CELL SEGMENTATION IN COELIAC DISEASE BIOPSIES

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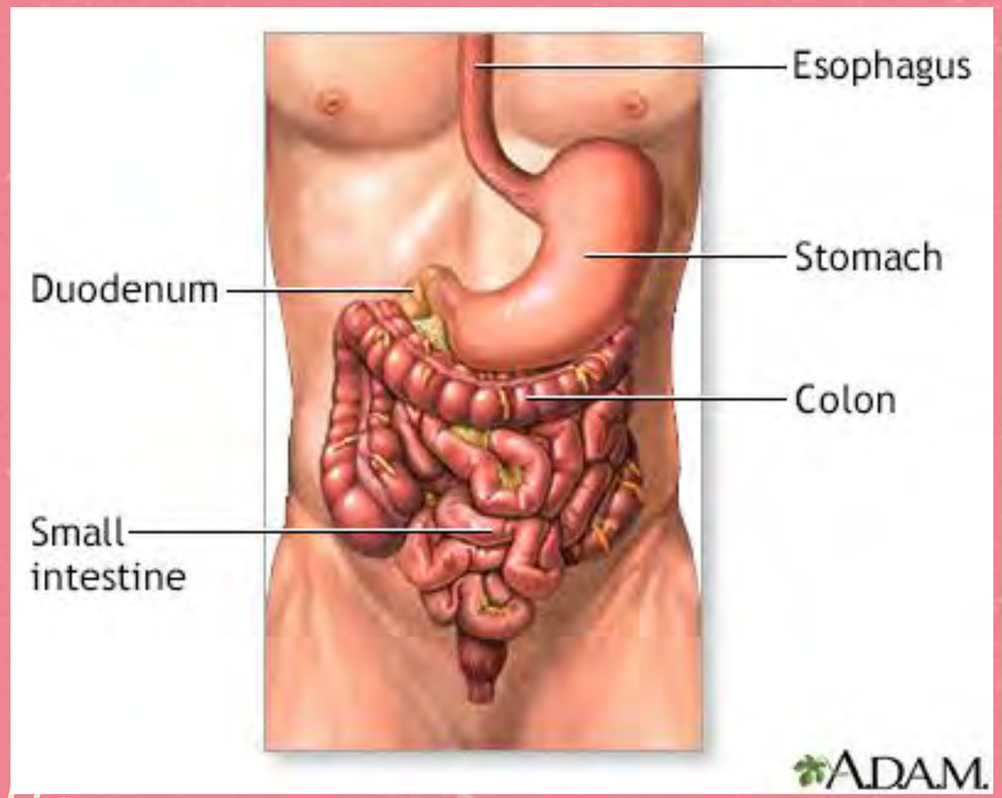
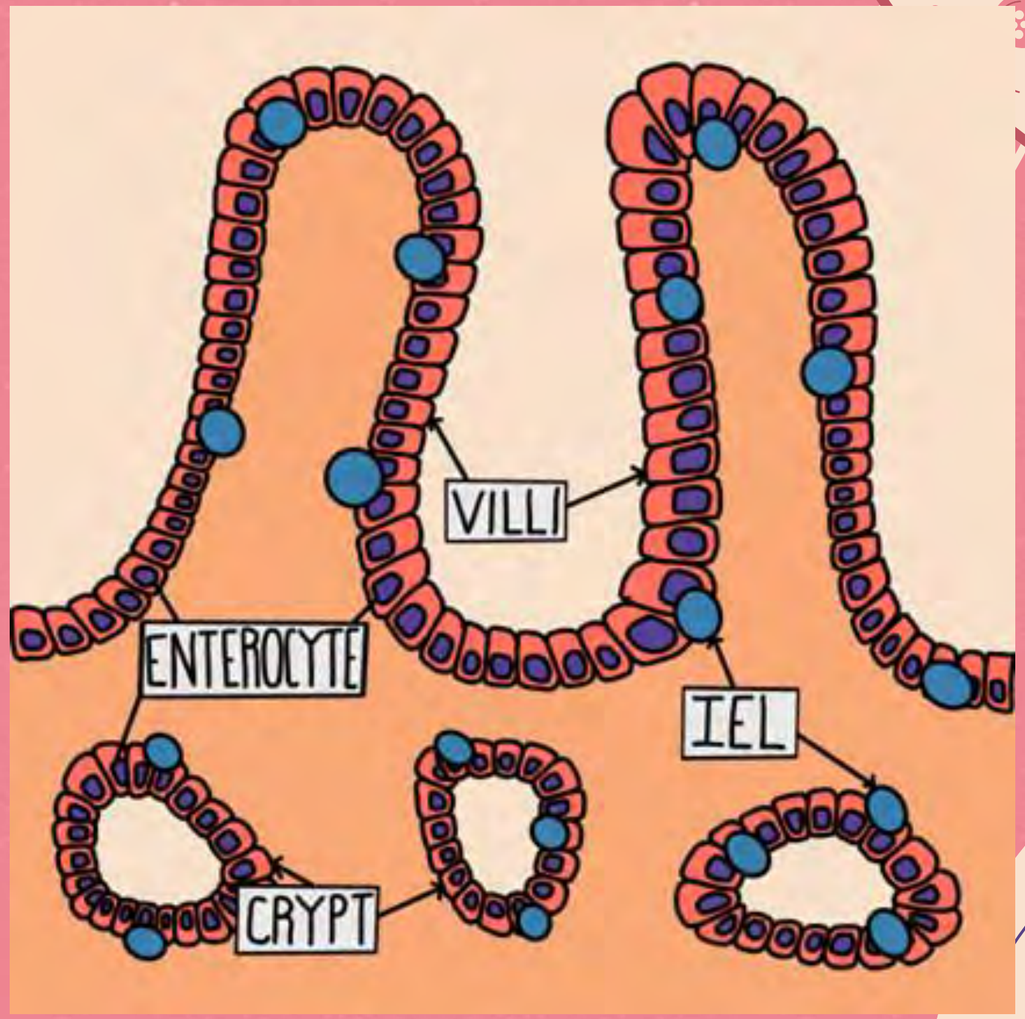
Coeliac disease

