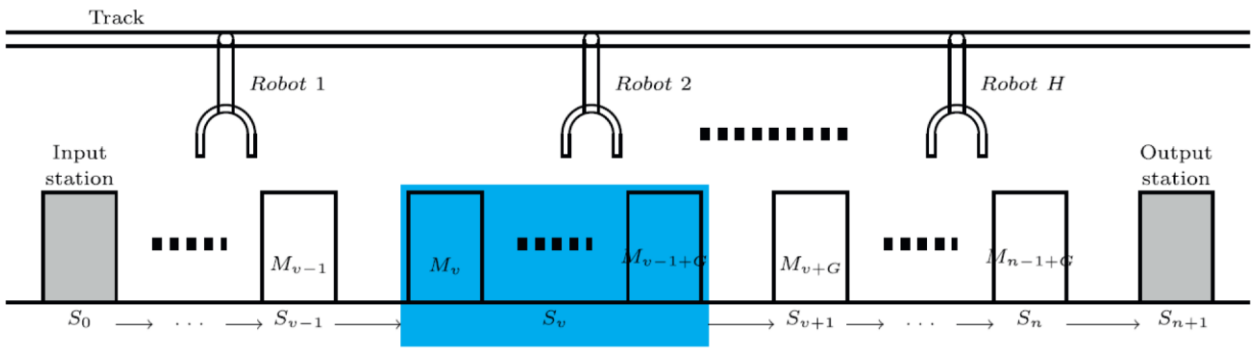
Prof Jacomine Grobler~ Department of Industrial Engineering

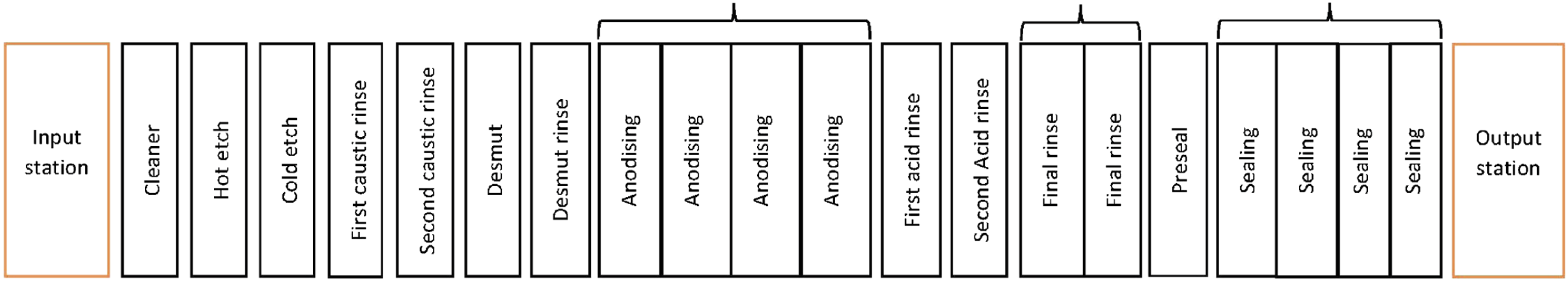
# AI-based industrial engineering: using data for improved decision making

