# ML CASES

OXFORD MACHINE LEARNING SUMMER SCHOOL MAY-JUNE 2023



5/22/23



### WITH YOU TODAY

### Vincent Moens

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Founder and maintainer of TorchRL (<a href="https://github.com/pytorch/rl">https://github.com/pytorch/rl</a>), the RL and decision-making library for PyTorch.



5/19/23

### WHAT YOU WILL TAKE OUT OF ML CASE



#### **ENGAGING**

Hands-on experience on a timely and challenging problem with relevant applications over multiple weeks



#### **FUN**

You will get to play around Machine Learning models and apply them to real-world applications in either healthcare or finance.



#### **COLLABORATIVE**

You will work closely in groups to learn from each other's experiences.



#### **REWARDING**

A personal project in your portfolio and if relevant uploaded to github. The best projects will be showcased through the OxML platform

INVEST +15H

BE CURIOUS

JOIN A TEAM, DEFINE A STRATEGY, RE-GROUP FREQUENTLY

BUILD A DELIVERABLE FOR YOUR PORTFOLIO

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## **SCHEDULE**



SUBMIT YOUR CASE TOW!

SUBMIT YOUR CASE
FOR FINAL EVALUATION!

JUNE 21<sup>TH</sup>

JUNE 30<sup>TH</sup>

MAY 30<sup>TH</sup> and 31<sup>TH</sup>

CASE PRESENTATION

CASE AND GROUP SELECTION

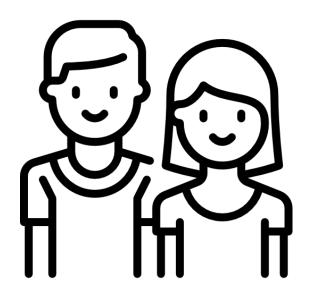
JUNE THE 2<sup>ND</sup>

WORK ON THE CASE GET SUPPORT THROUGH SLACK FROM OTHER GROUPS AND SPEAKERS [LIVE] AT 13:00 UK TIME - 1H SPEAKERS SHARE FINAL RANKING ALONG WITH THEIR FEEDBACK FROM THEY HAVE SEEN FROM GROUPS.

# LET'S START!

# The challenge

You're hired by a small scale clinical biology clinic



### YOUR CLIENTS...

Looking for a quick, cheap solution to automatically triage histopathological samples as high or low priority.

### **YOUR COMPANY...**

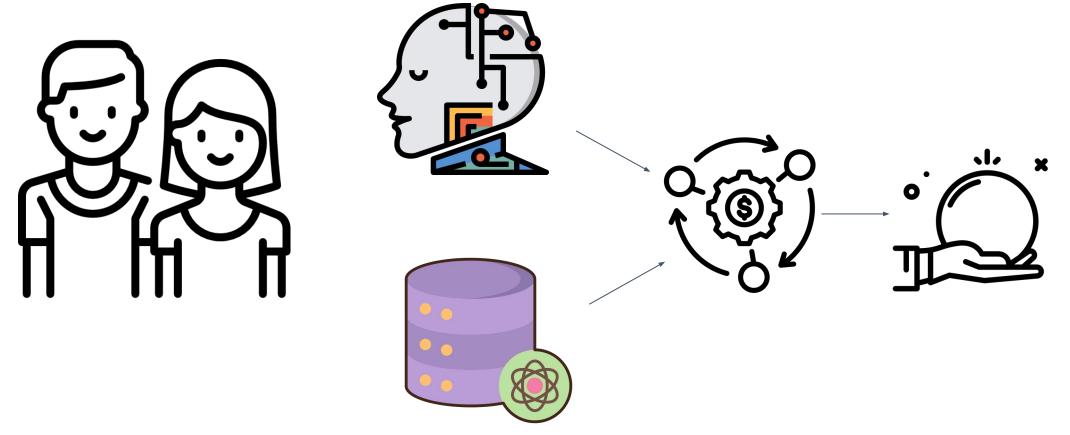
You provide efficient, lightweight off-the-shelf ML solutions for clients looking at automating their workflow.

