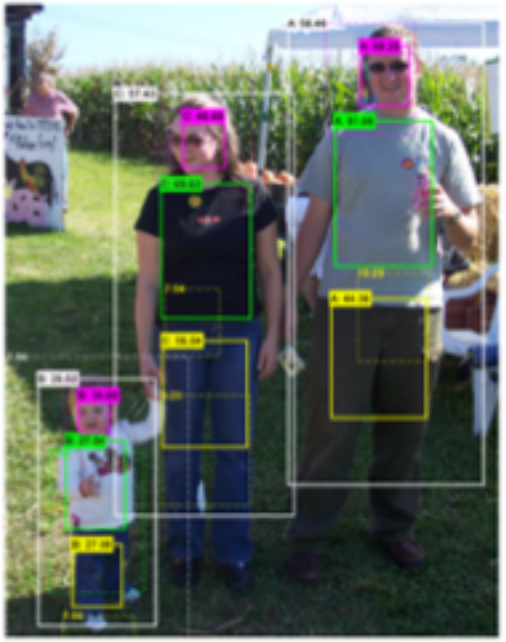
Distance-based face discrimination



Detecting lower and upper body parts







DROP detection and tracking

Collaboration with

METROPOLITAN POLICE

- 5-year ongoing collaboration with Scotland Yard

How to identify this suspect?

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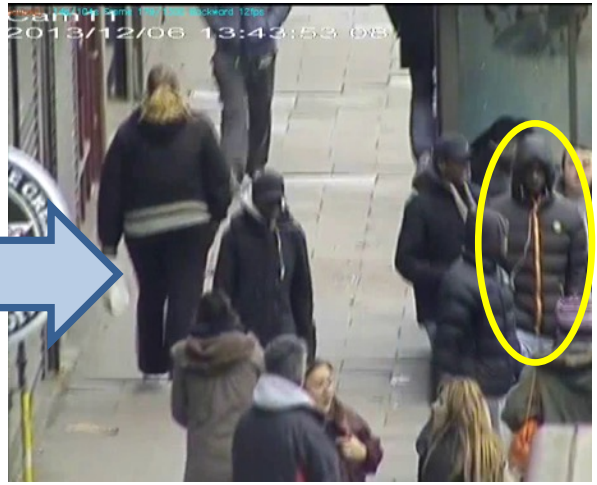
DROP detection and tracking

Collaboration with

METROPOLITAN POLICE

- Automated video processing solution that helps investigators to reduce the search for a suspect from 2-3 weeks to 2-3 days



