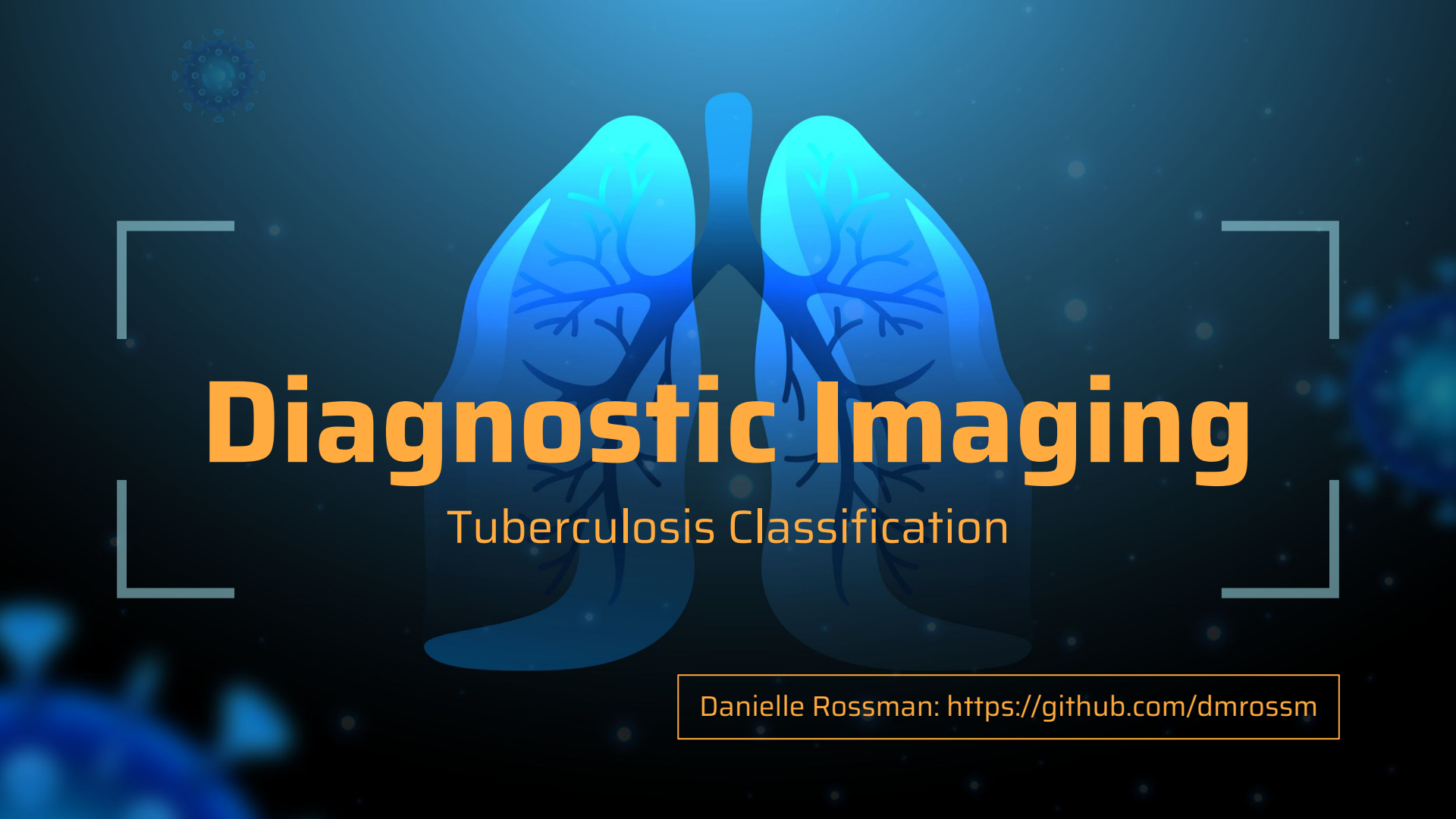


Diagnostic Imaging

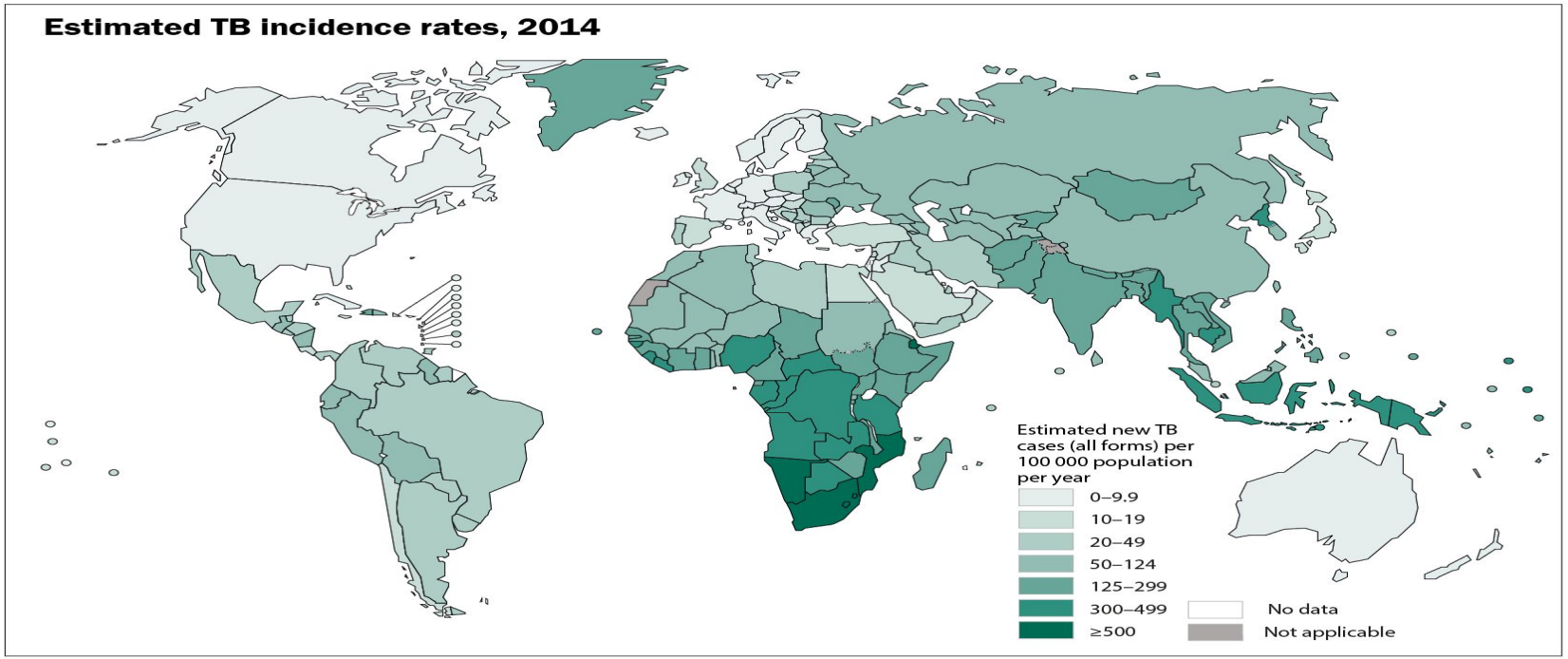
Tuberculosis Classification

Danielle Rossman: https://github.com/dmrossm

Background

- **25%** of the world population is infected with tuberculosis (TB)
  - most patients live in poorer countries
- **2.5%** of the world population has active/infectious TB
- Medical imaging needed to assess infectiousness/prognosis → **$**

Worldwide Tuberculosis Distribution



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: *Global Tuberculosis Report 2015*. WHO, 2015.