- Autoimmune disorder to gluten
- Causes inflammation/ damage to the intestine
- Effects roughly 1% of the population

- Diagnosis:
  - Blood tests
  - Duodenal biopsy

The Duodenum

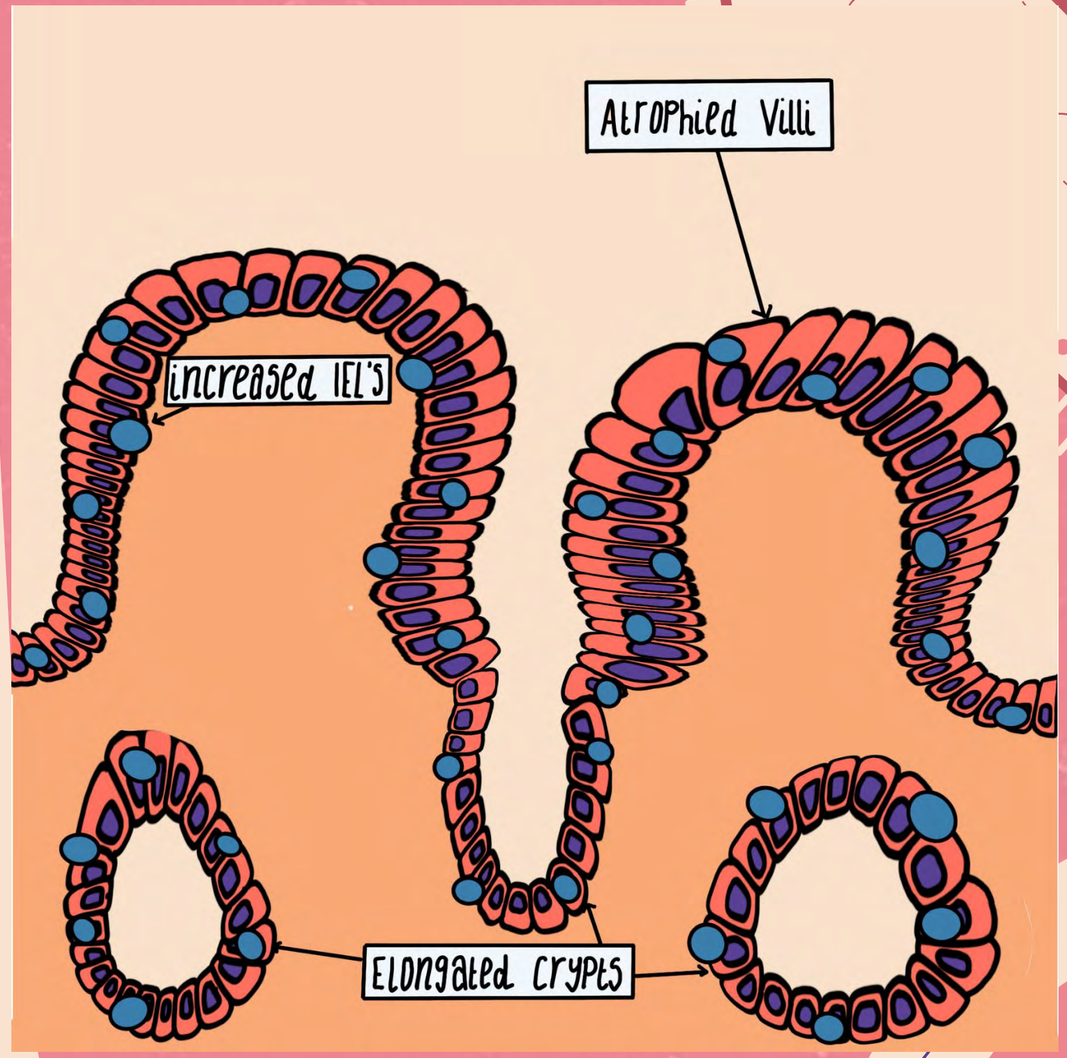




Coeliac Disease

- Coeliac disease causes:
  - Villi atrophy and flattening
  - Crypt enlargement
  - Increased IEL’s
  - Decreased enterocytes

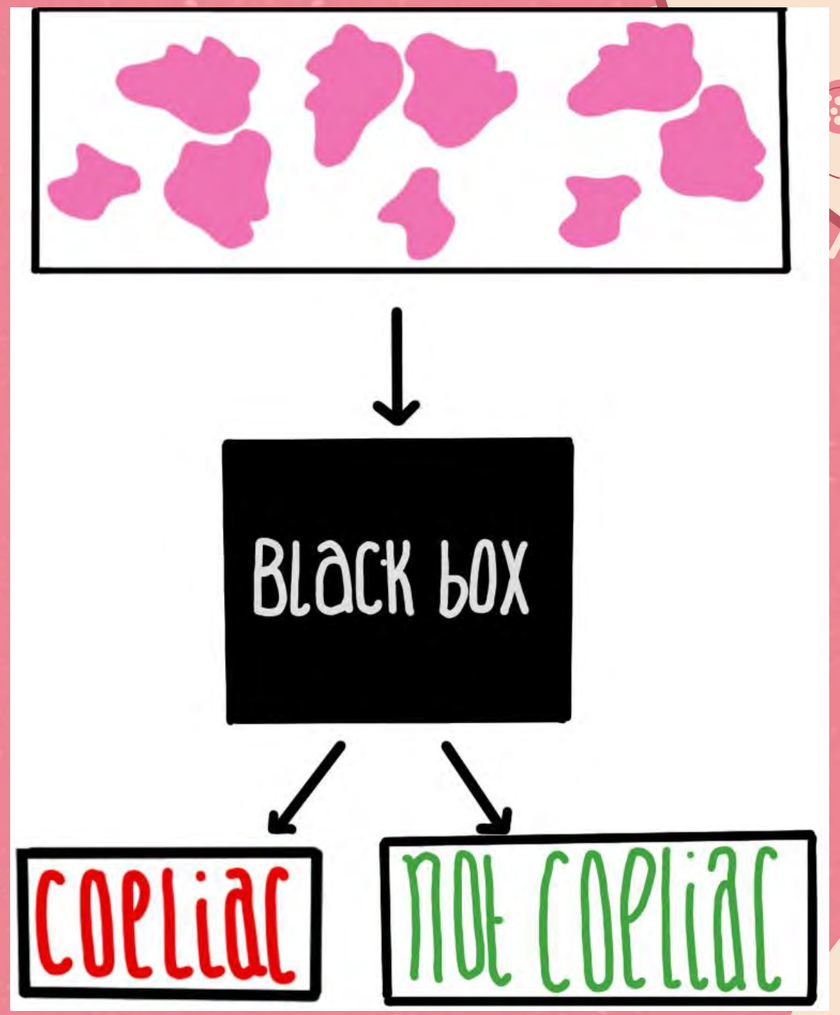
- Doctors look at:
  - LENGTH of villi vs crypt
  - RATIO of IEL’s to enterocytes

