

Using Image recognition in production support

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AGENDA

1. Introduction
2. Classical machine learning vs. Deep learning
3. Our approach
4. The results
5. Conclusion



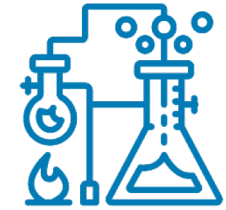
1. Introduction

Production of vaccines

How can we enhance productivity?



Pharmaceutical Company: Vaccines production

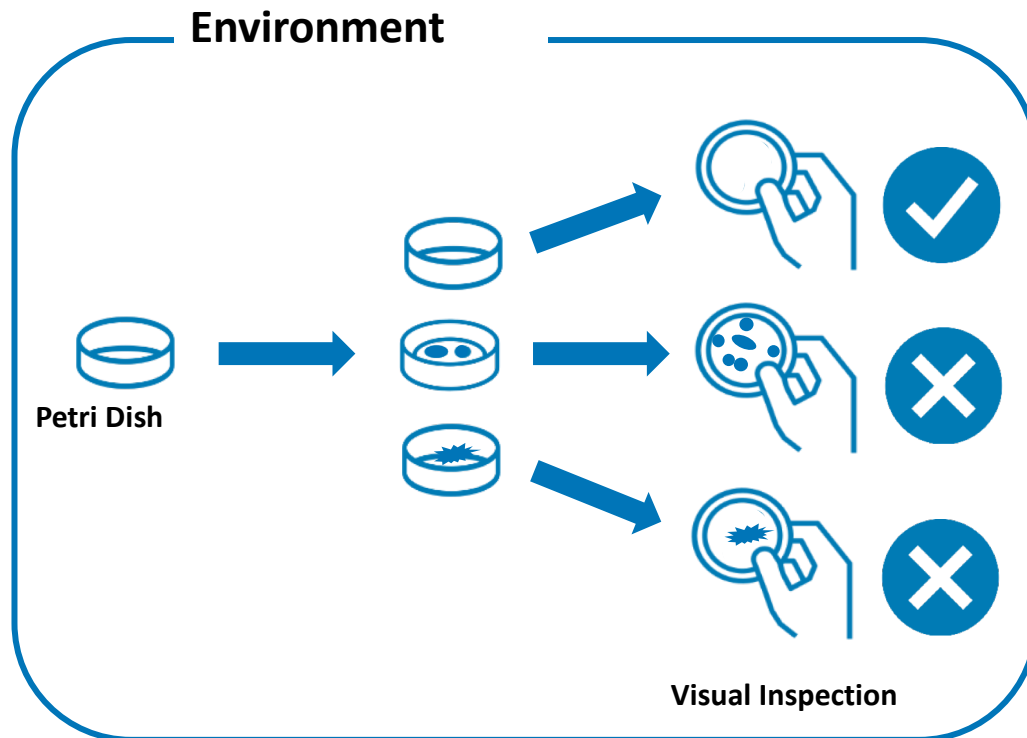


Environmental QC

- To check sterility of zones
- Mandatory
- Numerous
- Routine analysis
- High volume to analyze
- Time consuming
- Human senses

AUTOMATIZATION !