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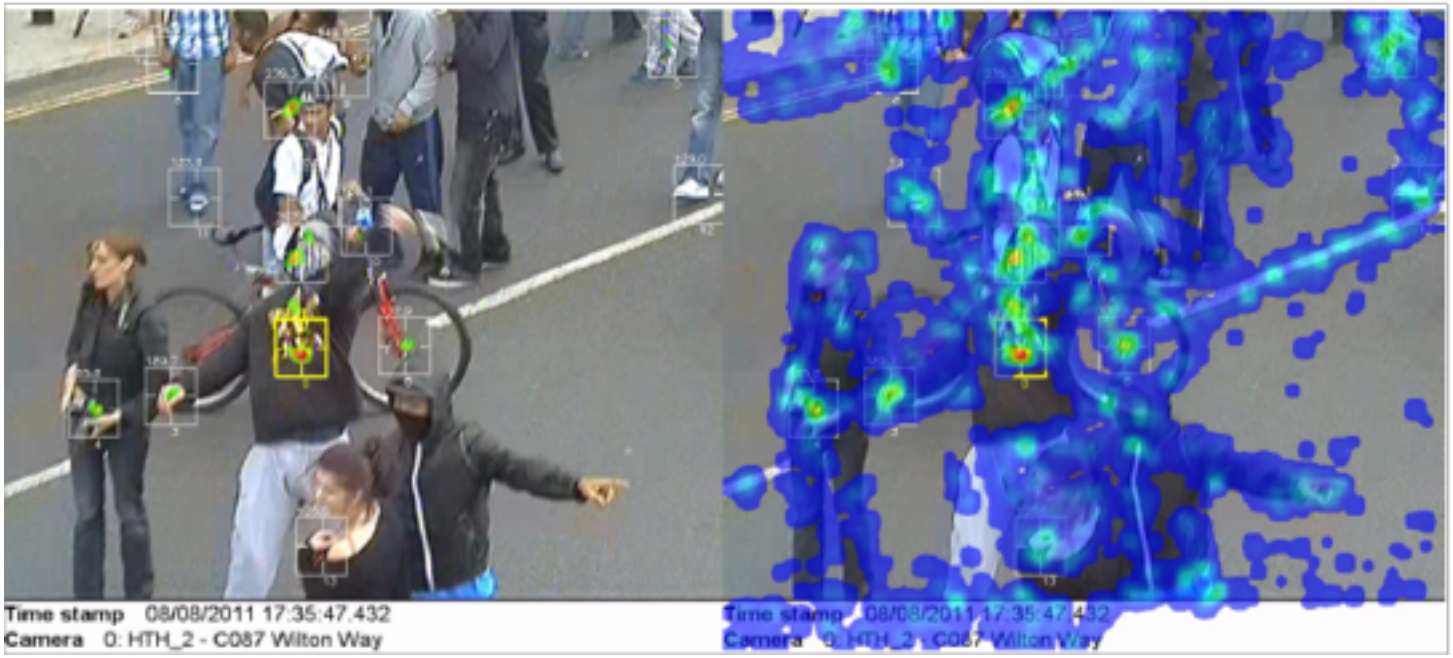
DROP detection and tracking

Collaboration with

METROPOLITAN POLICE

- Query-by-example search through wavelet analysis
- Unstructured pattern search using tailored Randomised Hough Forests
- Single-pass detection finds pattern in all frames, simultaneously



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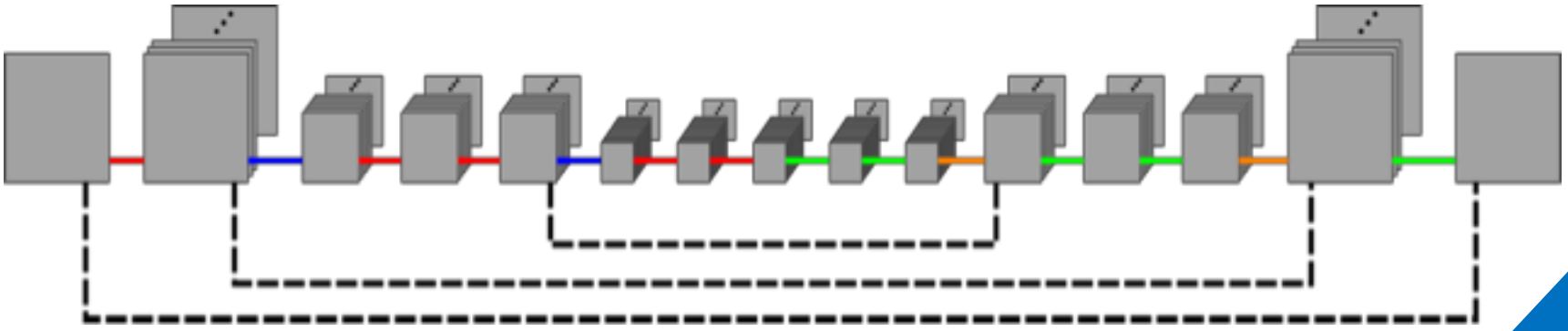
Spatial video up-sampling