World Health Organization

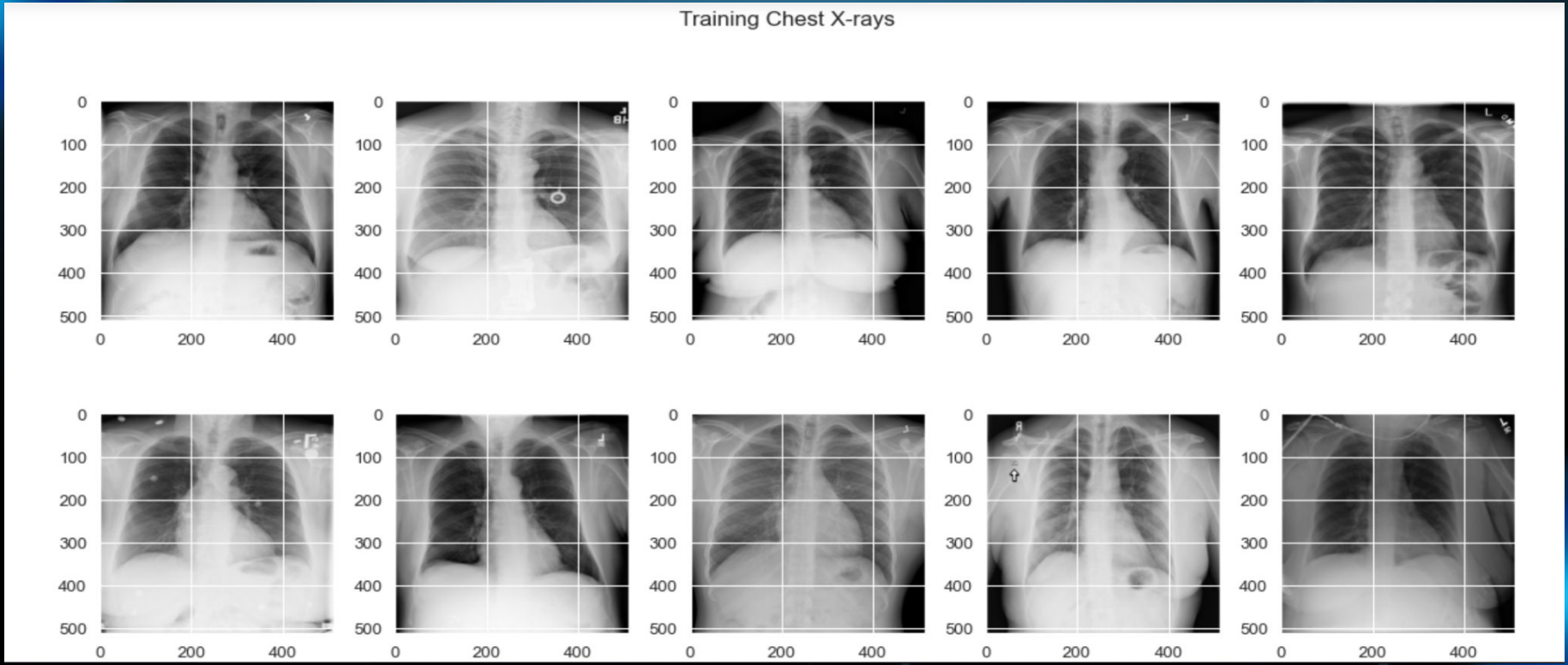
Business Need

- **The World Health Organization** (WHO) is seeking an **Image Classification Tool** for chest X-rays (CXRs) of TB patients
    - to allow poorer and/or rural countries cheaper assessment of CXR's
    - decrease the worldwide tuberculosis burden at lower $$$