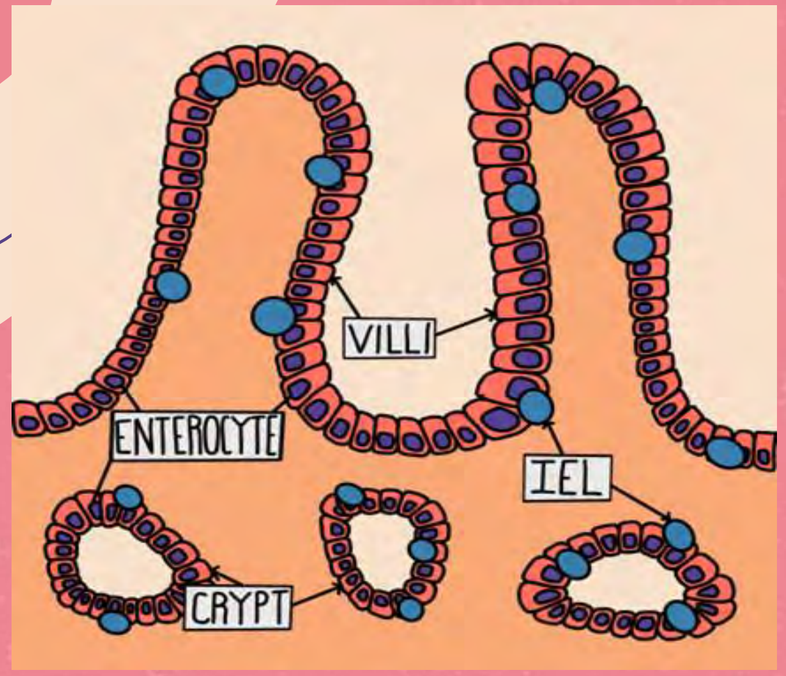


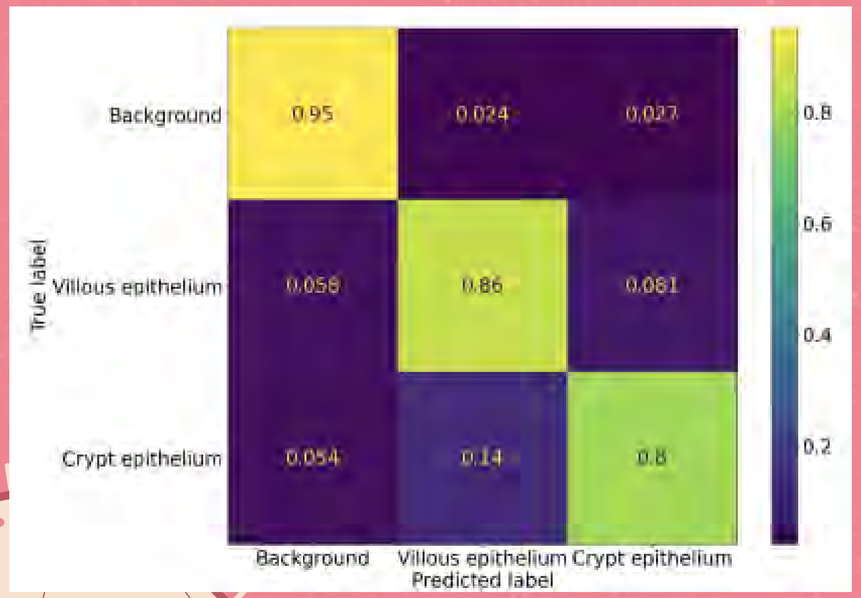
Problem Identification

- Diagnosis Problems:
  - 20% disagreement between histopathologists
  - Labour / time intensive

- Lyzeums Model:
  - Black box classification
  - 94.1% accuracy
  - lacks clarity