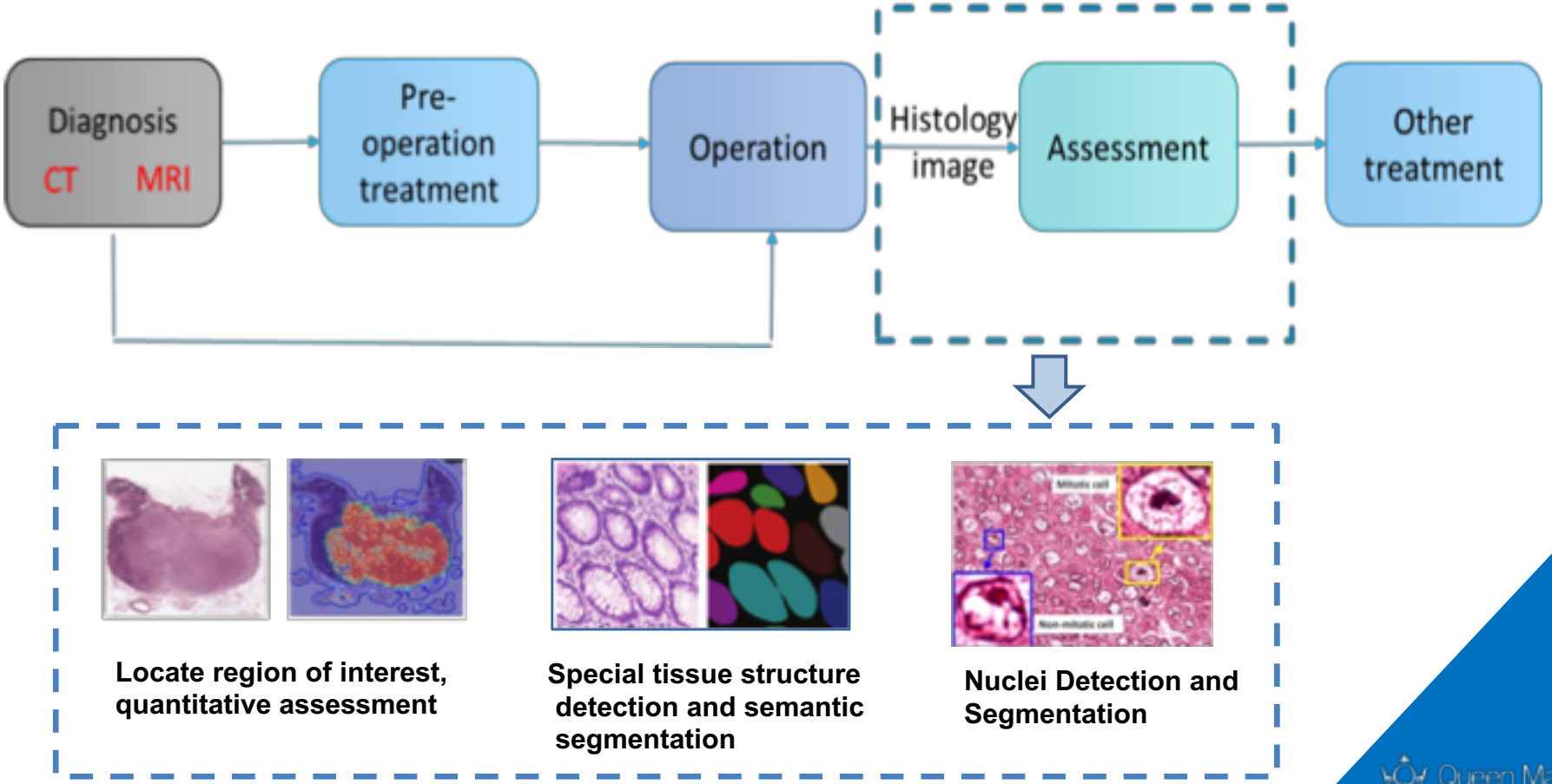
Collaboration with BBC

- Over 15 years ongoing collaboration with BBC on video processing and video coding
- Application of deep super-resolution convolutional neural networks for spatial up-sampling of videos
- High-quality up-scaling of any visual content to the standard 4K UHD resolution of 2160×3840