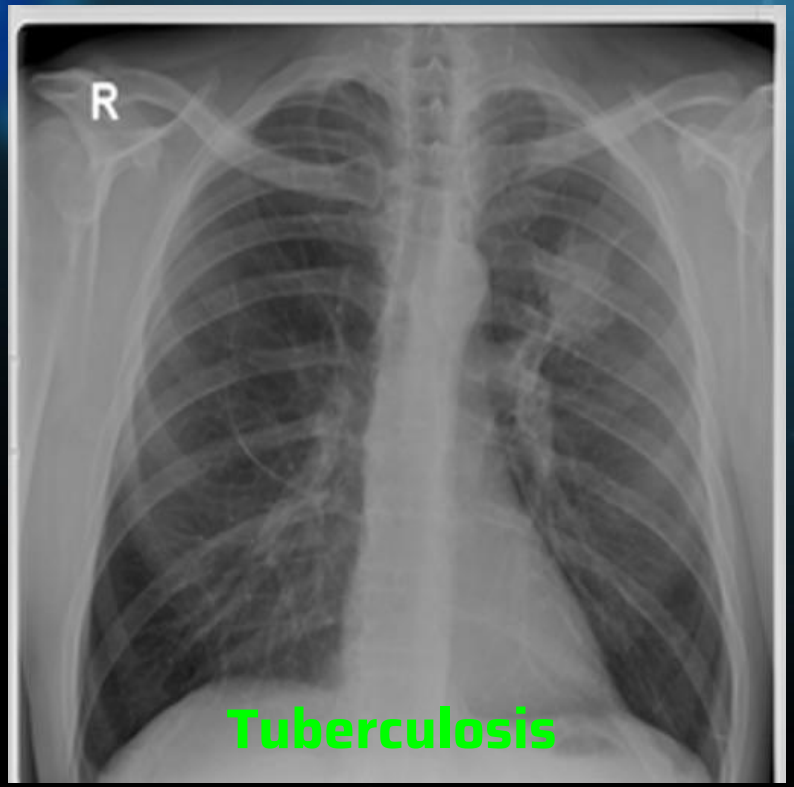
Data Understanding

- 4200 Chest X-rays (CXRs) of standard size
  - 700 TB positive (17%)
  - 3500 TB negative (83%)
- Data Imbalance

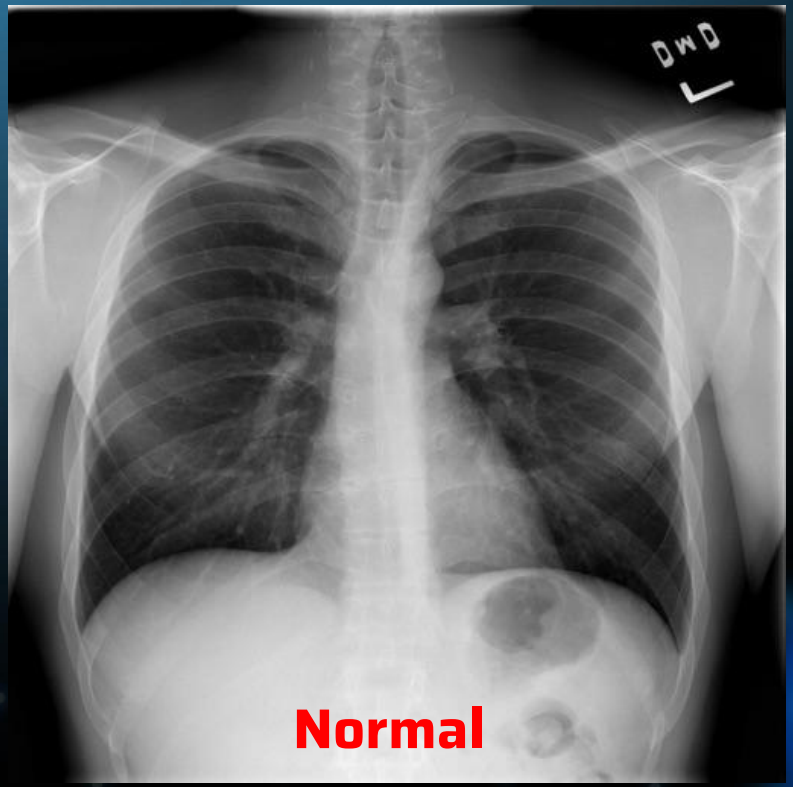
Training Images



Training Images



Tuberculosis



Normal

Data Understanding

- **False positive:**
  - normal X-ray → Image Classifier → X-ray demonstrating TB

- **False negative:**
  - X-ray demonstrating TB → Image Classifier → normal x-ray