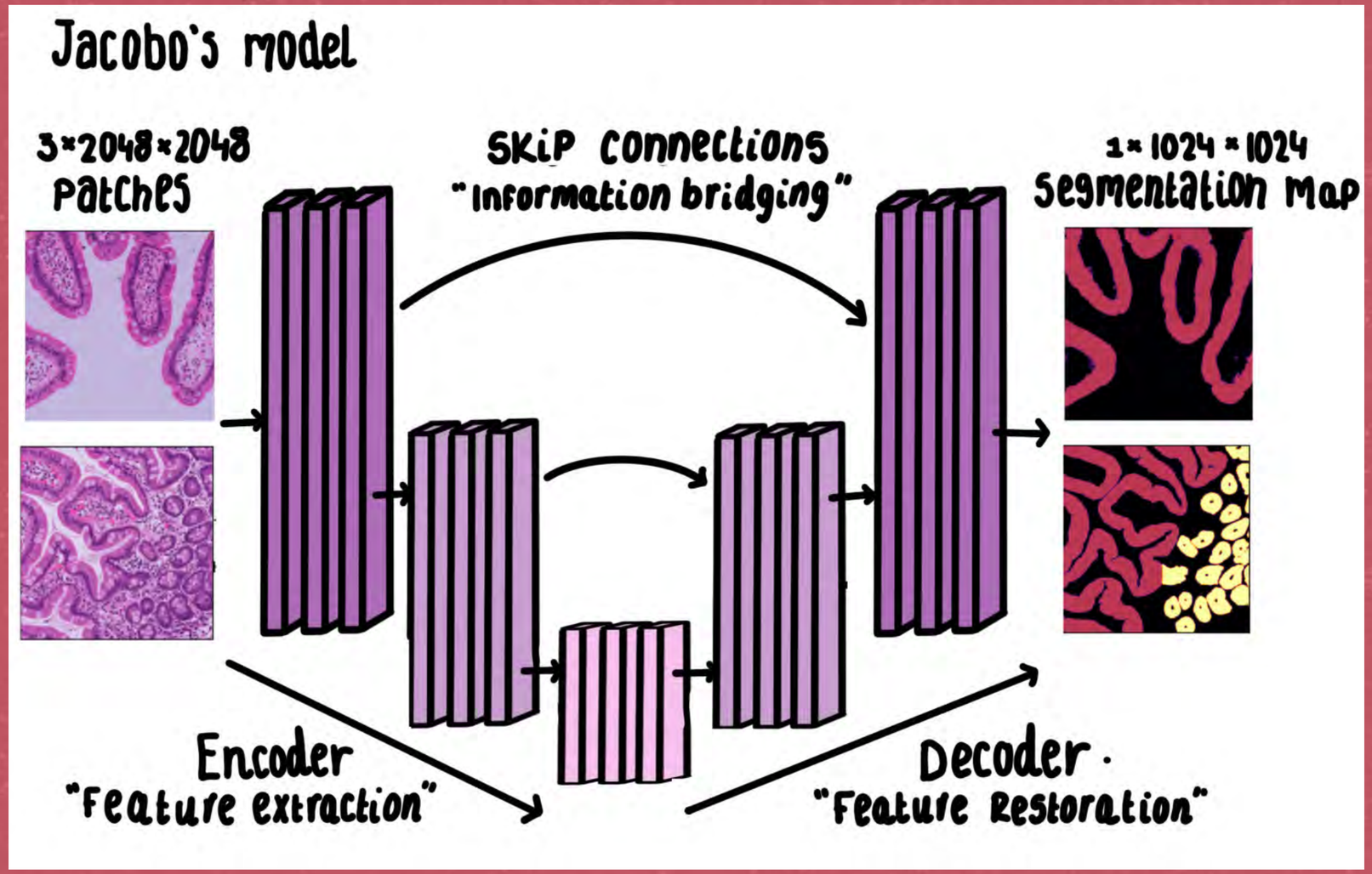


Overview

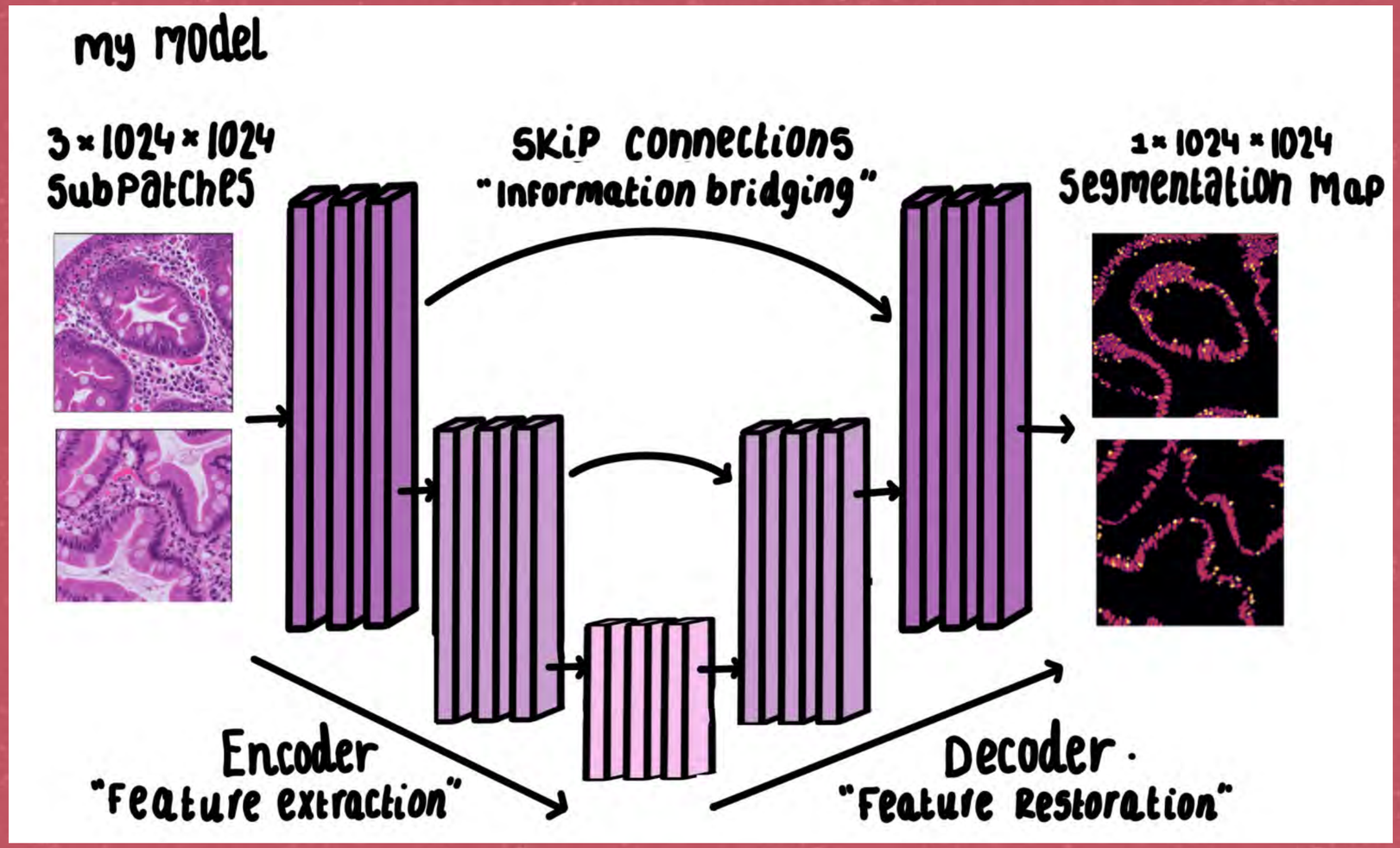
- Existing model:
  - Semantic segmentation of villi and crypt epithelium
  - Instance segmentation of villi and crypts

