# Automatic estimation of slaughter pig live weight using convolutional neural networks

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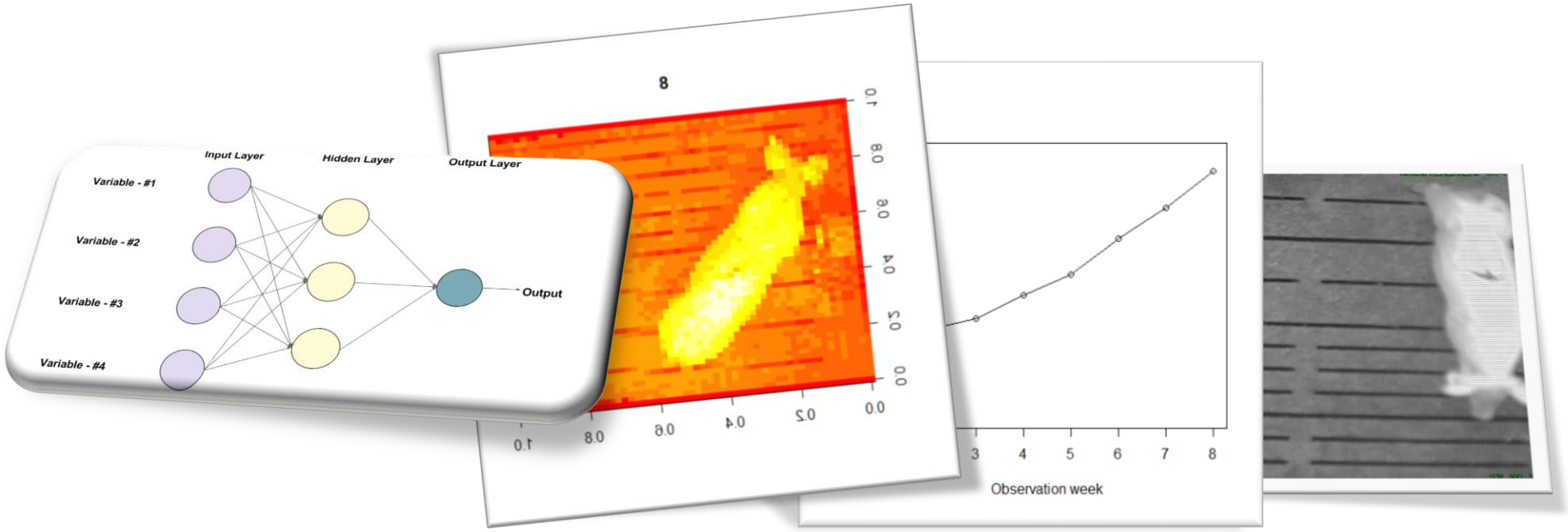


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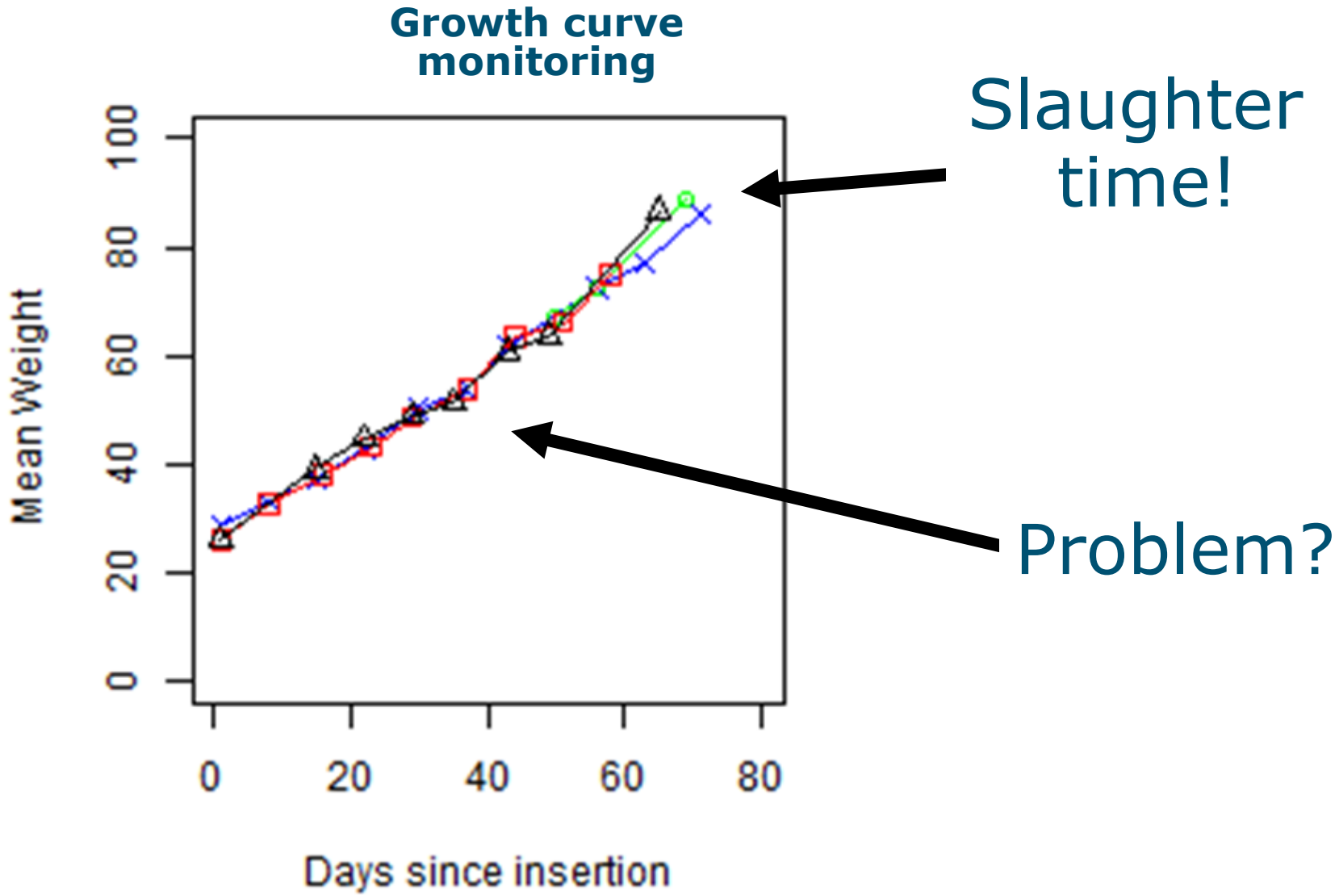
# Why, though ... ?