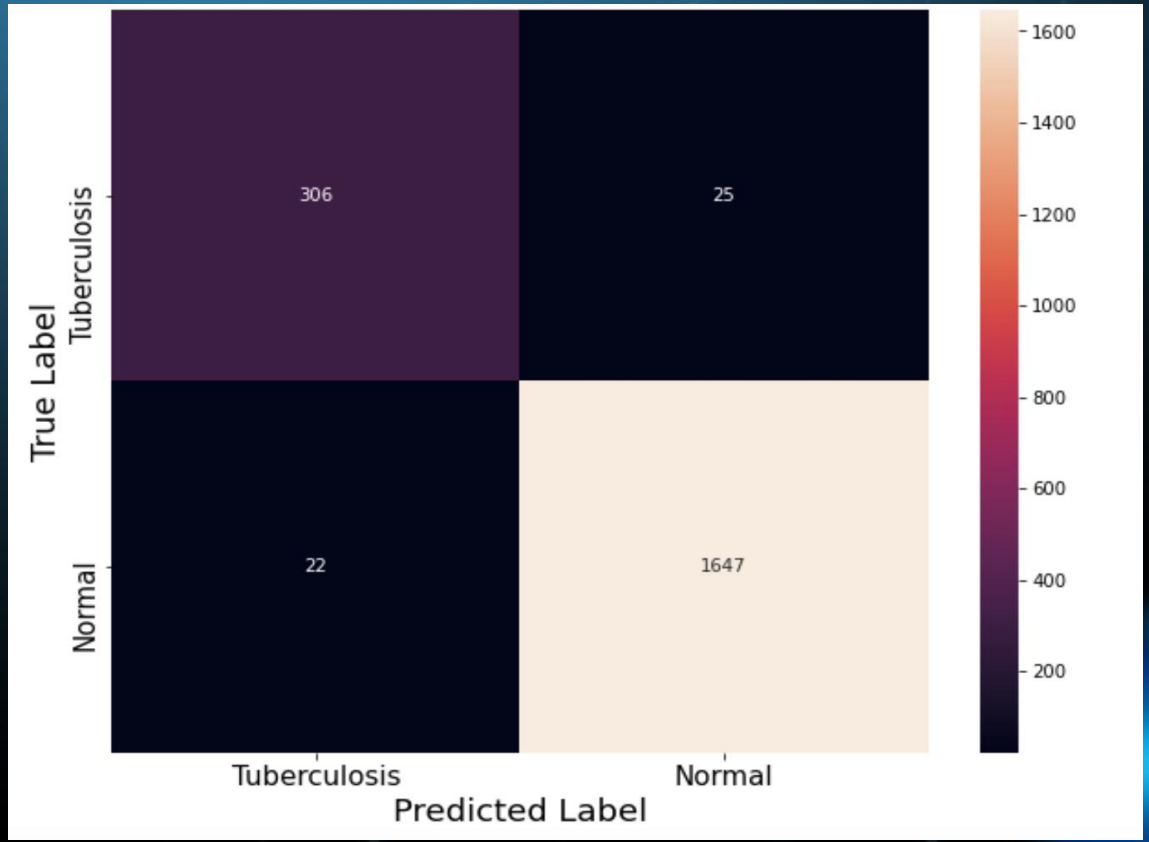
Modeling

- **Final Model: A Multilayer Perceptron (MLP)**
  - Pattern recognition

    → differentiation between normal Chest X-rays and those demonstrating tuberculosis

Final Model

- **Testing Accuracy: 92%**
- **Testing Recall: 90%**



Conclusion

- This model accurately labels an x-ray from a patient with or without tuberculosis* **95**% of the time.

Next Steps

Study of **Image Classification Tool** efficacy:

- Test tool in an urban and a rural area
- Calculation of “case save rate”
- Estimate **$** savings due to decreased cost of imaging interpretation, care delay and unnecessary case spread
- Further development of tool to differentiate between latent and active tuberculosis

Thank you!

Questions → Danielle Rossman: https://github.com/dmrossm