- My goal:
  - Semantic segmentation of IELs and enterocytes
  - Coeliac disease diagnosis through segmentation masks

UNET – Jacobo's Model

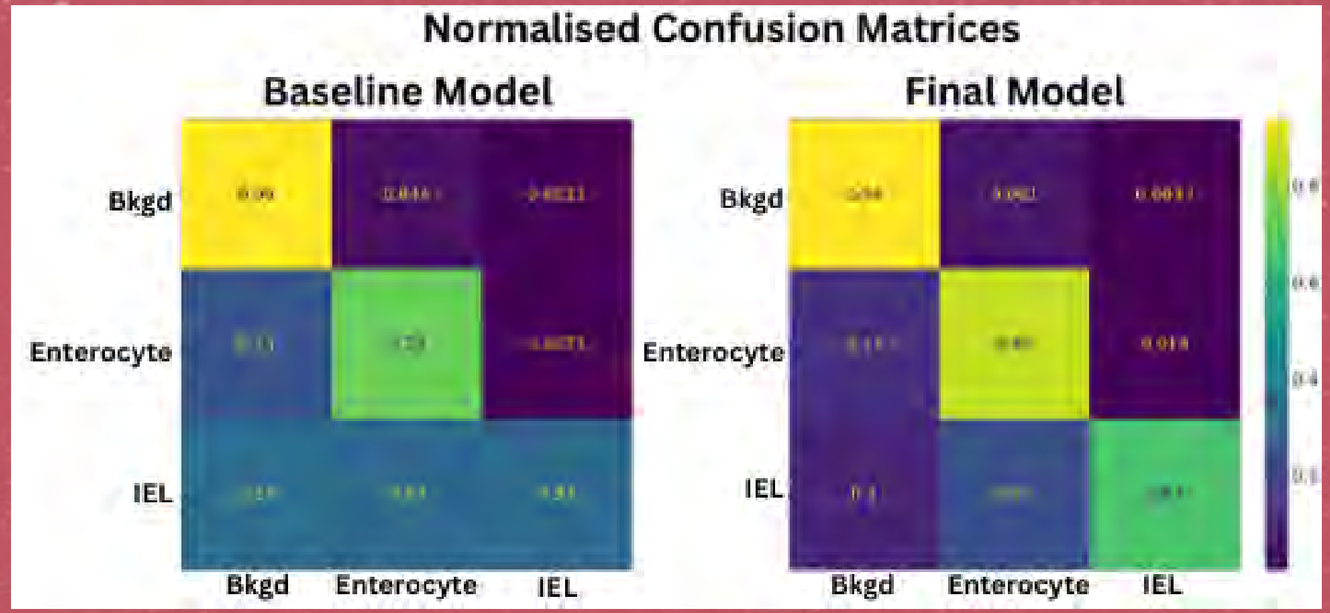


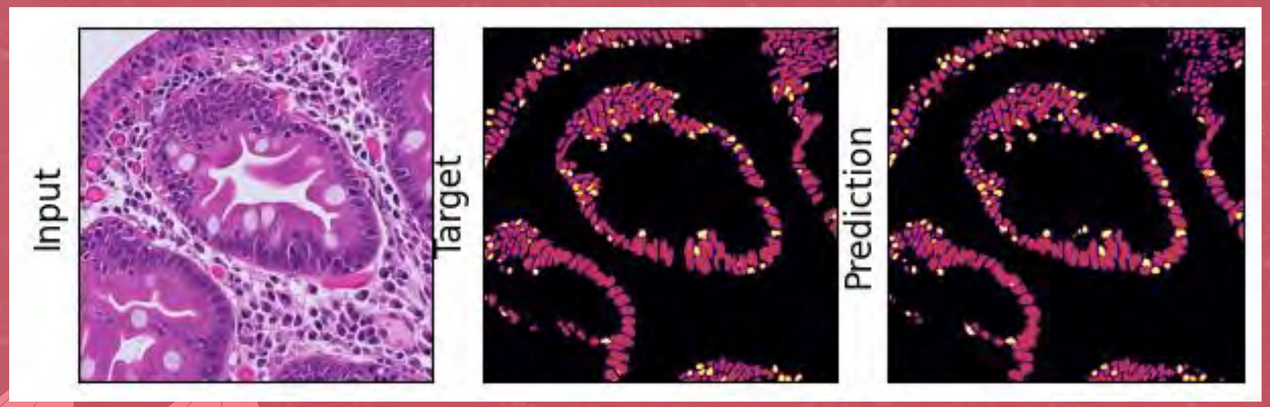
UNET – My Model