***What's the use of this?***



# AIMS

1. Demonstrate that a **CNN** can estimate **LW of individual pigs**

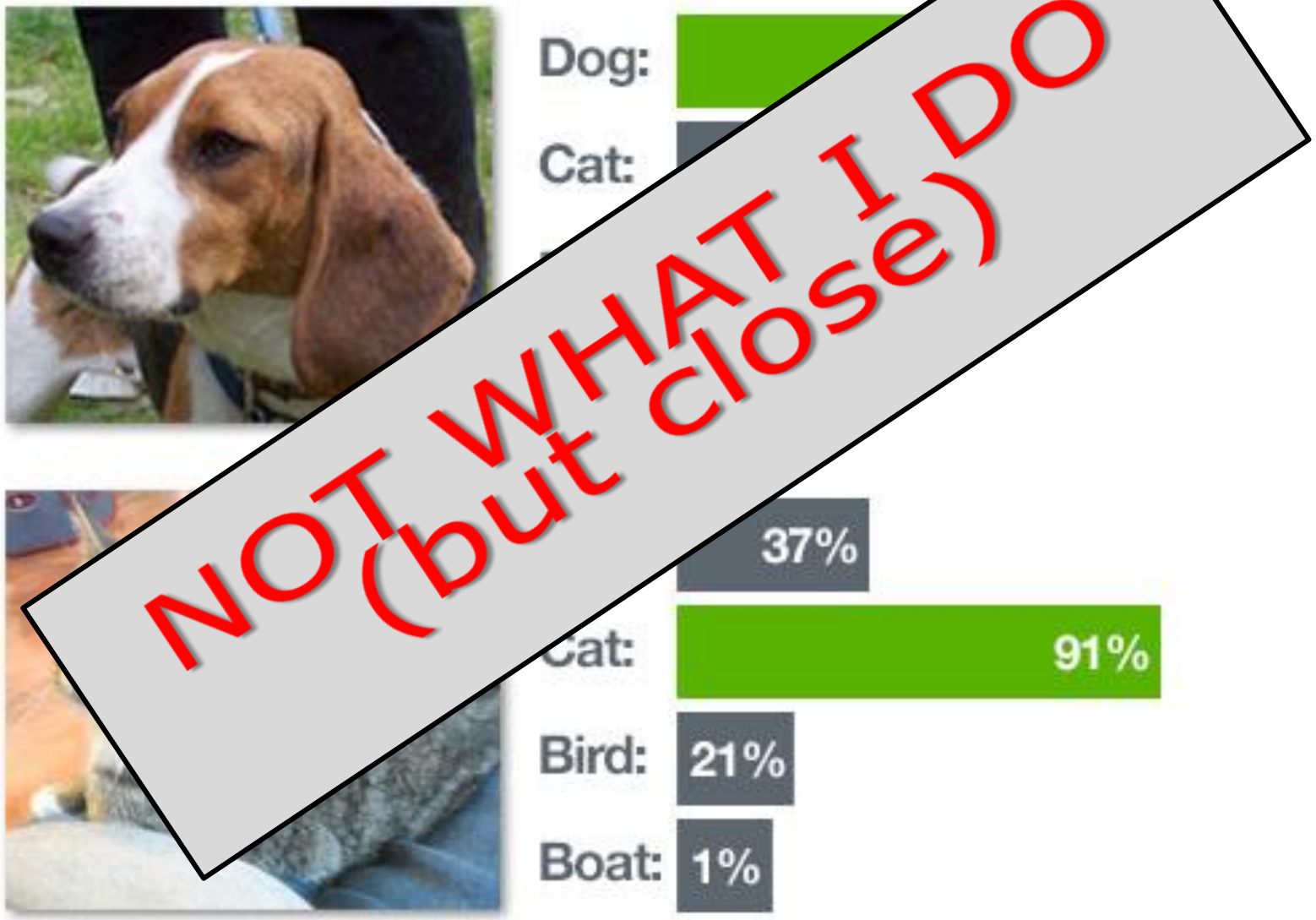
2. Compare the accuracy given the inclusion or exclusion of **reference images**