**Solution : Digital assisted
control via artificial
intelligence !**



Negative : growth /
contamination / media dry



Positive : No growth



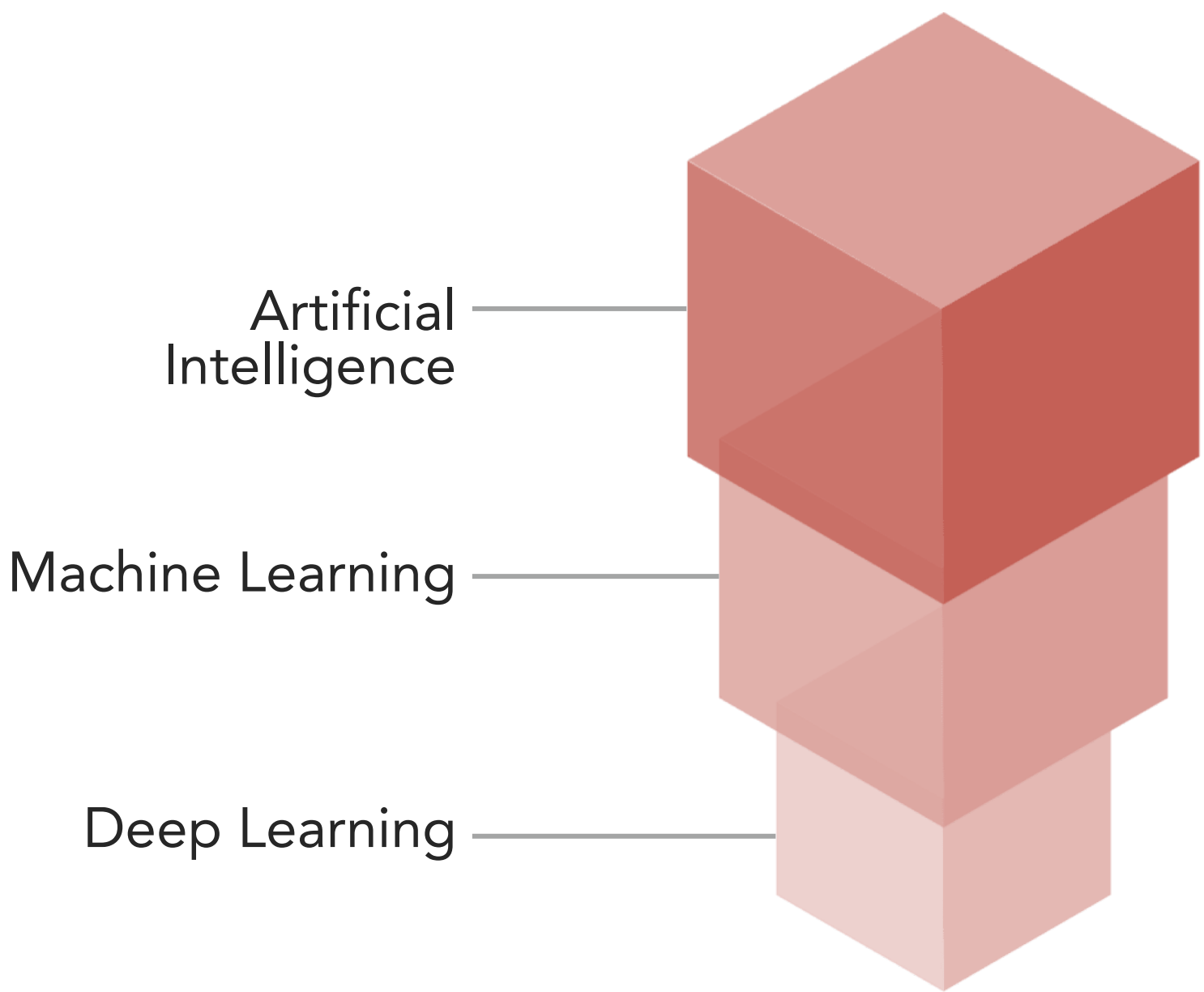
2. Classical ML vs. DL

In image classification

What is the difference ?



“Classical” Machine Learning vs Deep Learning



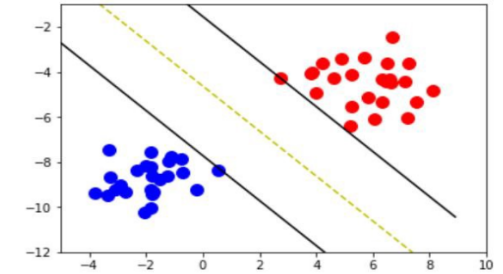
“Classical” Machine Learning with images



Image



Feature extraction



Classical classification

“Classical” Machine Learning in bacterial counting

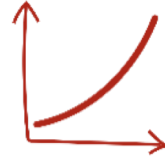
Performances comparable to humans but with limitations:

- Only for very specific settings
- Not scalable
- Human presence required

Deep learning



No feature extraction



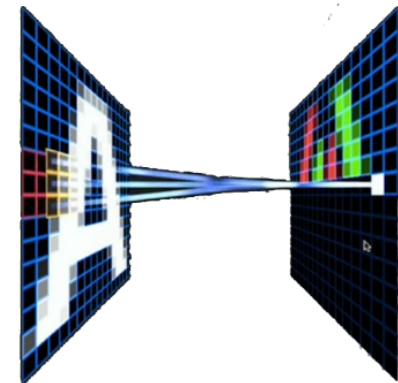
State-of-the-art performances



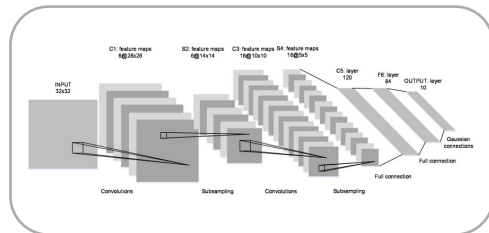
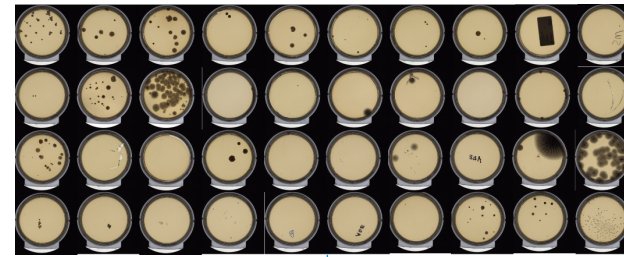
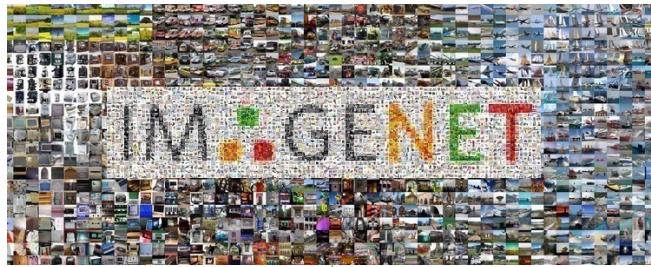
Generalisation properties

Convolutional Neural Network (CNN)