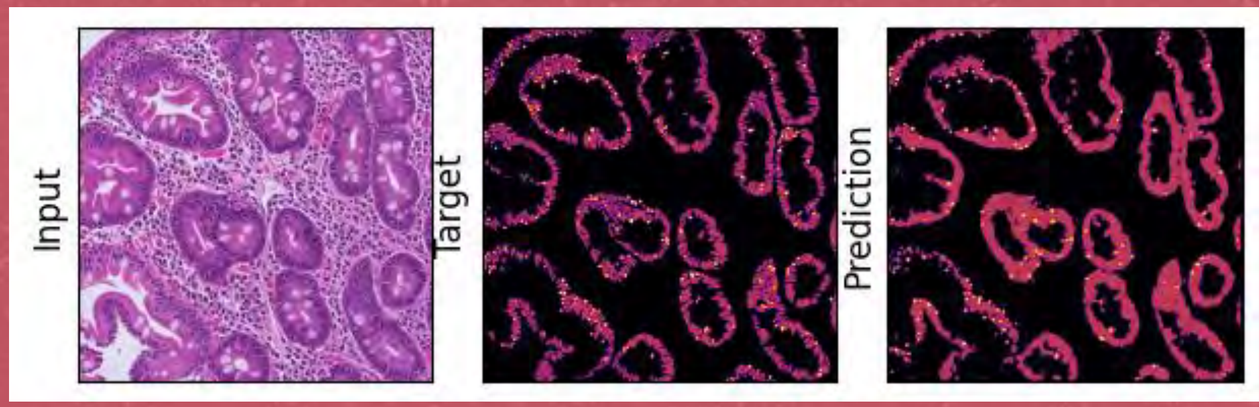
Training - Results

Confusion Matrix



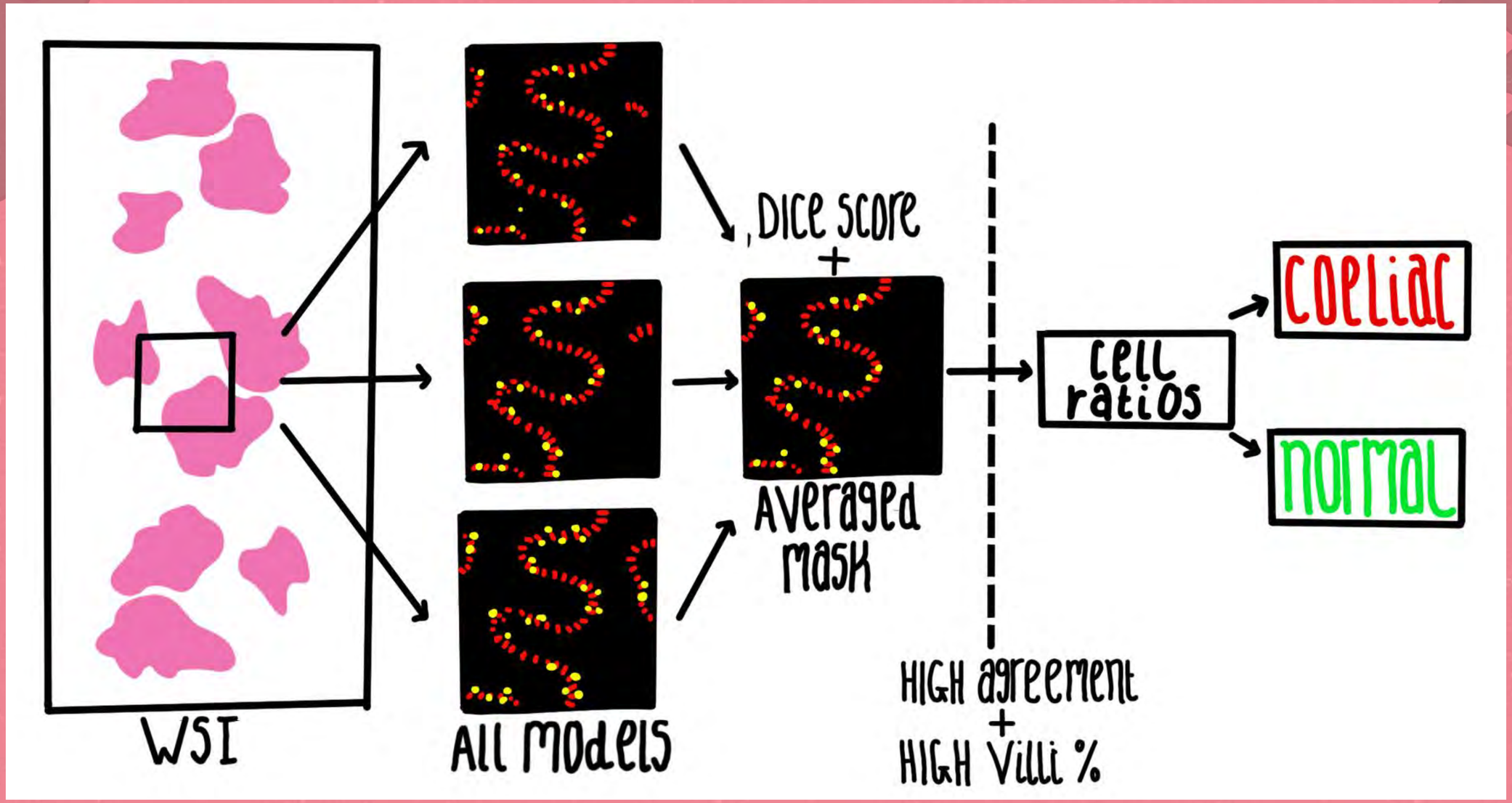


Final Model

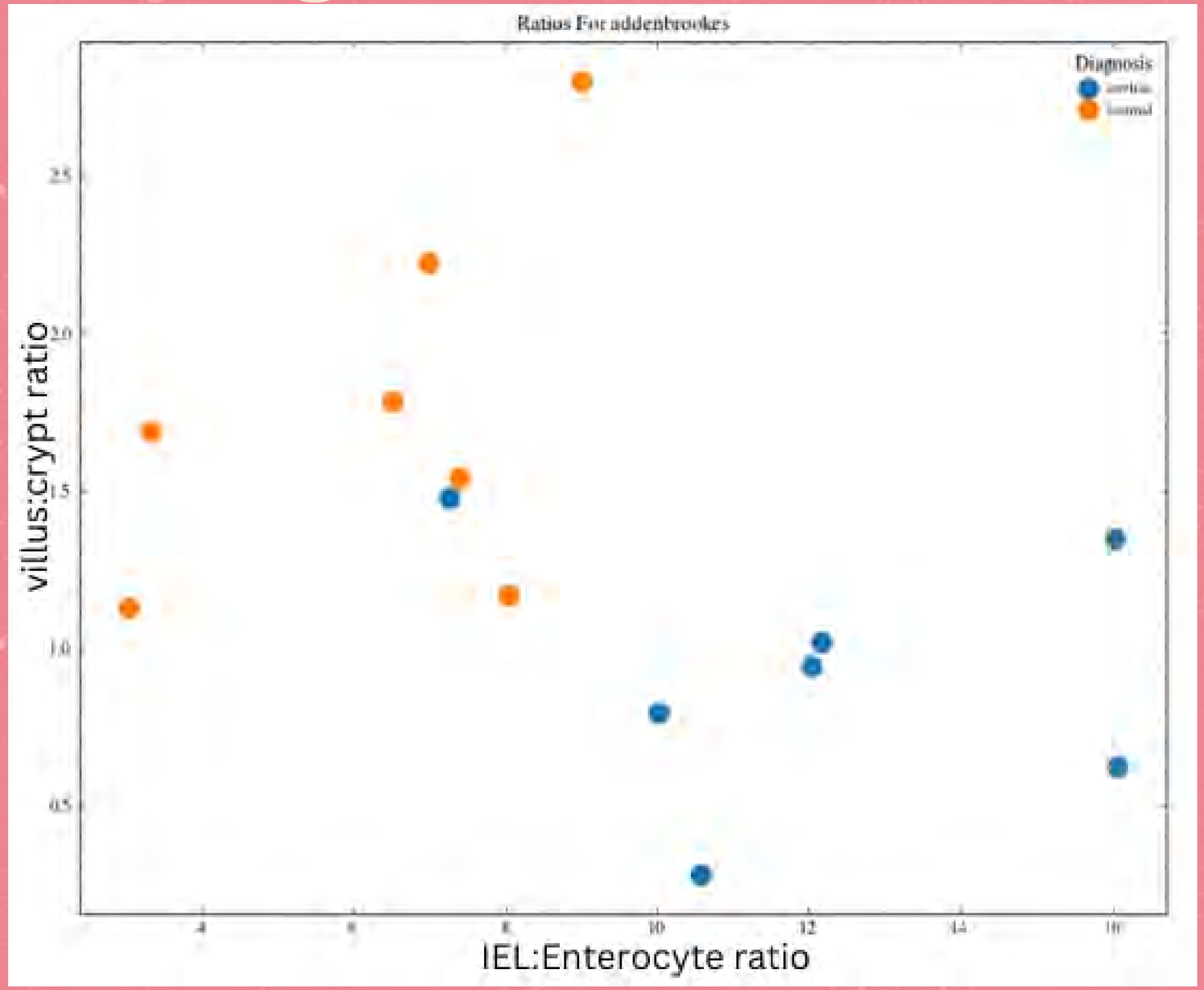


Baseline

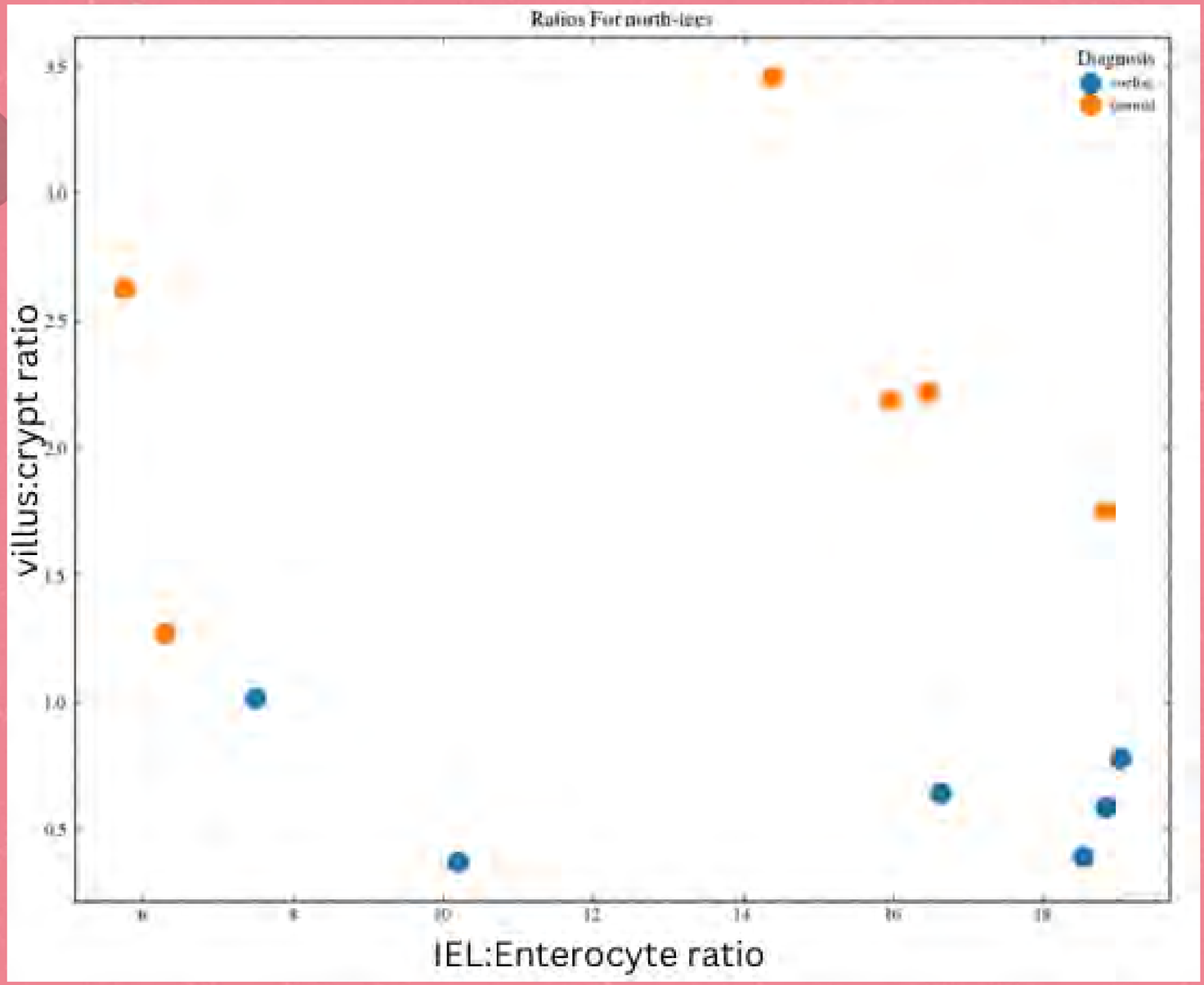
Testing - Methodology