Industry Showcase 2025

DATA

# Aluminium anodising scheduling

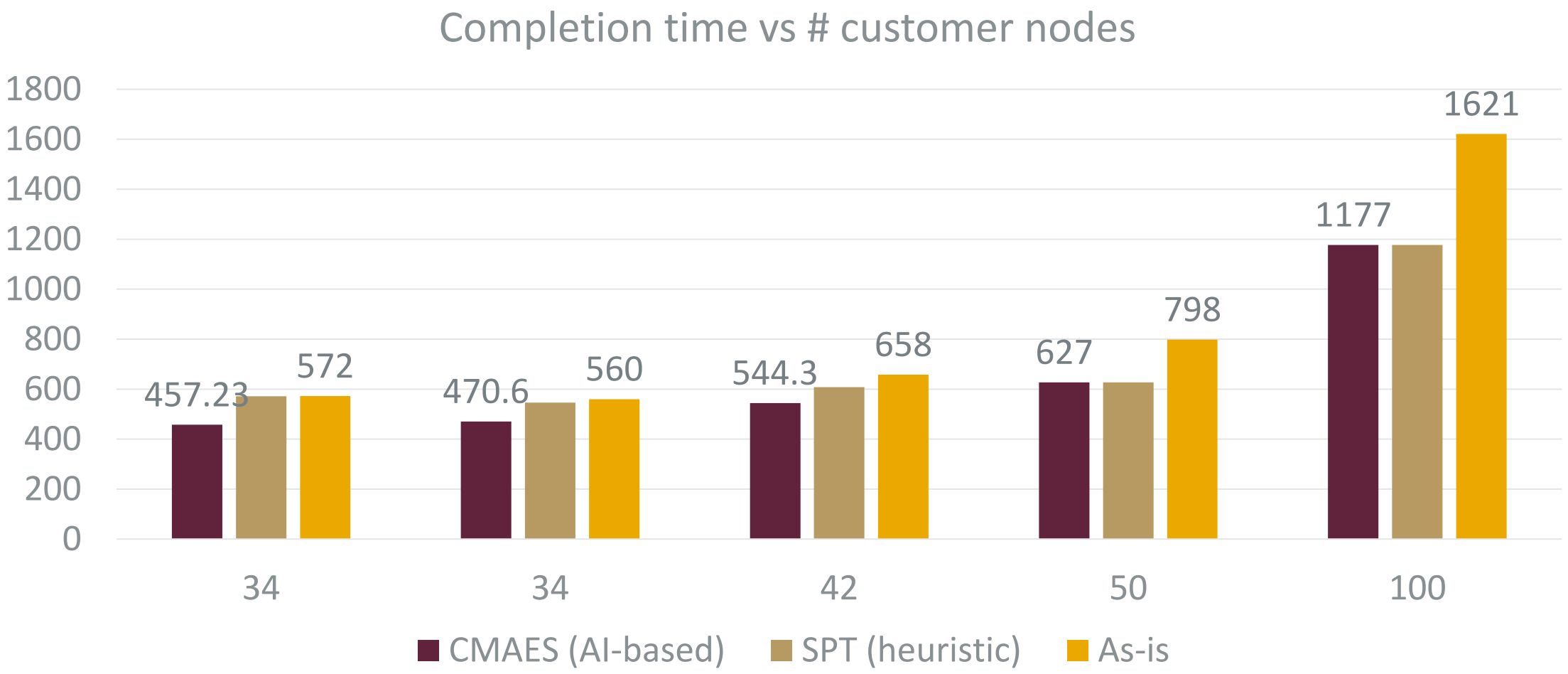





Acknowledgements: Carina Behr

# Aluminium anodising scheduling



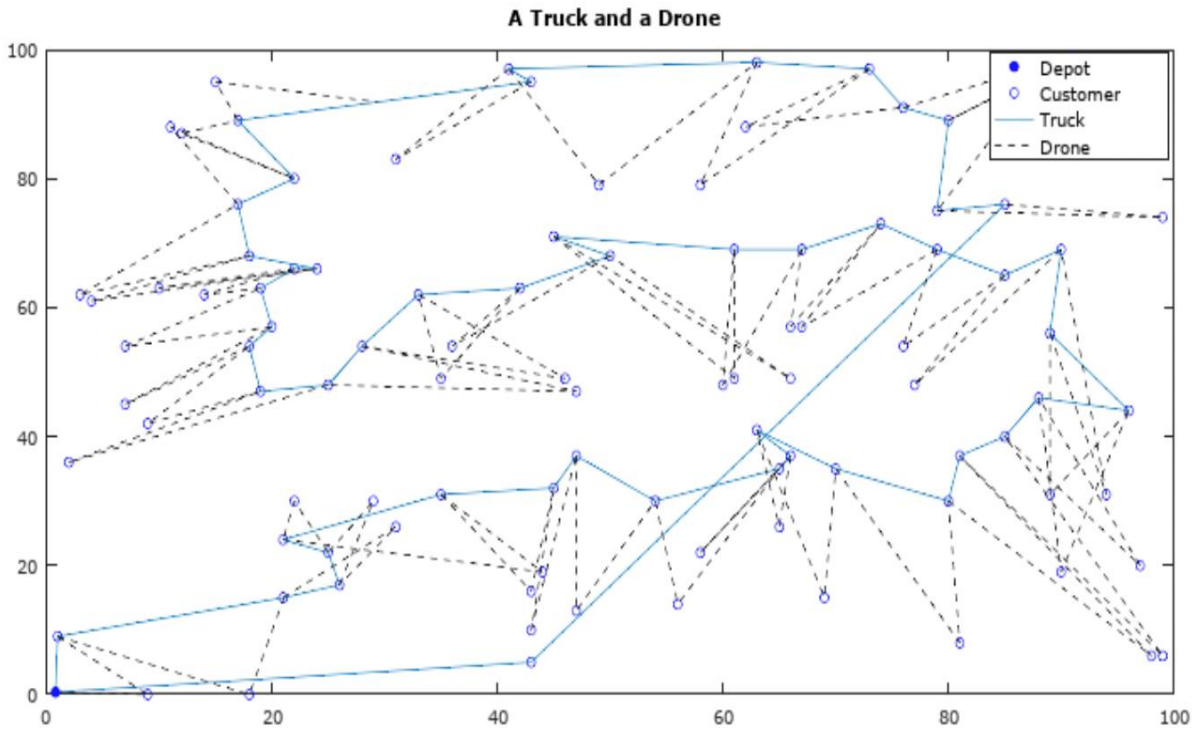


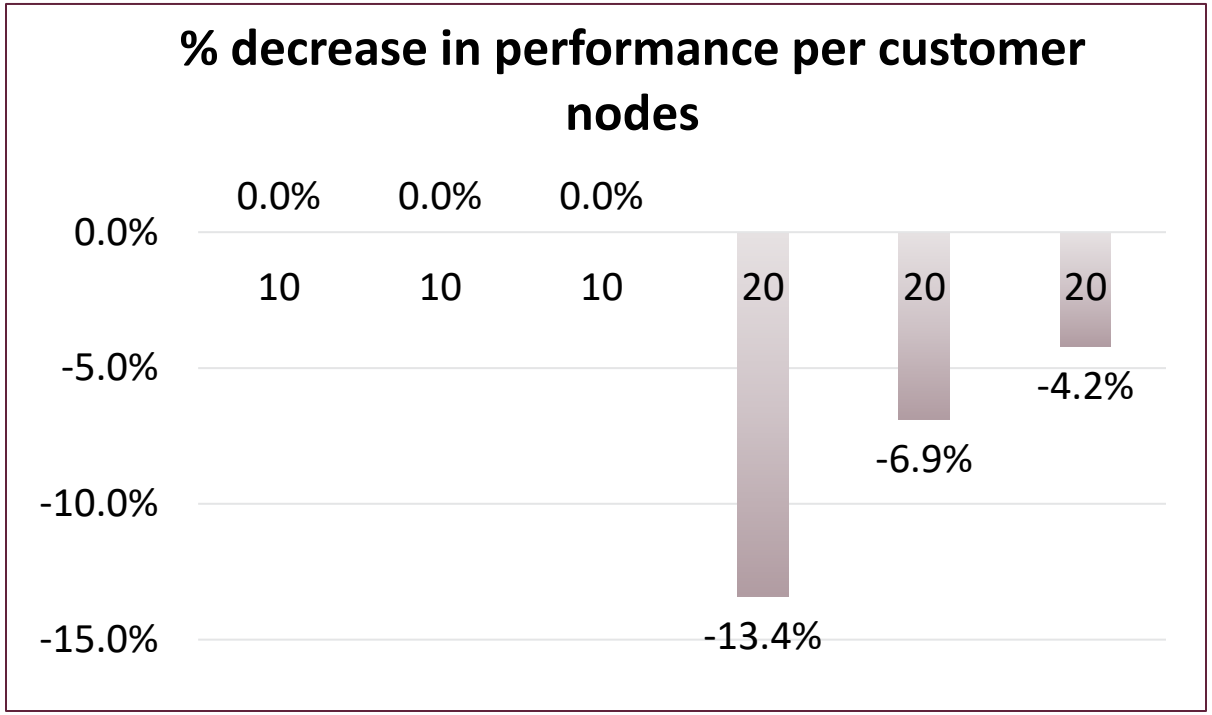

Acknowledgements: Carina Behr

amazon

Acknowledgements: Francois Knoetze

# Optimal vs AI-based Algorithm Results



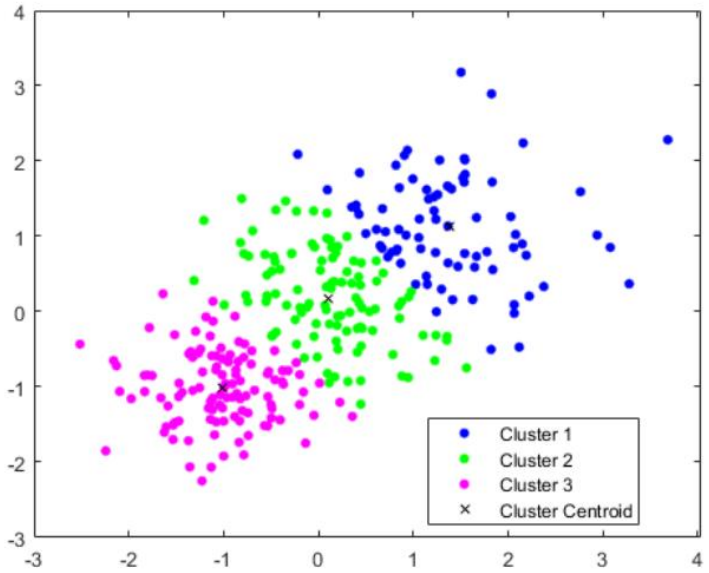






Acknowledgements: Tsietsi Moremi, Francois Knoetze