- **Local connectivity**
- **Parameter sharing**



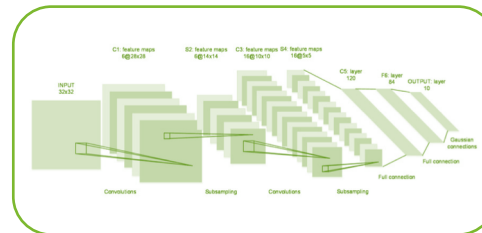
Transfer learning



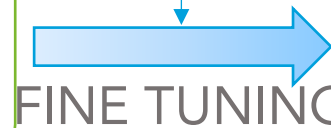
State of the art
neural network



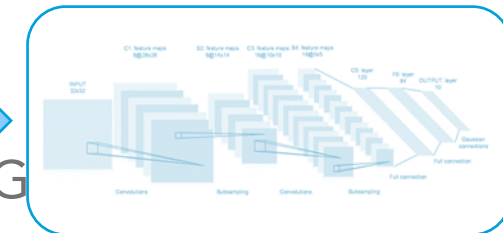
TRAINING



Pre-trained
neural network



FINE TUNING



Custom trained
neural network

3. Our approach

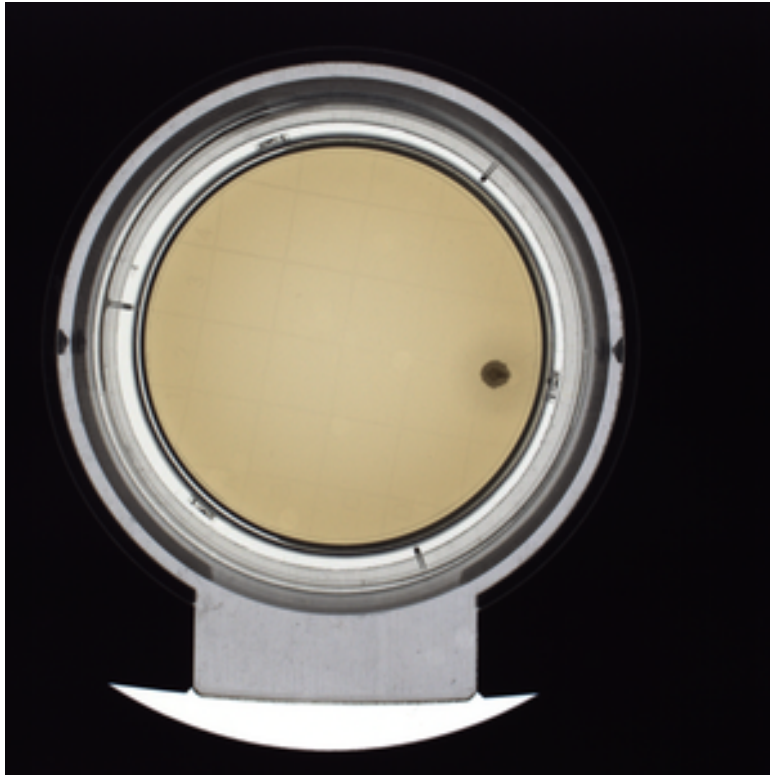
Automatization of QC

How did we tackle this?