3. Compare the **robustness** against image brightness variation given the resolution of the input images

# The CNN
# (in simple terms)

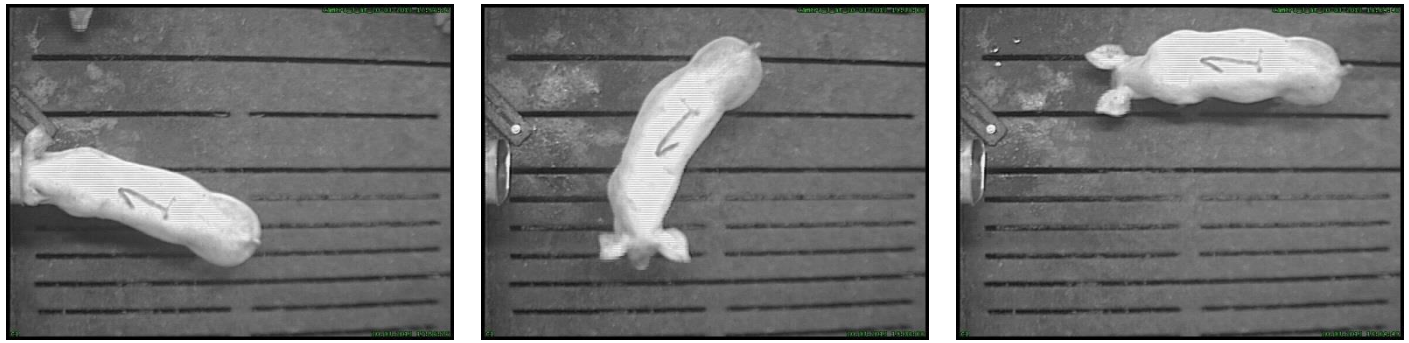
# Machine vision

***What I DON'T do: Image classification***



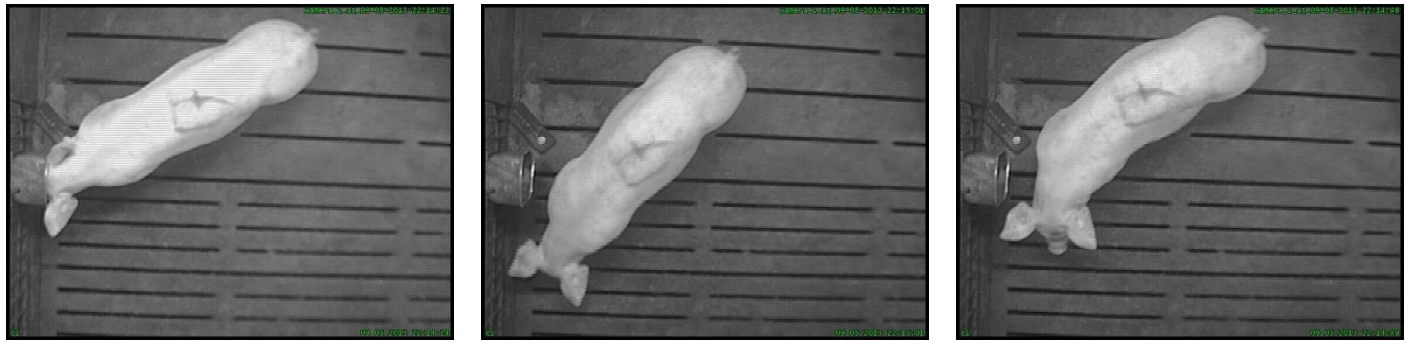
# Machine vision

***What I ACTUALLY do: Image regression (is that a term?)***



28.8 kg

56.0 kg

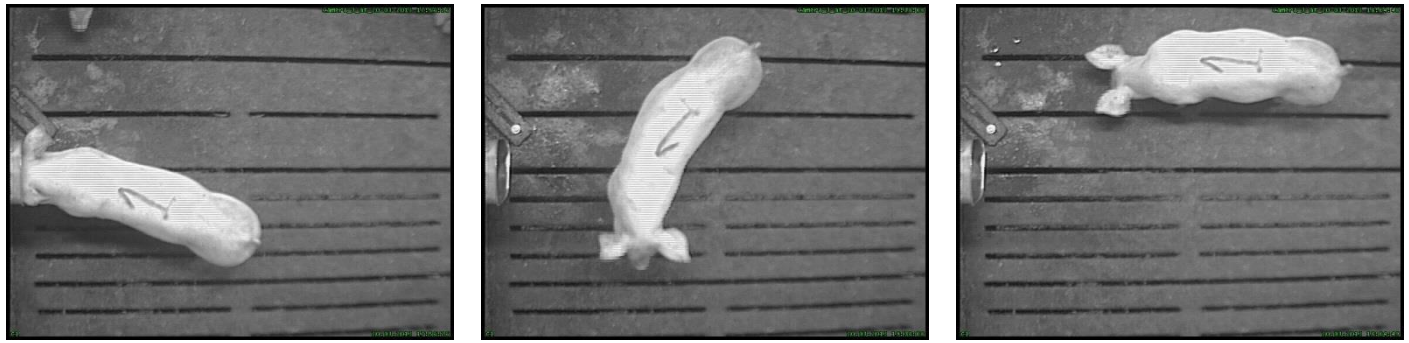


79.4 kg

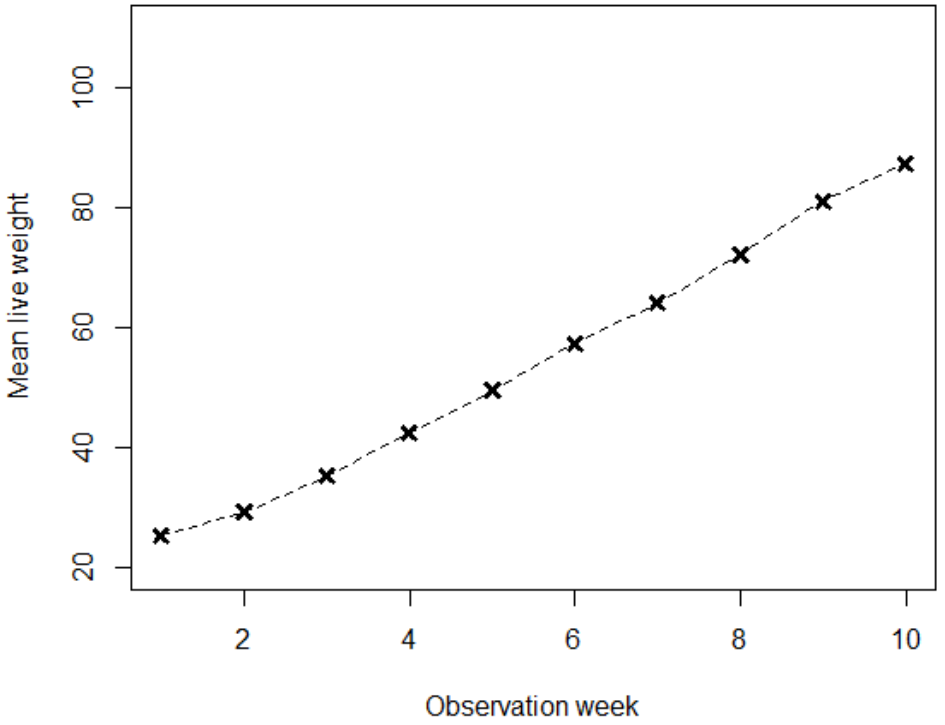
# Data Description

# Data

***Images and Weight Measurements***



28.8 kg