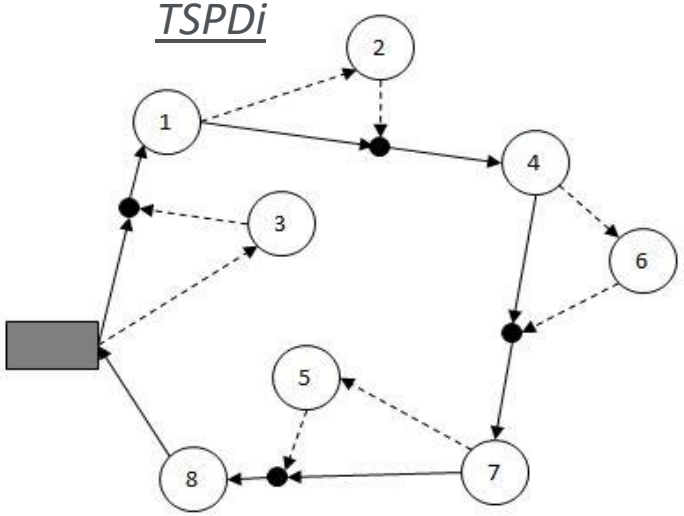
# VRPDi with time windows

*K-means Clustering*




+

*TSPDi*

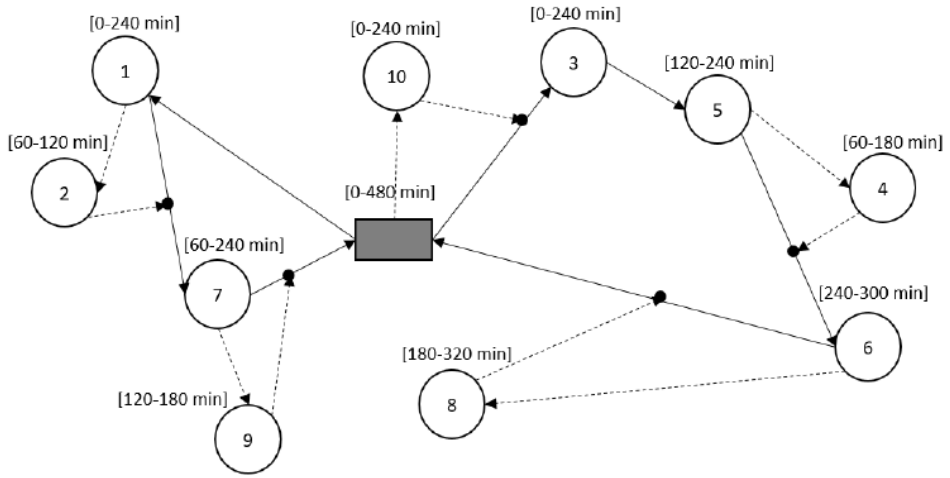



+

*Time windows*

=

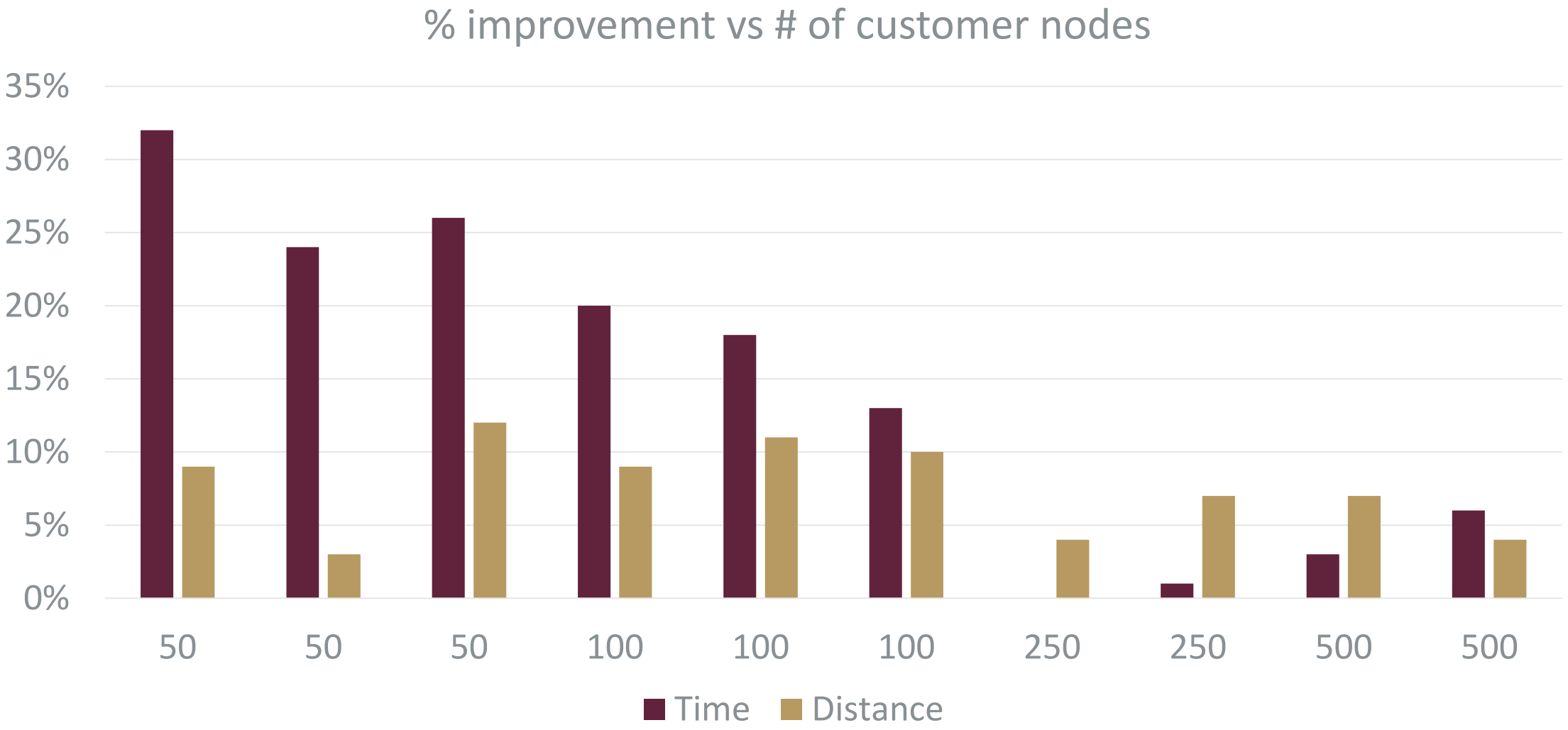
*VRPDiTW*






Acknowledgements: Tsietsi Moremi

# Truck-only vs truck-and-drone system
## (with time windows)






Acknowledgements: Tsietsi Moremi

# Mozambican Cassava Suppliers

Cassava stiff porridge

Boiled cassava roots