Hierarchical Histology Image Analysis

- Over 8 years ongoing collaboration with Karolinska Institute



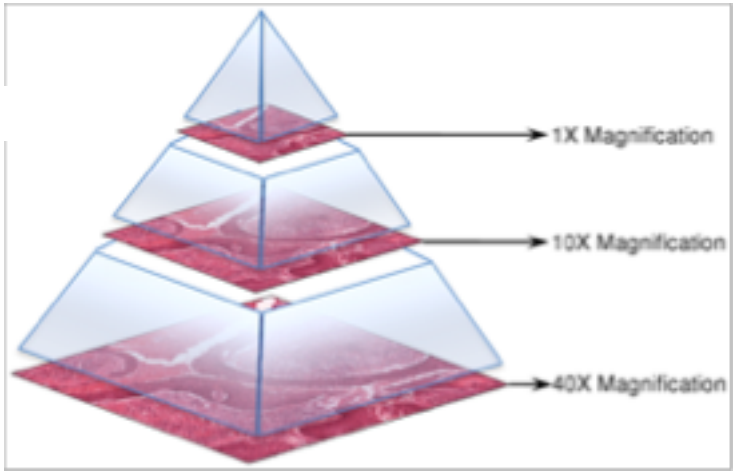
Hierarchical Histology Image Analysis

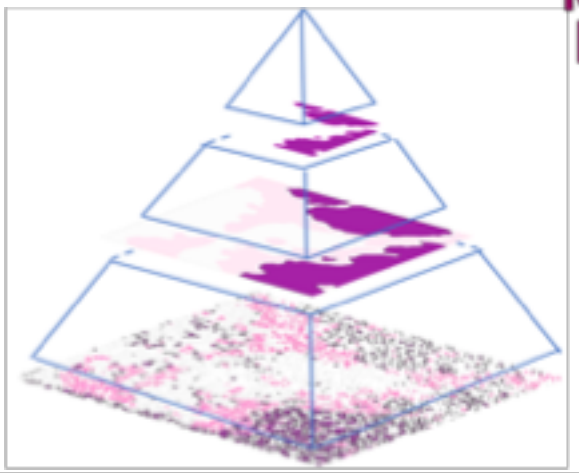
Karolinska Institutet

Slide Level