## Training set:

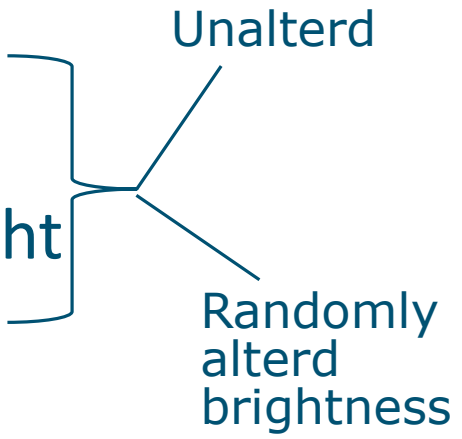
876 images

54 unique pig weights

## Test set:

21 unique pig weights

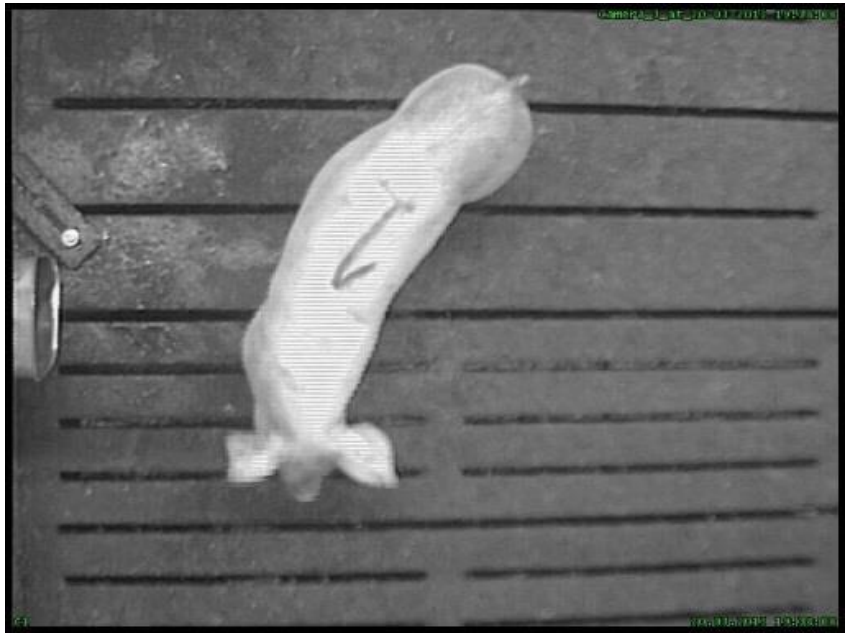
4-64 images per pig-weight



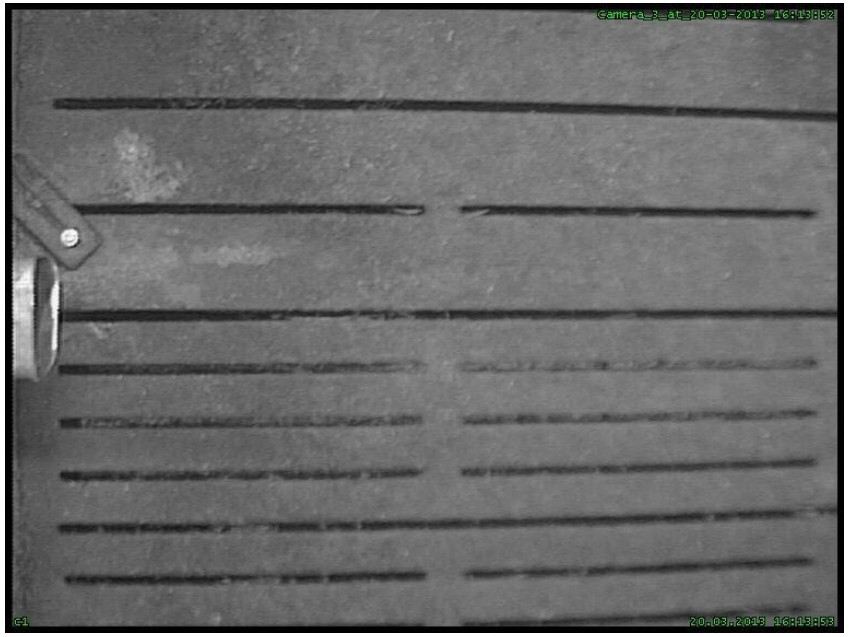
# Data

## *Inclusion and omission of reference images*

Image



Reference Image



# Data

***Resolution reduction (original: 768x576 pixels) and brightness alteration***

# Machine vision

***Performance evaluation***

$$\eta = \frac{Y - \hat{Y}}{Y + 1}$$

Relative Error

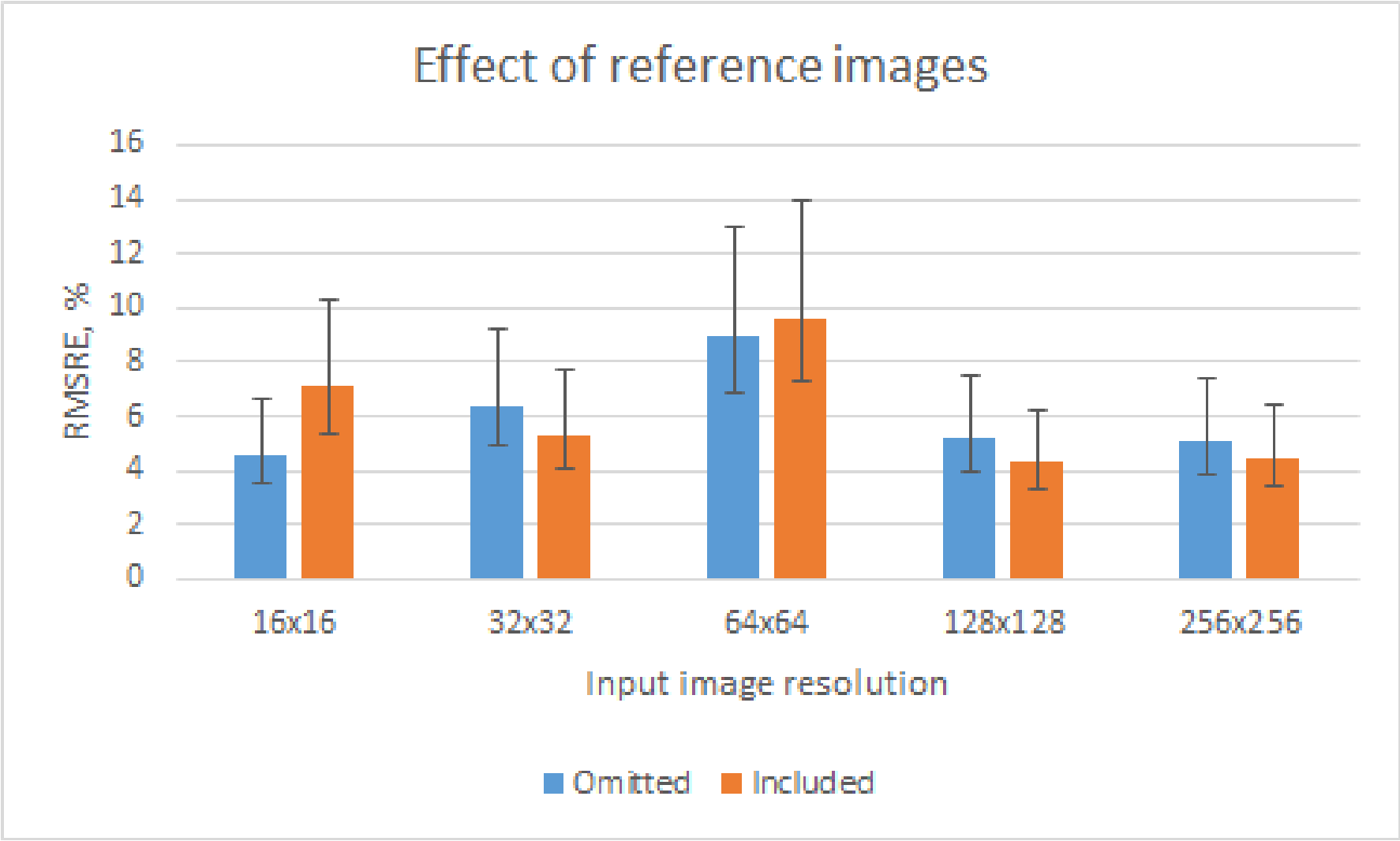
$$RMSRE = \frac{1}{n}\sum_{i}^{n} \eta^2$$