Cassava leaves

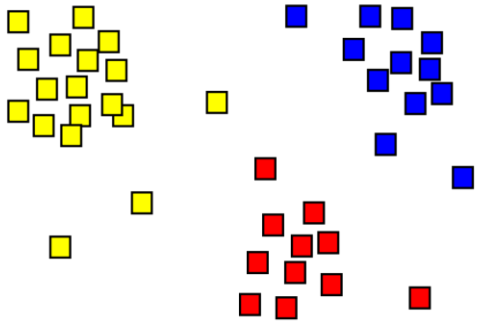


Acknowledgements: Ntebaleng Matshabaphala

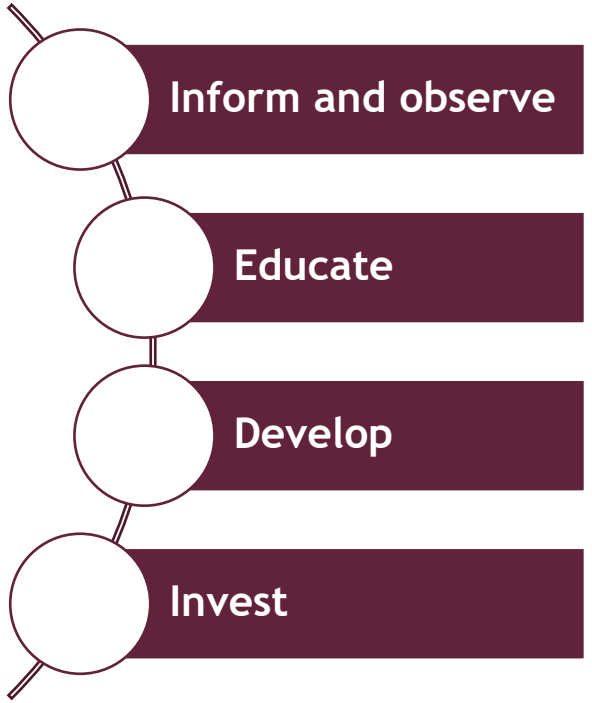
# Segmentation of Mozambican Cassava Suppliers

| Feature name |
|---|
| Farmer code |
| Location of factory |
| Location of plot |
| Latitude of plot |
| Longitude of plot |
| Fieldworker |
| Modified variety? |
| Starch content (%) |
| Cassava quantity (Kg) |
| Cassava cost (MZN) |
| Transport cost (MZN) |