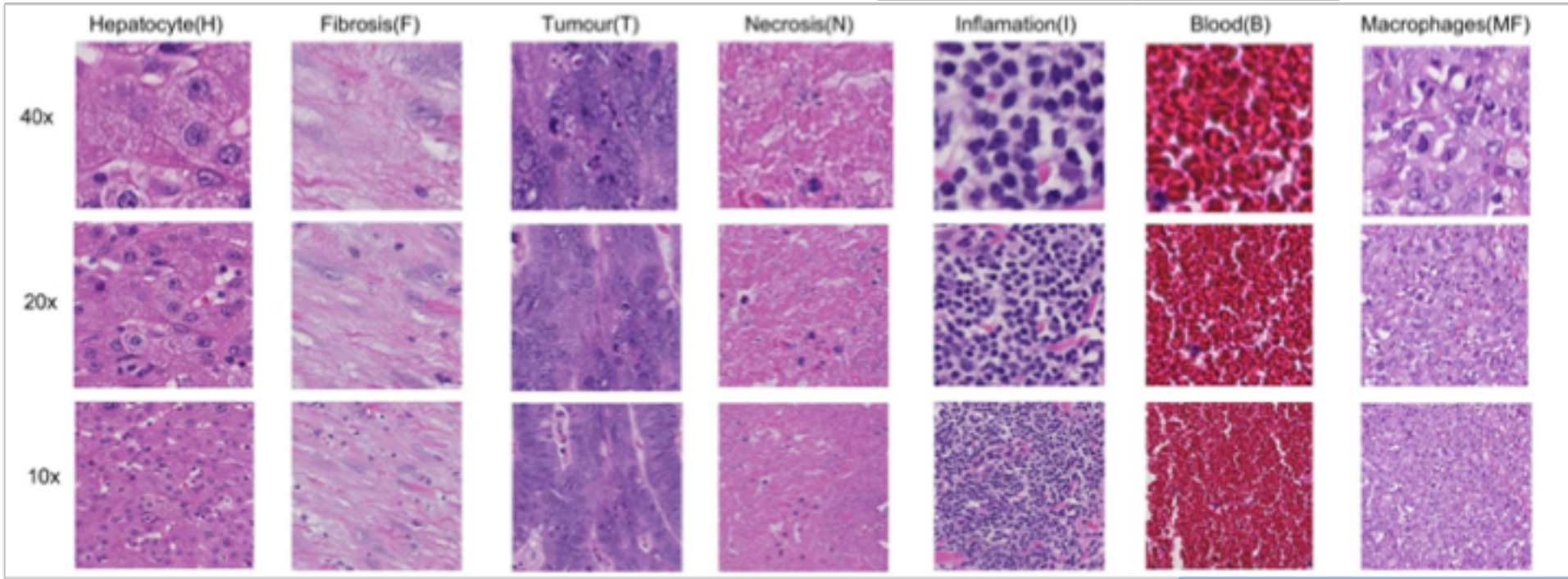
Tissue Level

Cell Level



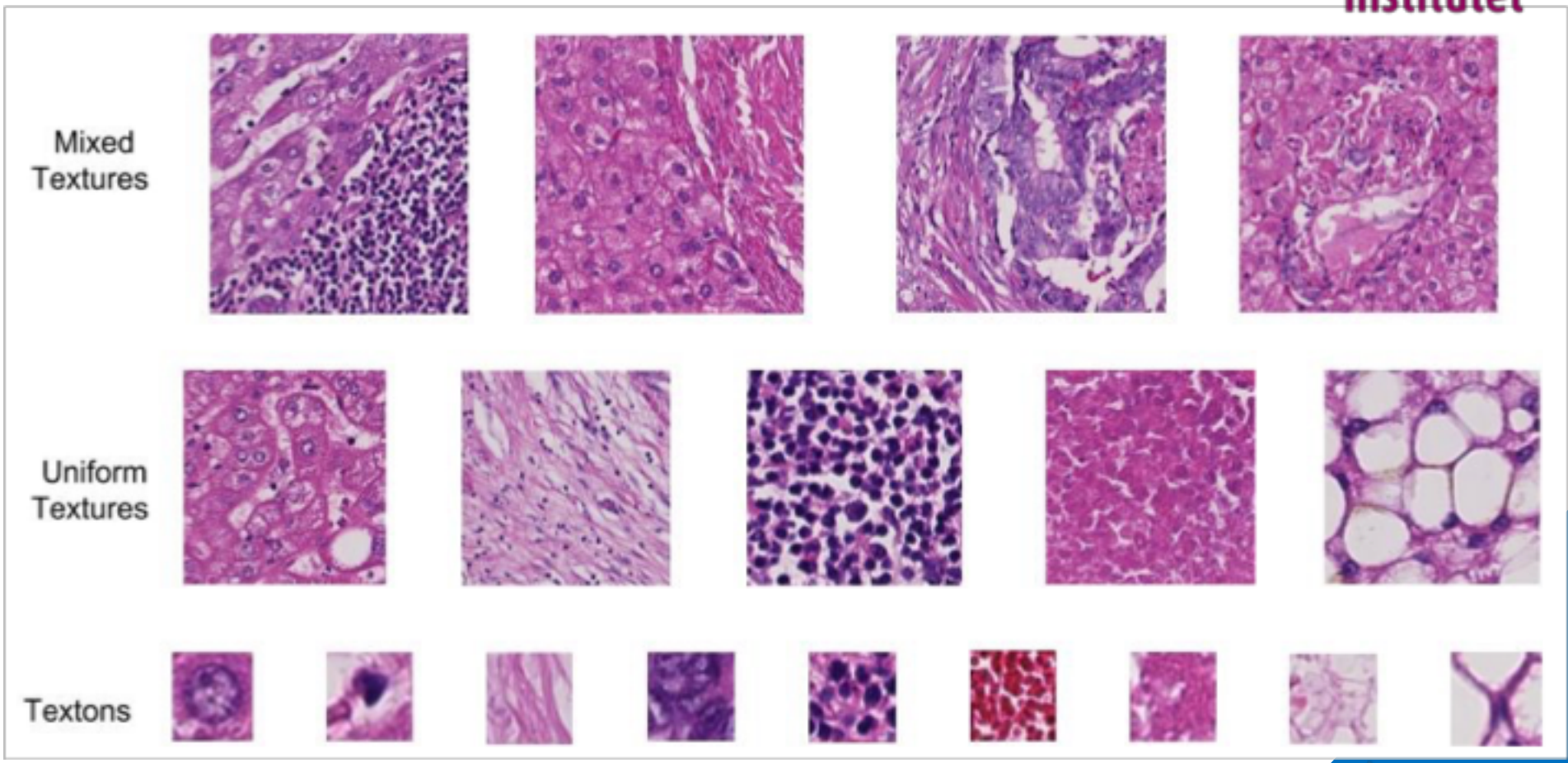


Pixel Level



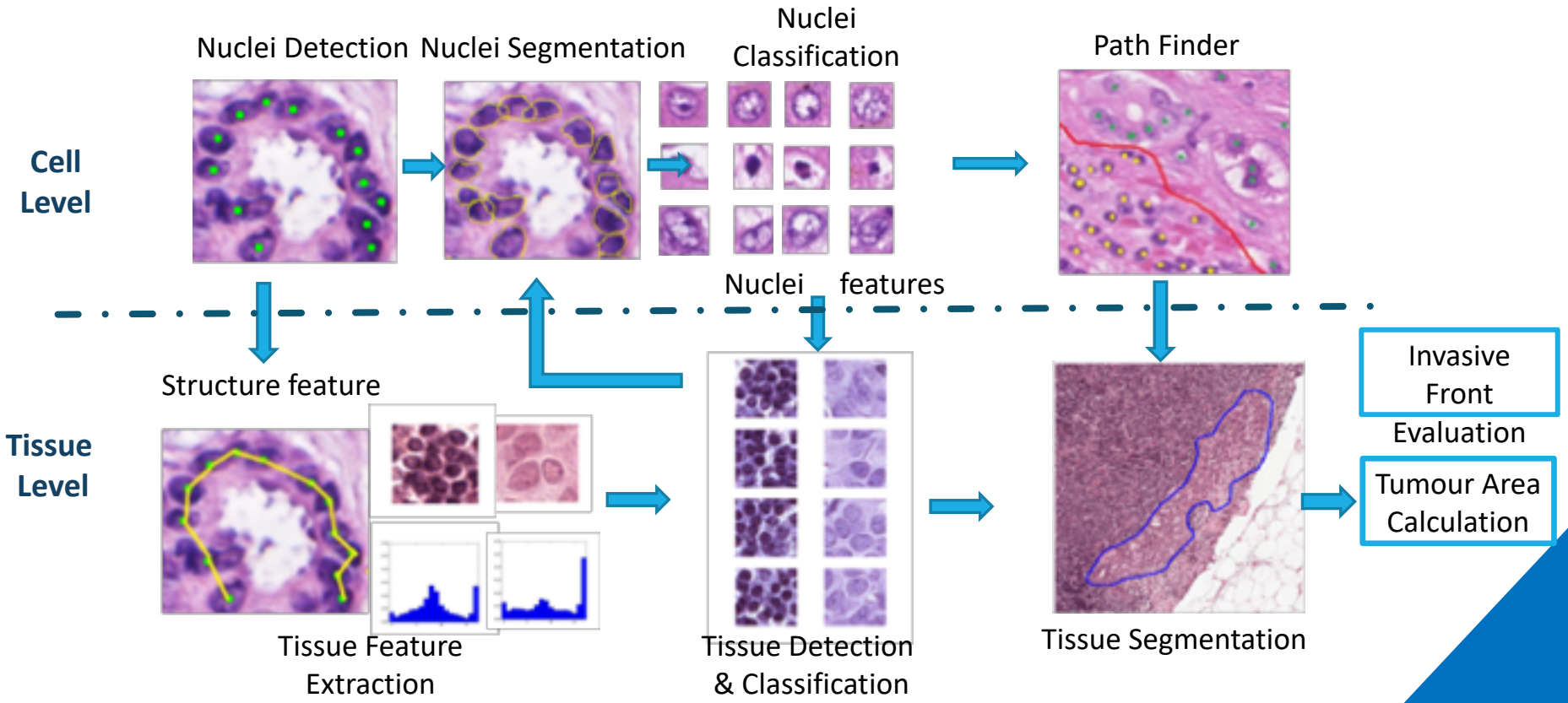
Hierarchical Histology Image Analysis

- Wide spectrum of hierarchical classes



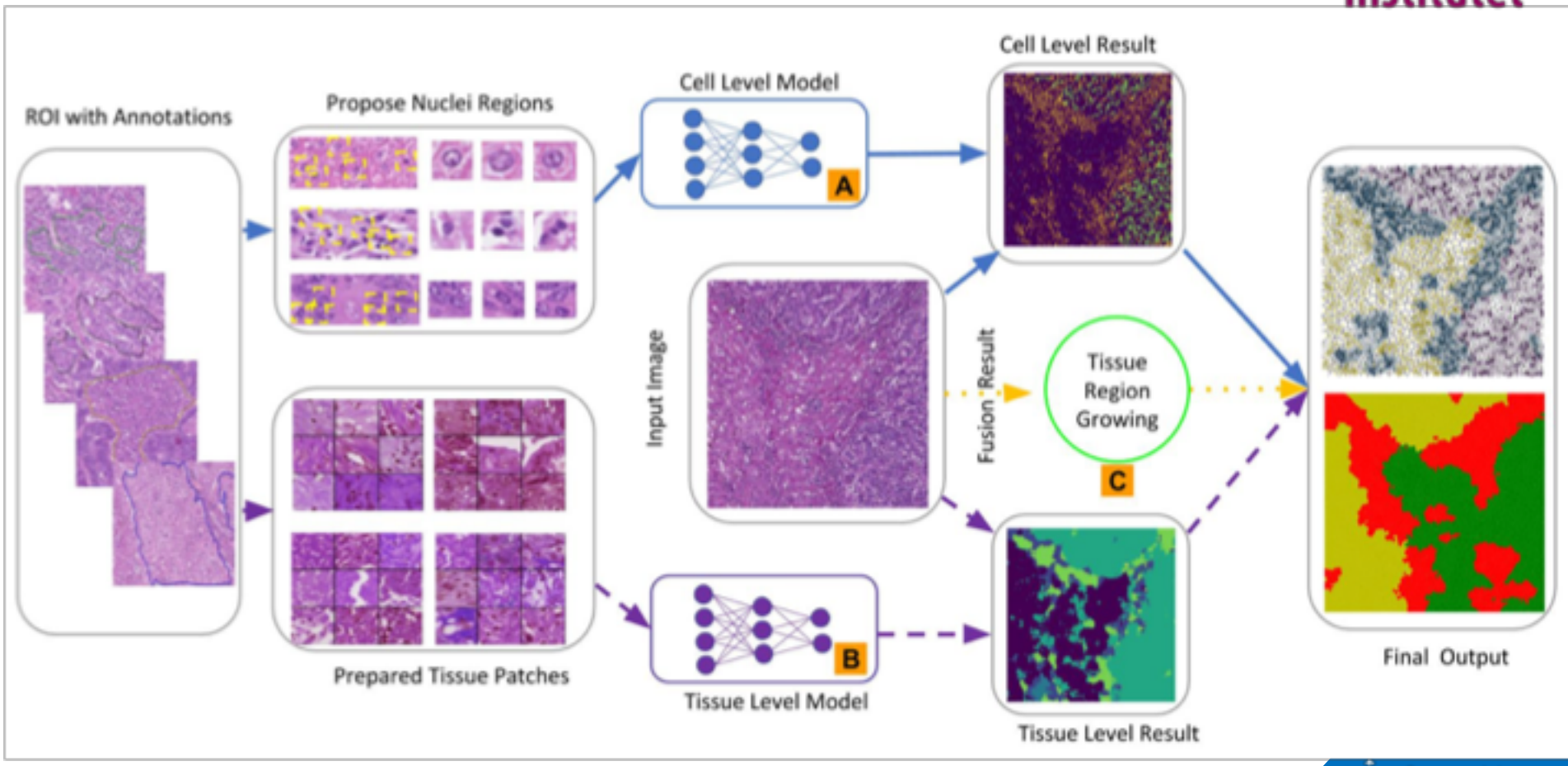