The Data

5,771 labelled images



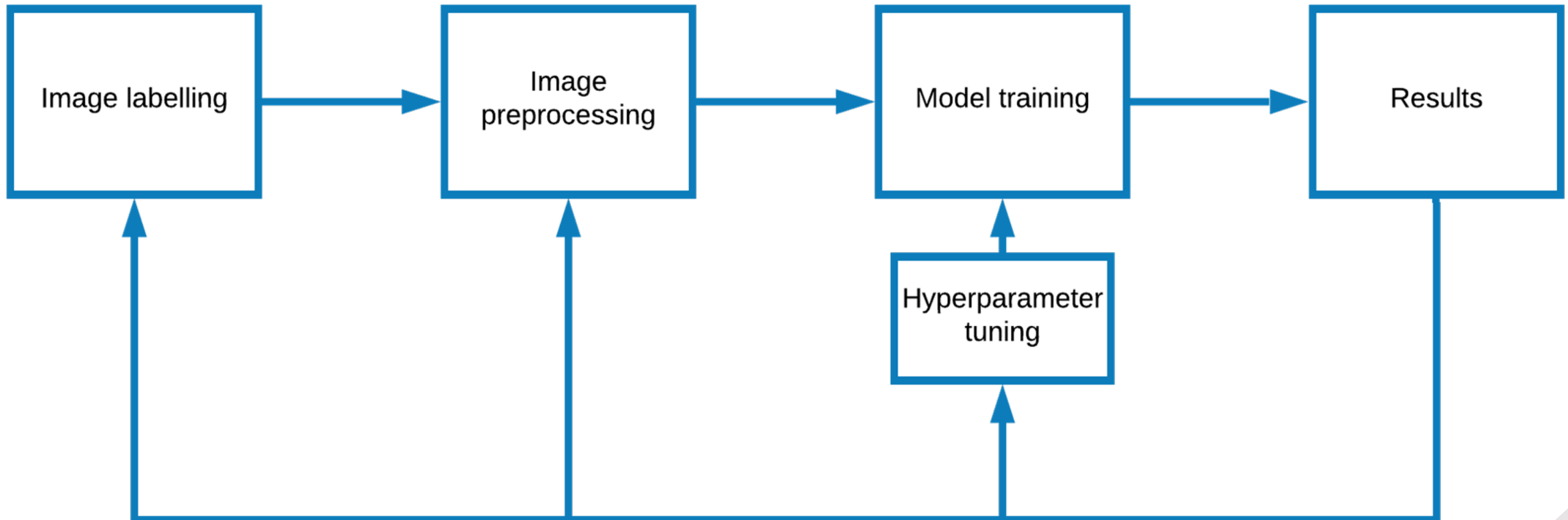
55 mm contact plates



90 mm settle plates

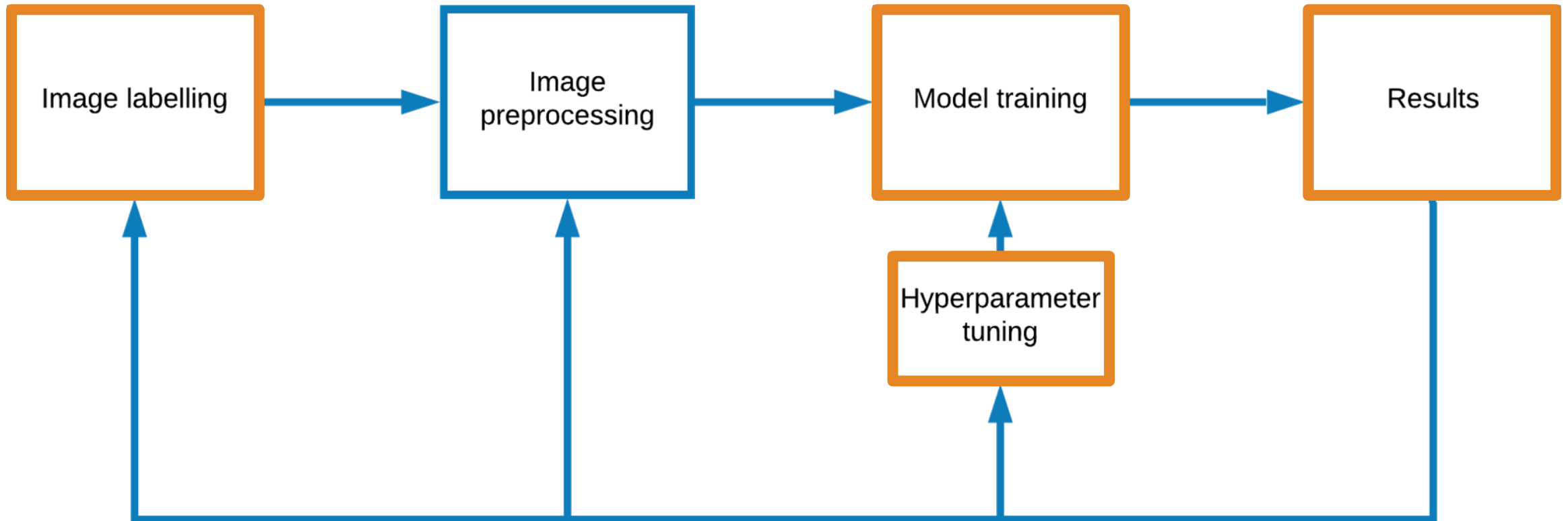
The modelling process

Iterative agile process



Challenges faced

1. 8 classes vs 2 classes
2. Minimizing False Negatives
3. Bigger network sizes
4. Separate models for 55mm and 90mm
5. Critical cases