- K-means
- AHC
- SOM



- Supply risk
- Effectiveness of operations
- Performance improvements



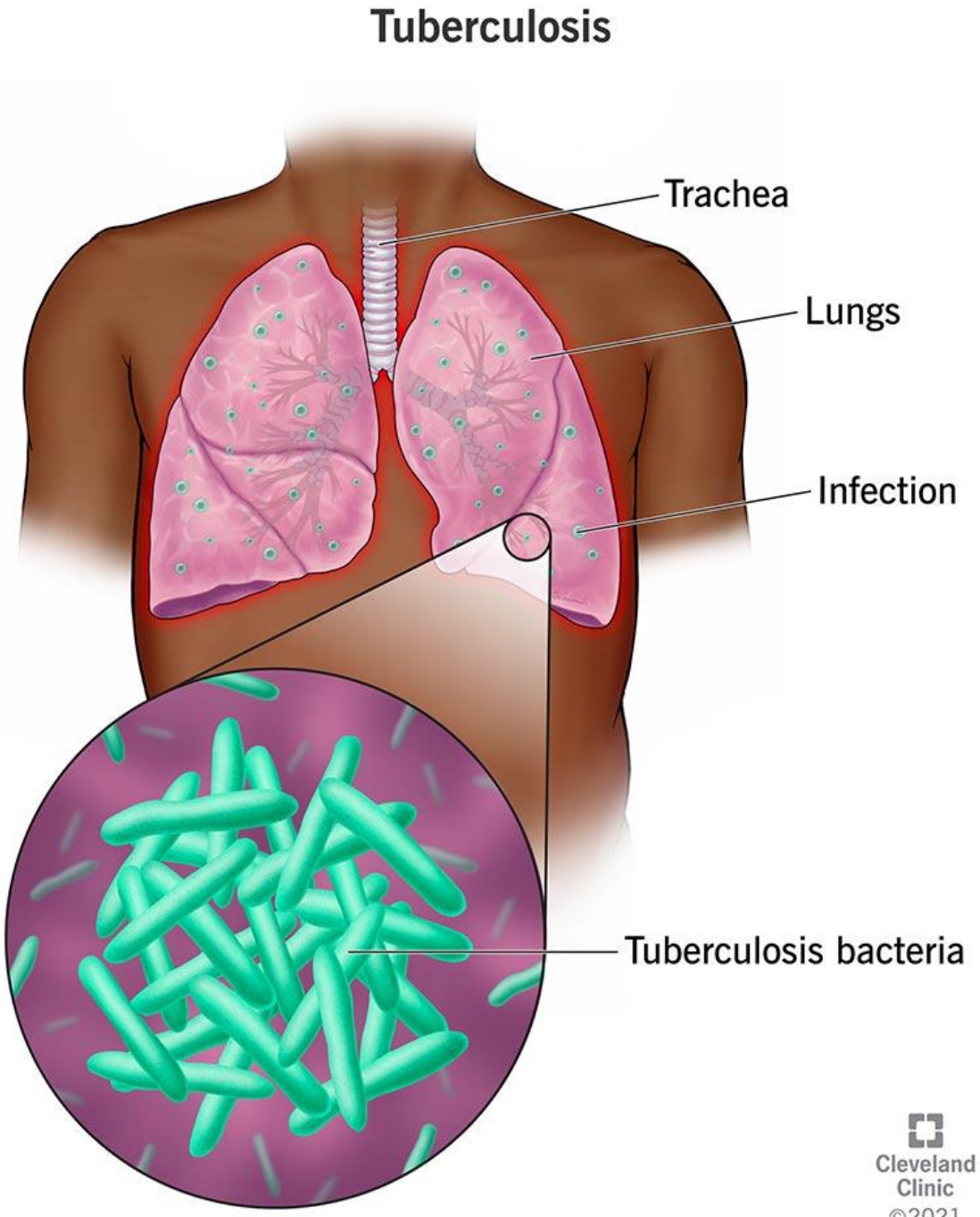

3000 suppliers over 2 years



Acknowledgements: Ntebaleng Matshabaphala

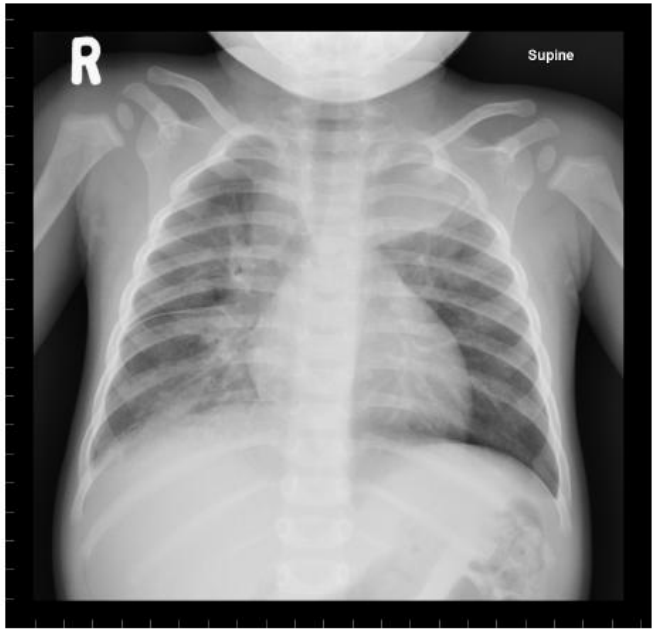
# Deep learning for identifying paediatric tuberculosis

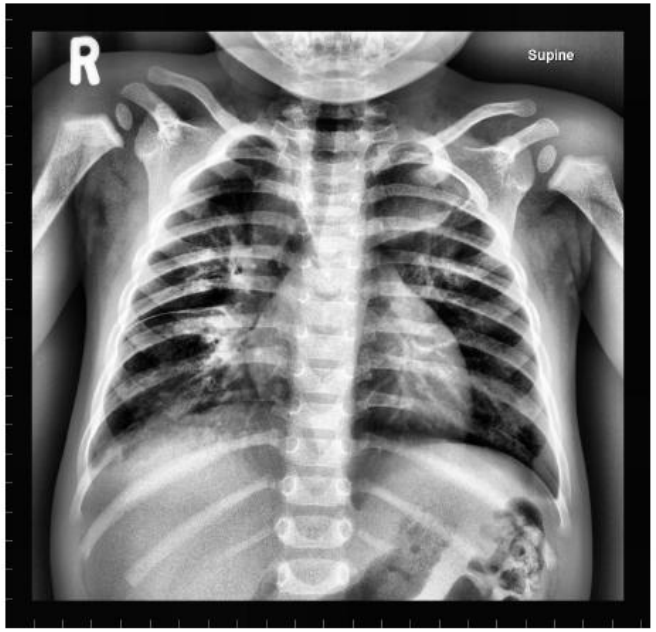
- Tuberculosis diagnosis in young children is difficult.
- Most prevalent in LMIC.
- Common symptom of lymphobronchial tuberculosis is enlarged lymph nodes which lead to airway compression.
- This study investigated the use of deep learning for identifying lymphobronchial tuberculosis in children under the age of 5 with chest X-ray images as input.




Acknowledgements: M Basson, P Goussard

# Image enhancement

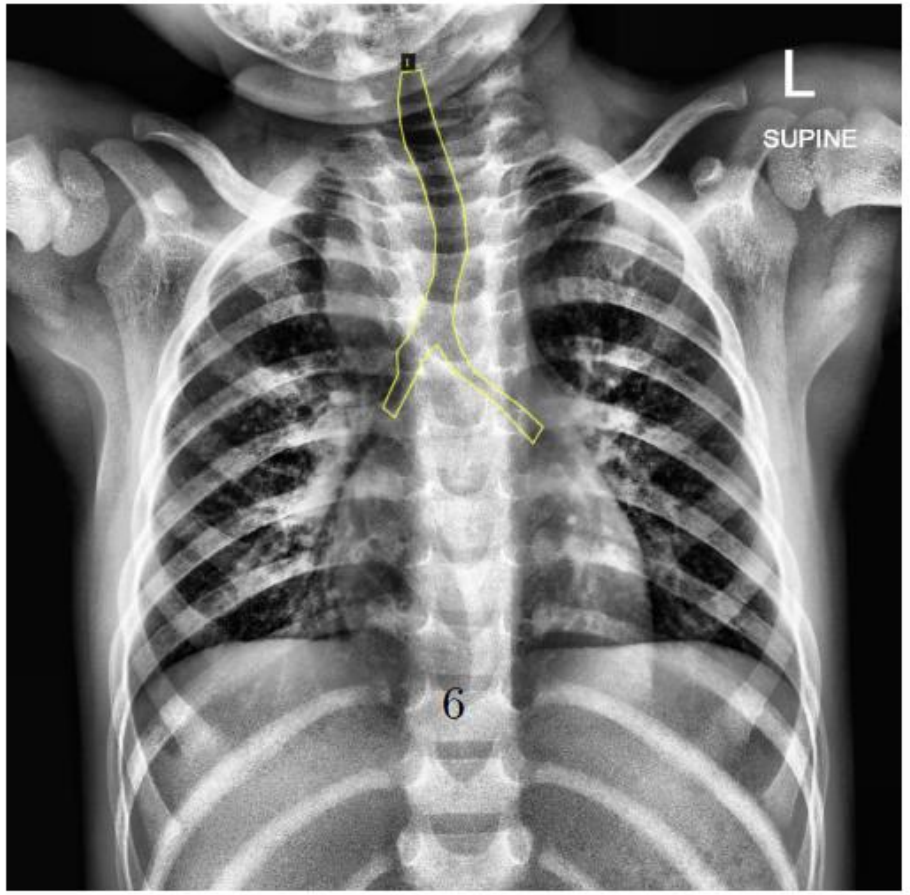



CXR image examples before and after CLAHE have been applied.