Root Mean Squarred Relative Error

# My Results

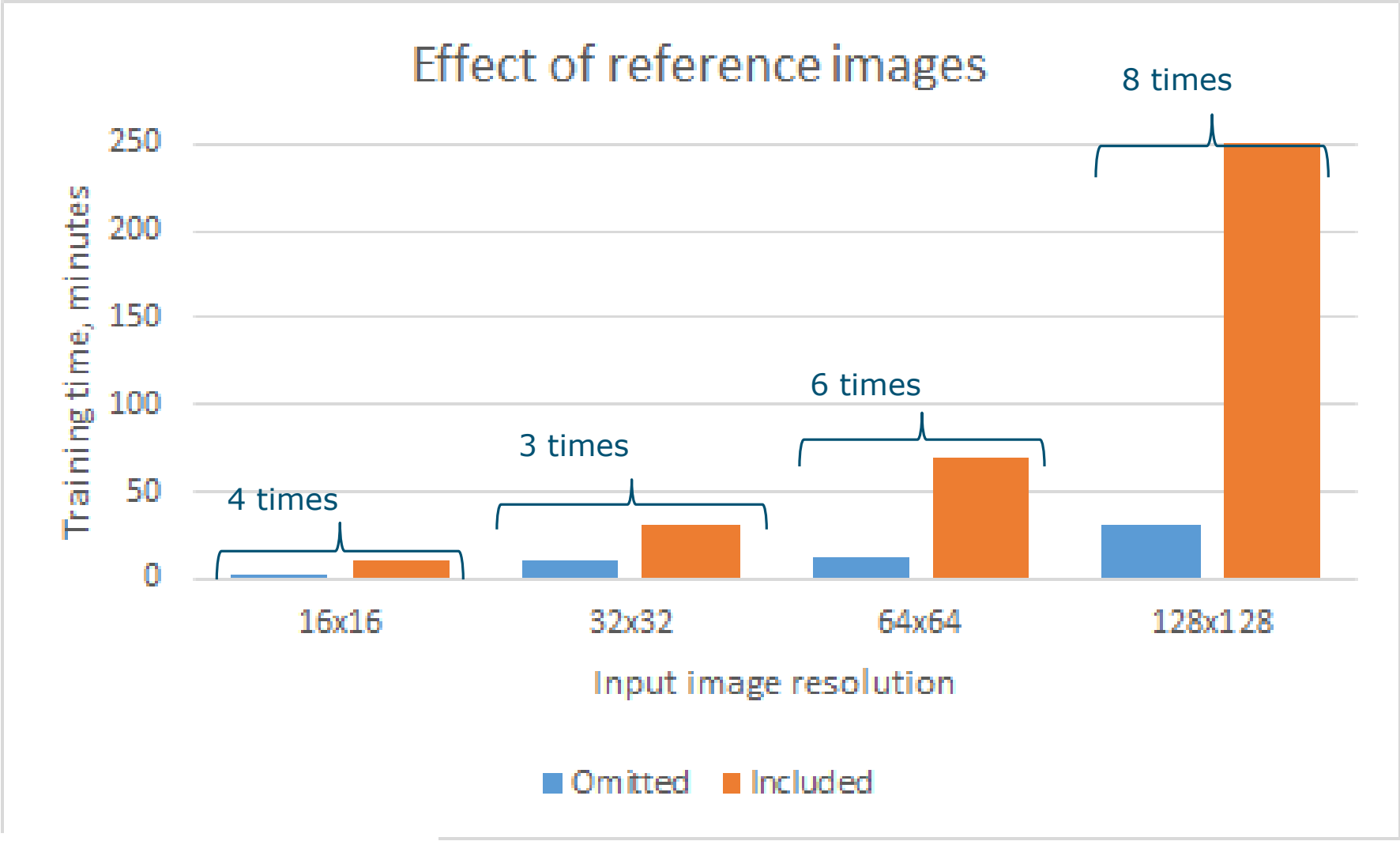
# Results

***Unaltered test set***



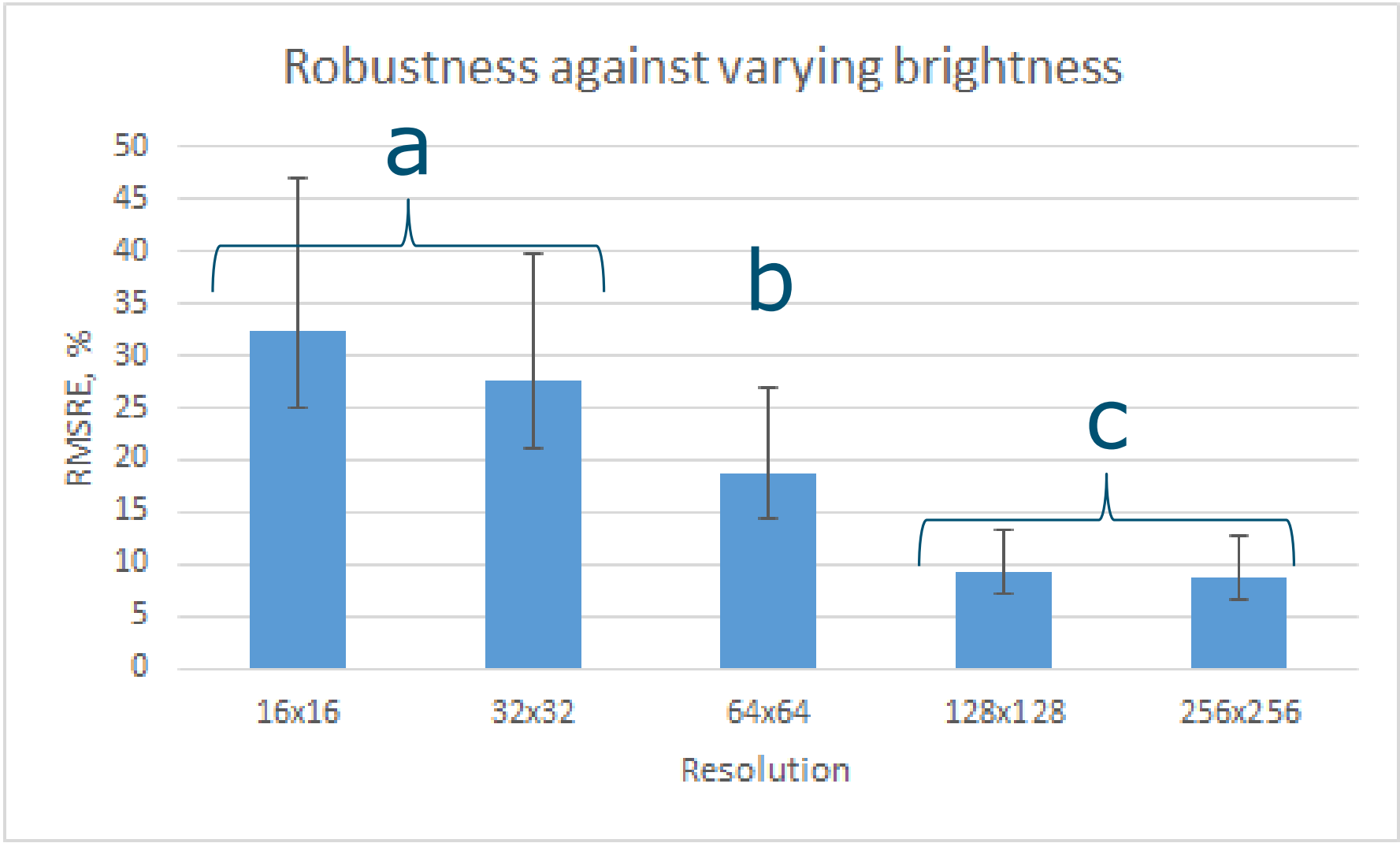
# Results

***Unaltered test set***



# Results

***Test set with randomly altered brightness***



# CONCLUSIONS

1. Demonstrate that a CNN can estimate LW of individual pigs
   - **It can!**
     **RMSRE: ~ 5-10 %**

2. Compare the accuracy given the inclusion or exclusion of reference images