4. The results

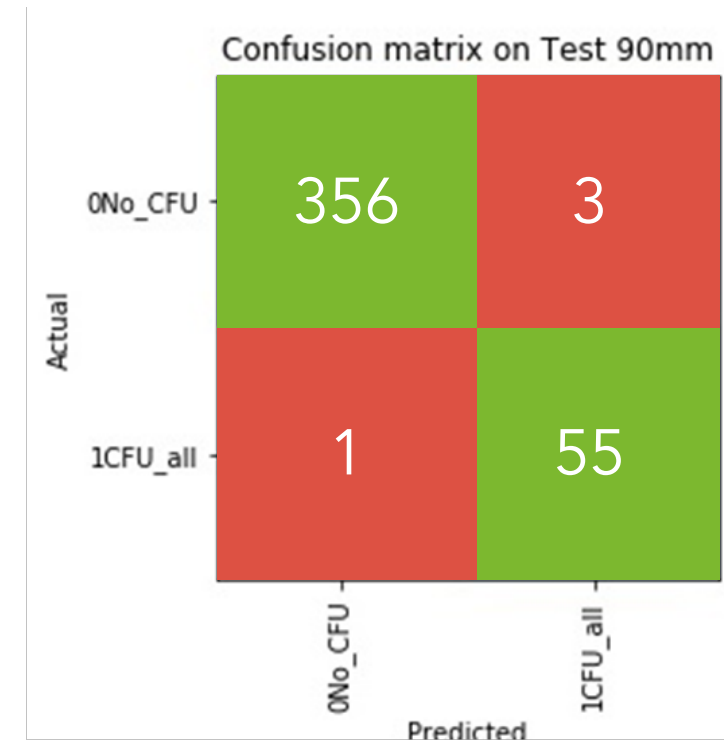
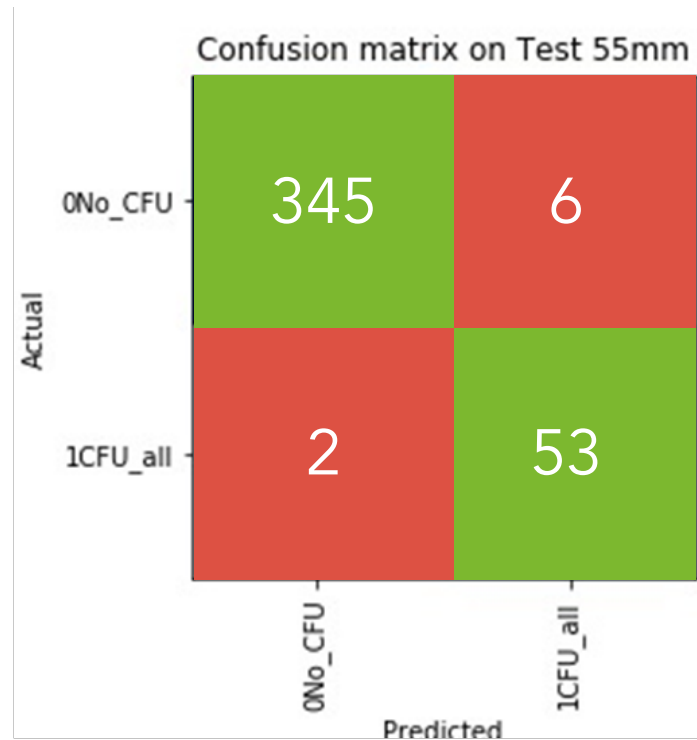
Automatization of QC

What results did we obtain?