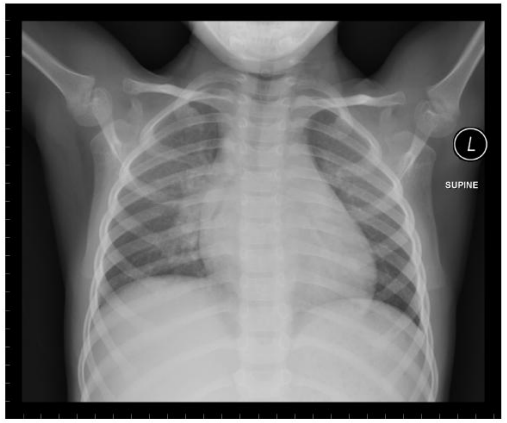
Acknowledgements: M Basson, P Goussard

# Manual annotation

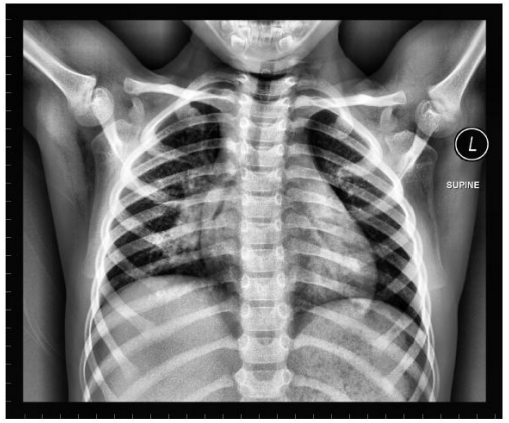



Acknowledgements: M Basson, P Goussard

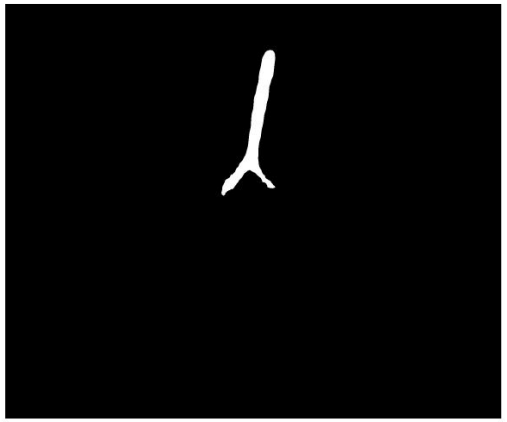
# Preprocessing




(a)




(b)



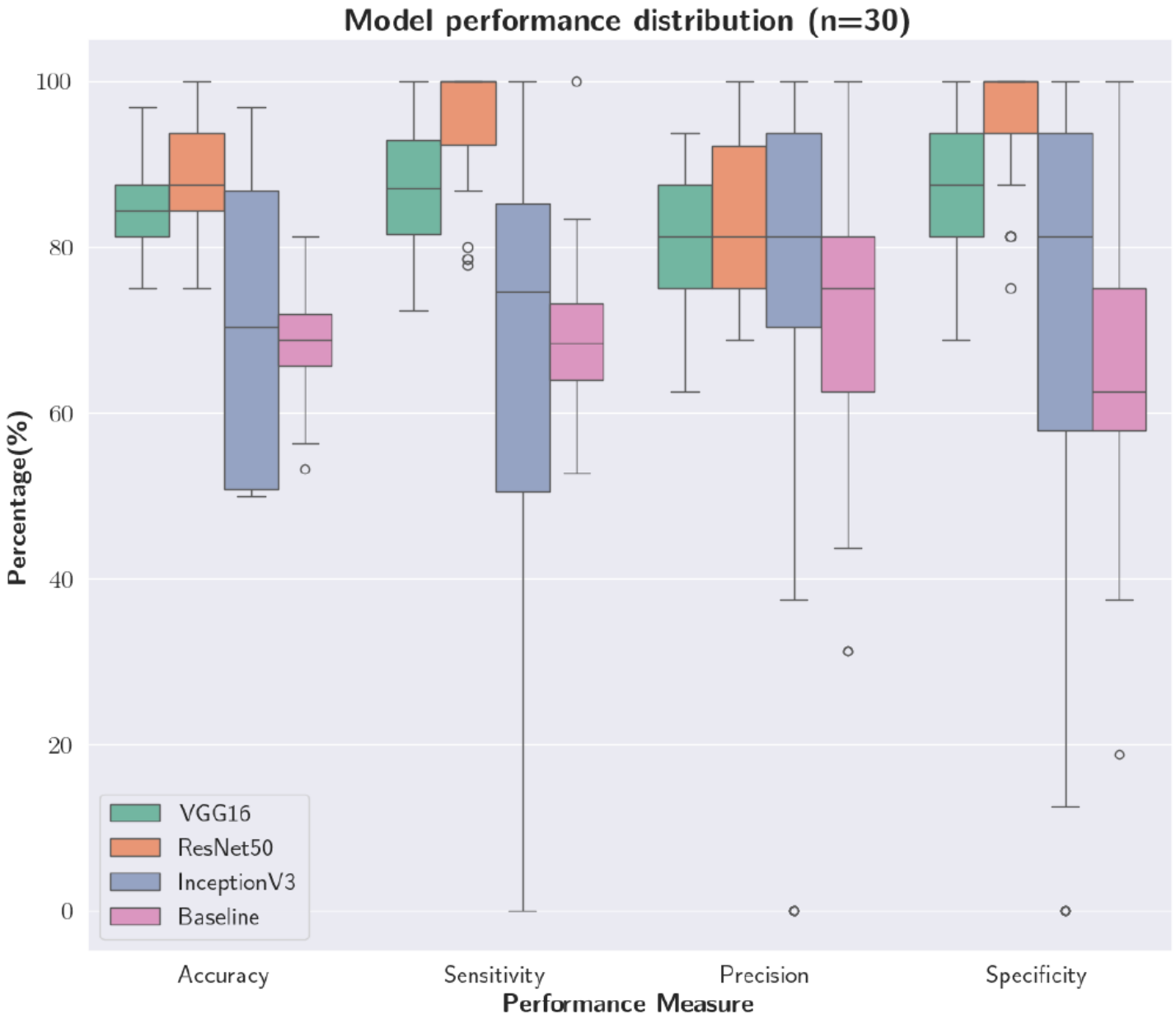
(c)

(d)

(a) Original CXR Image.
(b) Enhanced image in (a) with the CLAHE algorithm applied.
(c) The resulting mask after the Mask R-CNN model was applied.
(d) The cropped image of the mask overlayed on the enhanced image.