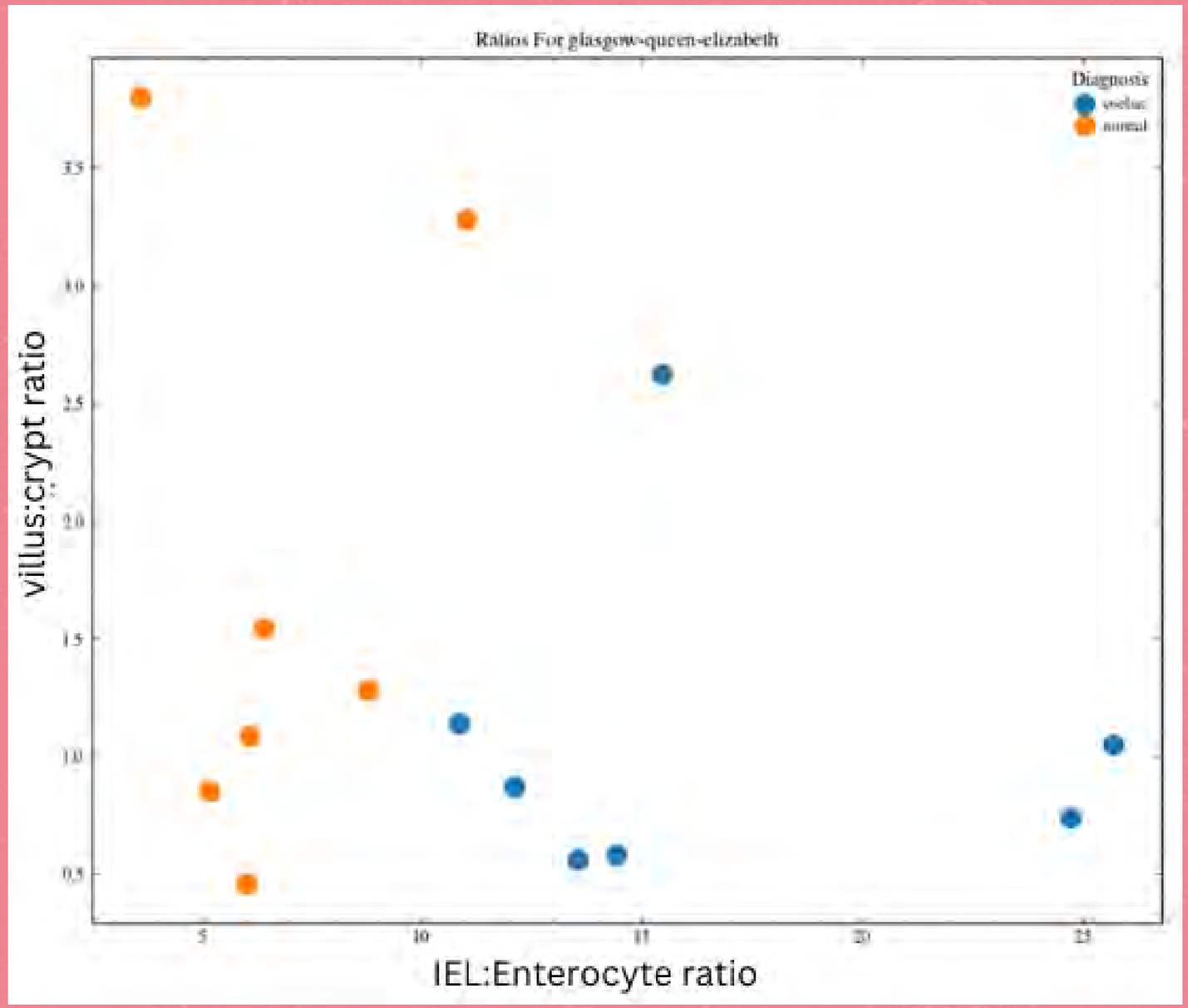
Testing – Addenbrookes



Testing – North tees



Testing – Glasgow queen elizabeth



Future Work

Test more data

Use testing function on more data to see if other patterns immerge

Test on other diseases

Other diseases see inflammation in the gut and increased IELs such as:

- Autoimmune Enteropathy
- Crohn’s disease
- Tropical Sprue

Transfer learning

Currently ResNet-34, a pathology-specific encoder would be better (which doesn’t exist at the moment)

Thank you !
Questions?