The results

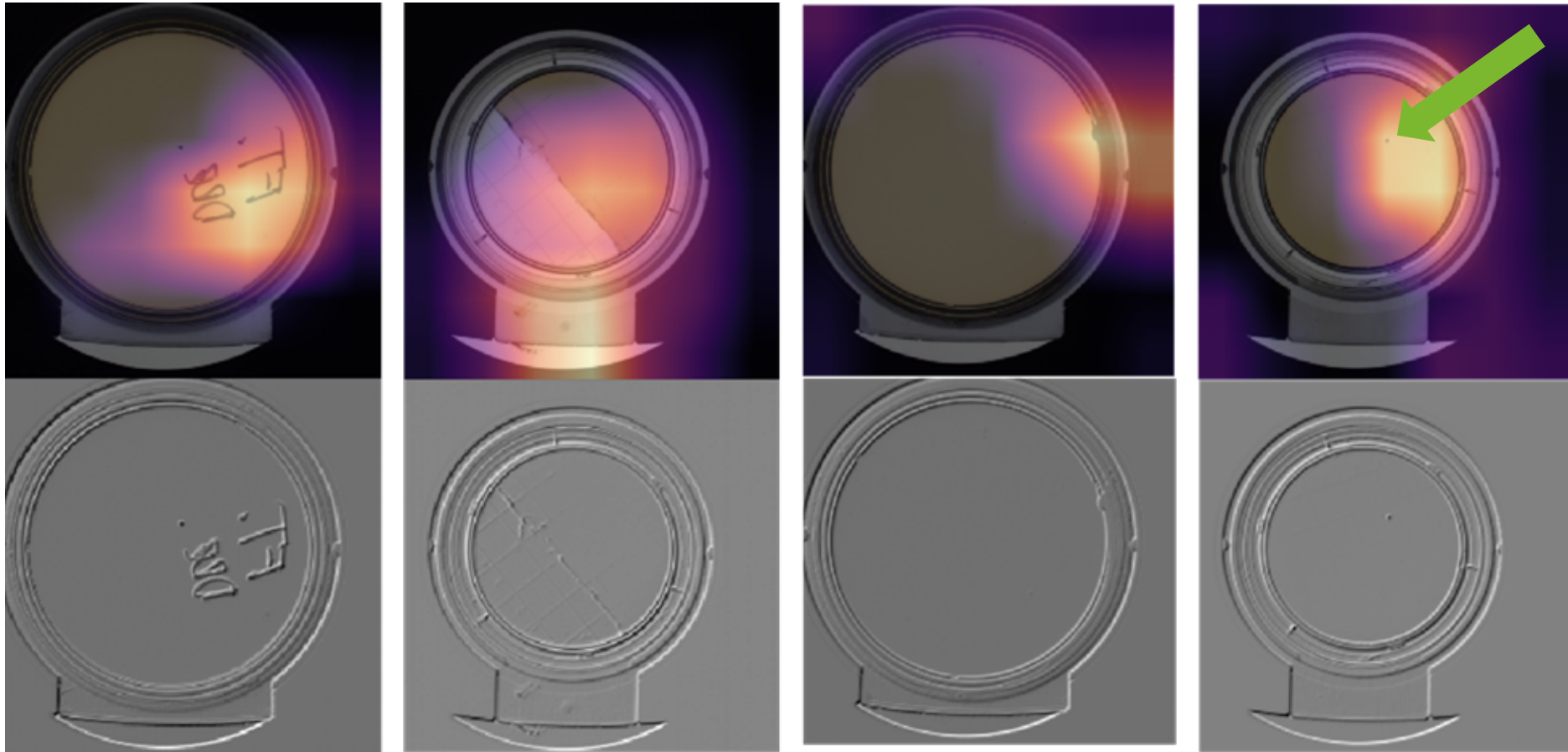
Worst case scenario



Size	CrossEntropy Loss	Accuracy	Cohen Kappa	False Negatives
55 mm	0.0741	98.07%	0.9187	3.64%
90 mm	0.1529	99.04%	0.9593	1.79%

Model visualizations

Grad-CAM heatmaps & Corner detecting convolution



5. Conclusion

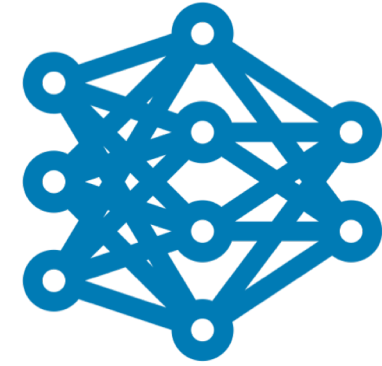
Using Image recognition in production support

What did we learn?



Conclusion

- Deep-learning technology is ready
- Transfer learning
- Watch out for bias in your model
- Iterative process with continuous collaboration with business





Q&

A



THANK YOU

ROI²
return on investment
through
return on information



• Thomas Dekelver

 **Business & Decision**
Life Sciences