   - **No effect!**

3. Compare the robustness against image brightness variation given the resolution of the input images
   - **Higher resolution → better!**
     **Optimal resolution: 128x128**

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Want to hear more about our studies?

PigIT closing conference – 13.11.2018, Copenhagen

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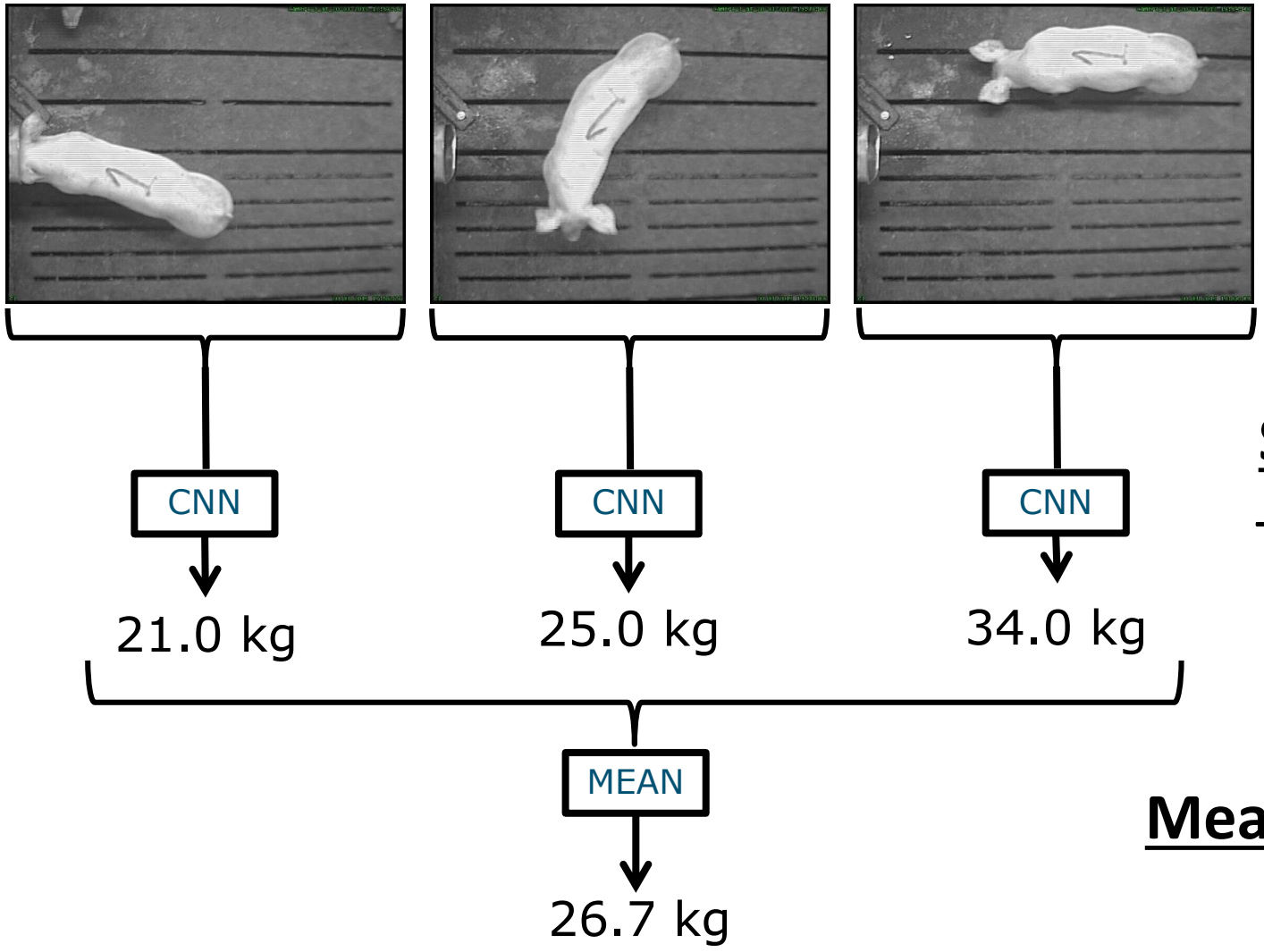
# Extra