Acknowledgements: M Basson, P Goussard

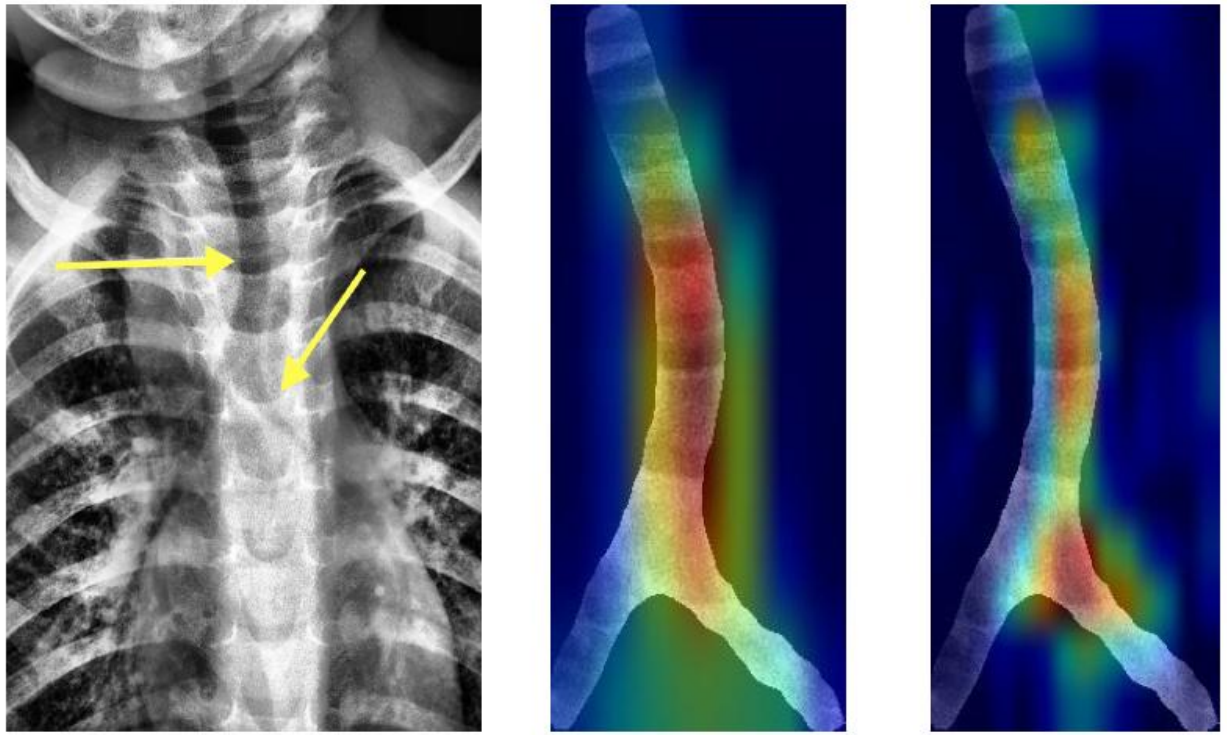
# Results




Recall: 94.43%
Specificity: 94.79%

Acknowledgements: M Basson, P Goussard

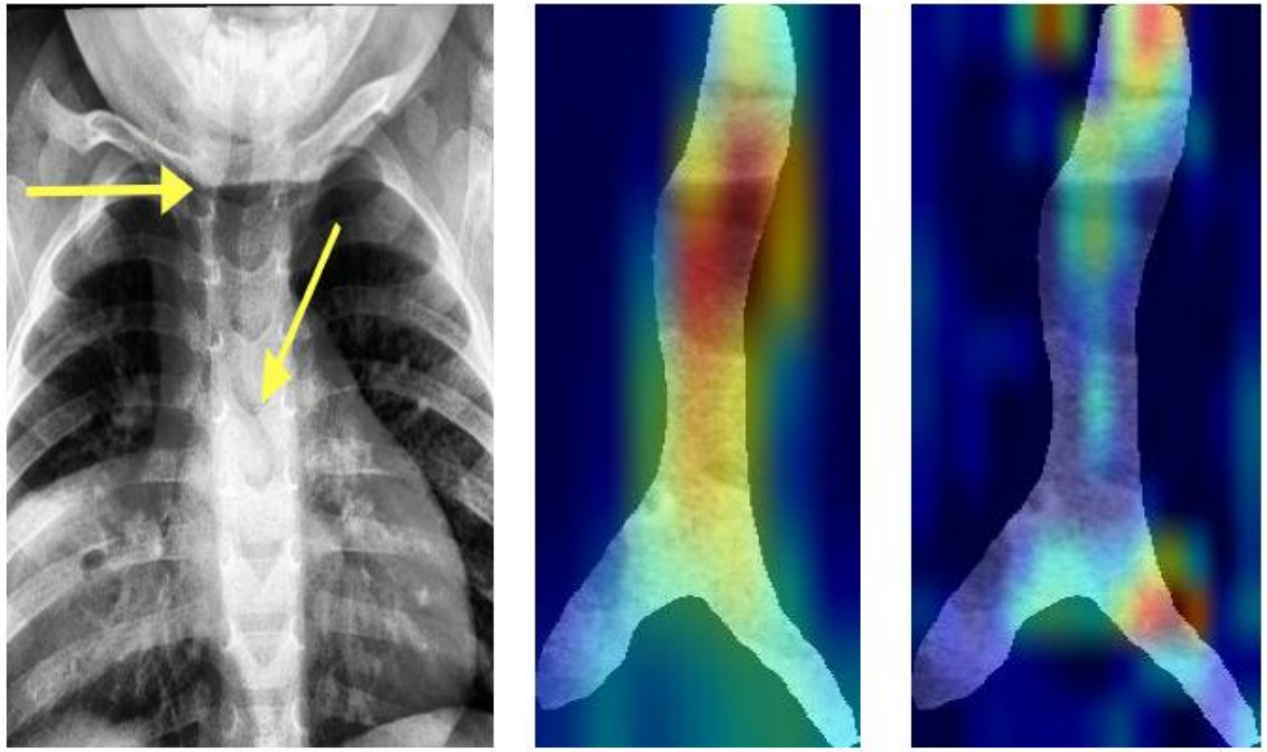
# Correctly predicted samples




(a) The enhanced and cropped CXR image where TB is present.
(b) Grad-CAM heatmap of the custom ResNet50 model.
(c) Grad-CAM heatmap of the custom VGG16 model.