Hierarchical Histology Image Analysis

- Key processing steps



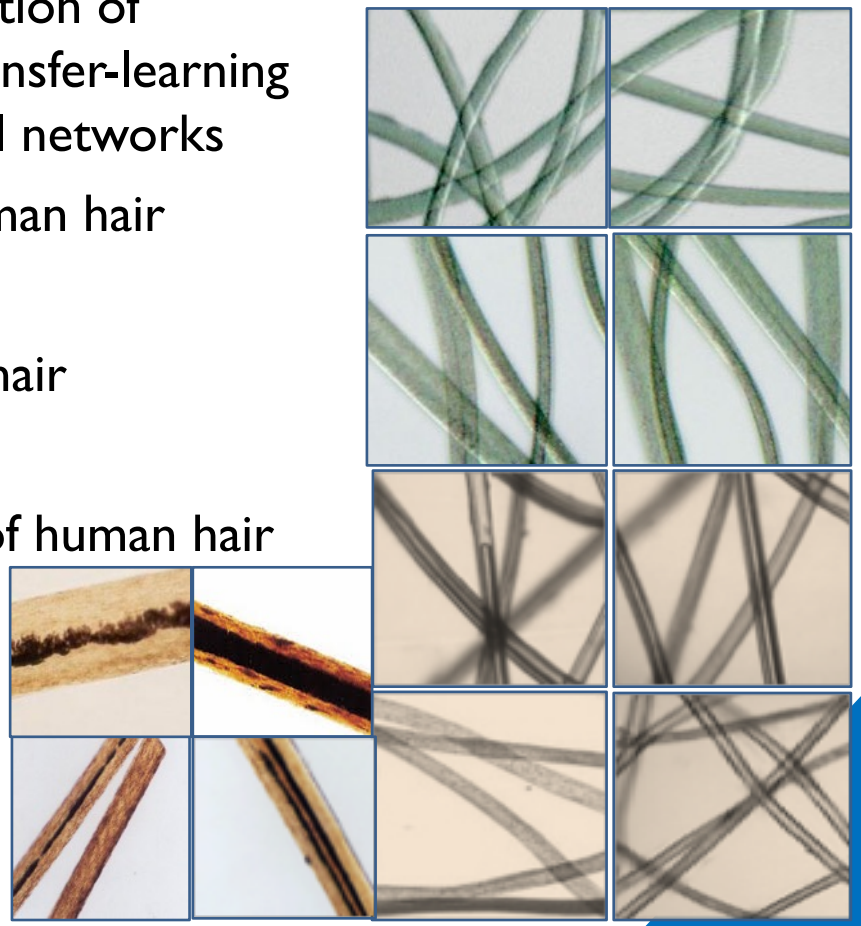
Hierarchical Histology Image Analysis

- Deep learning based fusion framework



Micro-trace image analysis

- Automatic segmentation and classification of elements in the trace sample using transfer-learning framework with generative adversarial networks
- Classification of types of fiber and human hair
- Analysis of color/texture aspects
- Analysis of color/structure of human hair
- Human hair vs animal hair
- Currently tested on additional types of human hair
- Expansion of training set with other types of materials and elements – traces of blood, glass, sand, wood, etc.



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Thank you

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