#### **YOUR PRODUCT**

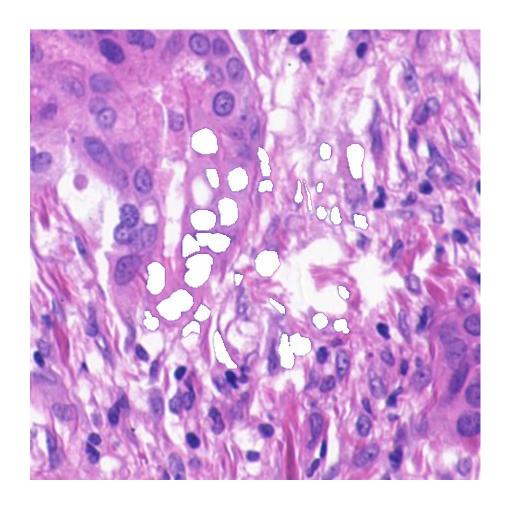
You bring a collection of pretrained ML architectures ready to be put in production as well as relevant tools to quickly assess their performance. Your strength is that you are able to work with small training datasets.

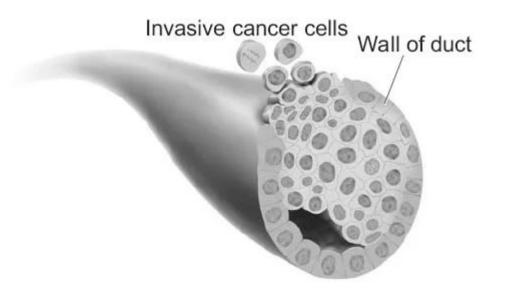
## YOUR CHALLENGE

Give an easy-to-use PoC of a carcinoma classifier



# #1 The dataset





Normal	Cancer	
		Large, variably shaped nuclei
400	# O O S	Many dividing cells;
		Disorganized arrangement
		Variation in size and shape
		Loss of normal features

## #1 The dataset

A total of 186 histopathological slides from breast biopsies.

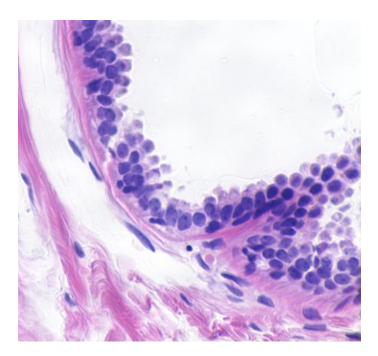
Can be split in three groups:

- Carcinoma ⊖: no tumor cells
- Carcinoma ®, benign: benign tumor cells
- Carcinoma ⊕, malignant: malignant tumor cells

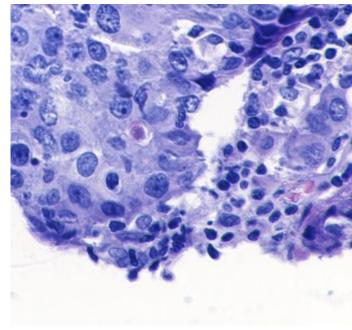
The task is to classify them accordingly.

### Histopathology 101:

- Collect sample
- Fixation (formaldehyde >24h)
- Processing (dehydration...)
- Embedding (paraffin)
- Sectioning
- Staining (HES)
- Coverslipping







malignant

## #2 RESOURCES and TIPS

You can approach this problem in several ways:

- Using a pretrained model and fine-tune: pick up a pretrained model and fine-tune it on the training dataset. You can usually replace the last layer by a module of your choice (usually a linear layer) that you will train while keeping the rest of the model frozen.

#### Resources:

https://pytorch.org/hub/

https://huggingface.co/

https://pytorch.org/vision/stable/models.html

- Zero-shot learning: Use a trained model that has not seen the relevant classes but is capable of inferring based on a suggestion of classes.

https://huggingface.co/tasks/zero-shot-classification

- Gaussian process or similar (NP etc): Allows you to make Bayesian inference based on the data available. Given data X\_train and classes Y\_train, you can use a GP (not a GP :p) to infer

Y\_valid | X\_valid, X\_train, Y\_train.

You will still need a pretrained model to embed your images.

You can also use more "classical" ML solutions: SVMs or XGBoost

https://botorch.org/

## #3 The competition



https://www.kaggle.com/competitions/oxml-carinoma-classification

Finding a team: <a href="https://www.kaggle.com/competitions/oxml-carinoma-classification/discussion/414087">https://www.kaggle.com/competitions/oxml-carinoma-classification/discussion/414087</a>