# Machine vision

***What I ACTUALLY do: Image regression – ensemble of predictions***



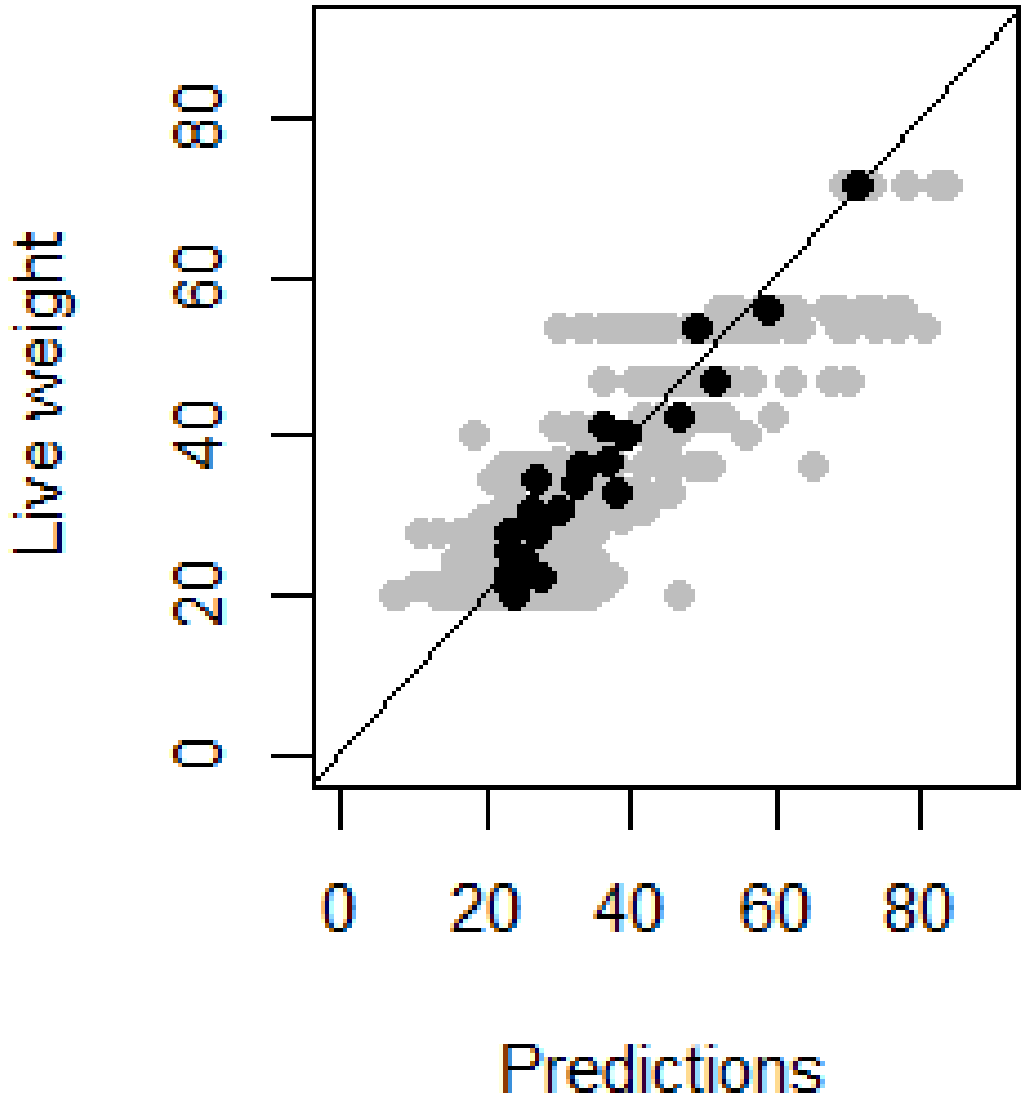

**Actual:**
28.8 kg

**Single errors:**
-7.8 , -3.8 , 5.2 kg

**Mean pred. error:**
-2.1 kg

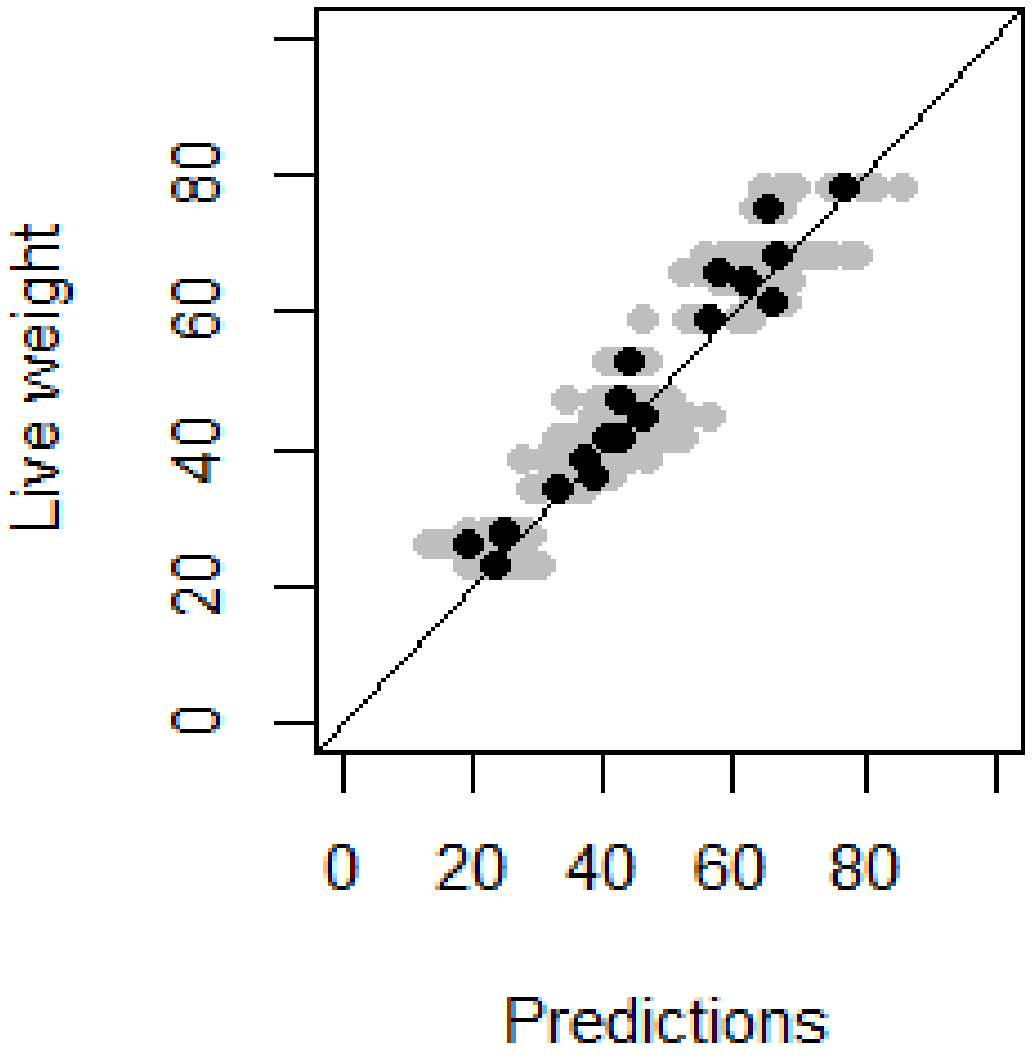