Acknowledgements: M Basson, P Goussard

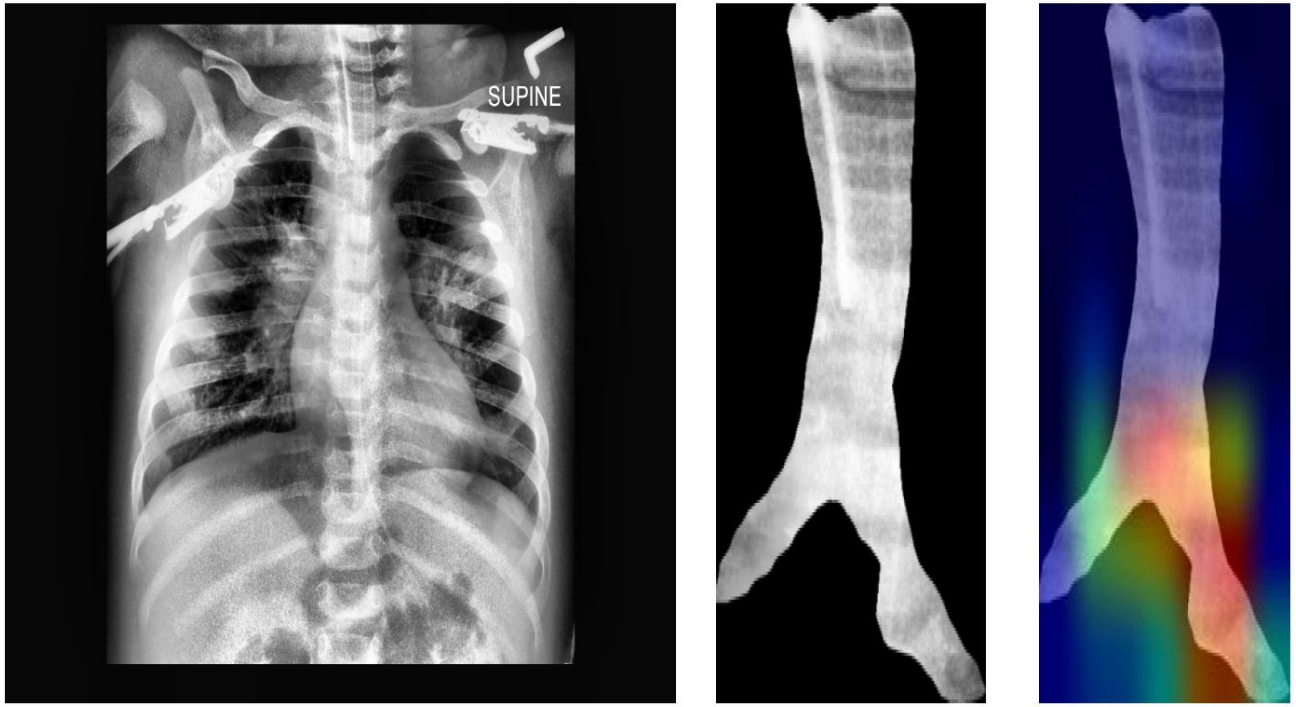
# Correctly predicted samples




(a) The enhanced and cropped CXR image where TB is present.
(b) Grad-CAM heatmap of the custom ResNet50 model.
(c) Grad-CAM heatmap of the custom VGG16 model.

Acknowledgements: M Basson, P Goussard

# Normal prediction where TB is present

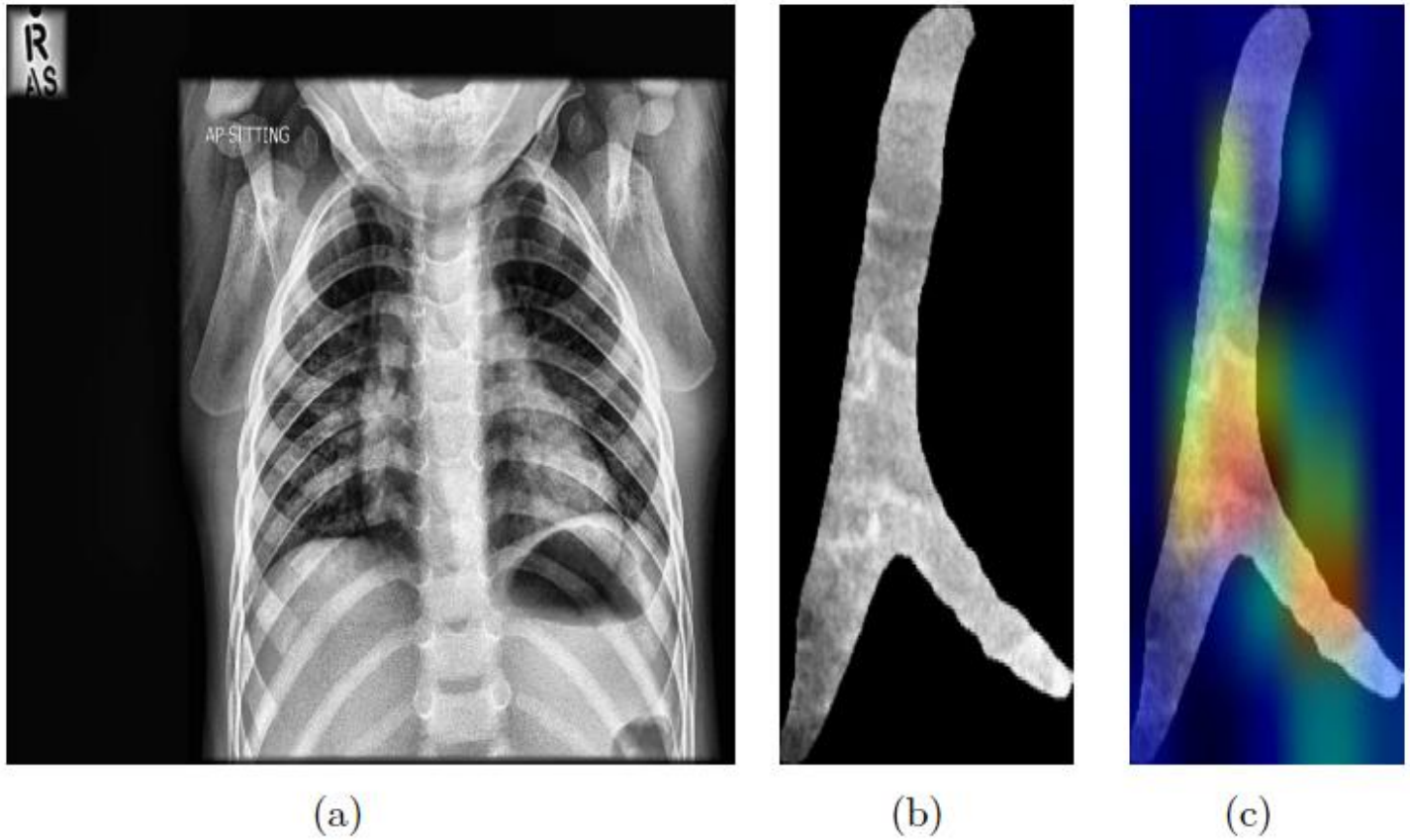



(a) (b) (c)

(a) Original enhanced CXR image.
(b) Segmented and enhanced trachea and main bronchi.
(c) Grad-CAM heatmap of normal prediction activation.

Acknowledgements: M Basson, P Goussard

# TB predicted where no TB is present




(a) Original enhanced CXR image.
(b) Segmented and enhanced trachea and main bronchi.
(c) Grad-CAM heatmap of TB prediction activation.

Acknowledgements: M Basson, P Goussard

Stellenbosch
UNIVERSITY
IYUNIVESITHI
UNIVERSITEIT
Engineering
EyobuNjineli
Ingenieurswese
Thank you
Enkosi
Dankie