# Machine vision

***What I ACTUALLY do: Image regression – ensemble of predictions***



# Results

***Ensemble effect***

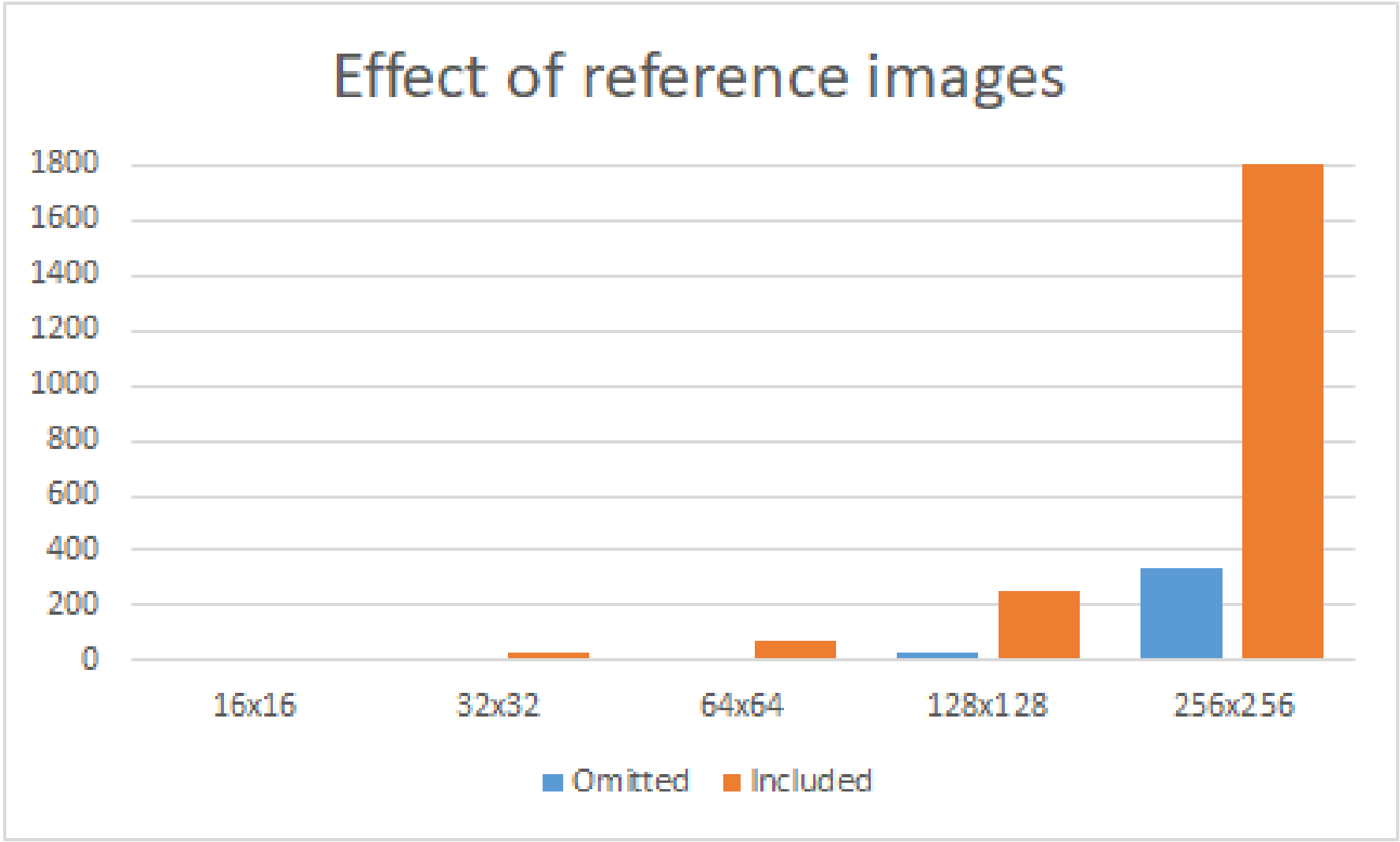



**RMSRE**

Pig level
~ 5 %

Single image
12 % - 21 %

# Results


Effect of reference images
1800
1600
1400
1200
1000
800
600
400
200
0
16x16
32x32
64x64
128x128
256x256
Omitted
Included