

Team4 - Praktikum Big Data Science

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## Superresolution

Saving caribous by counting trees



# Motivation



Figure: Caribous

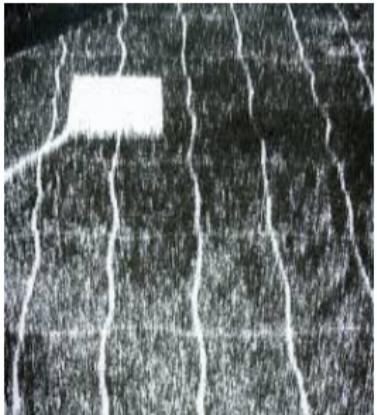


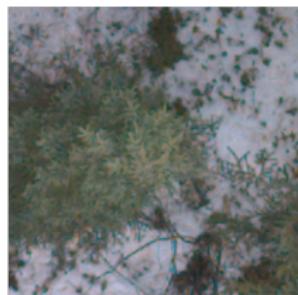
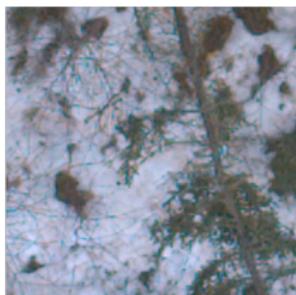
Figure: The Problem



Figure: Smart wolves

## 5m (1px=3.5mm)

- ▶ Slices of 512x512
- ▶ winter & summer
- ▶ seedlings with bounding boxes
- ▶ overlap



## 30m (1px=7.5mm)

- ▶ Slices of 256x256
- ▶ only summer
- ▶ seedlings with bboxes



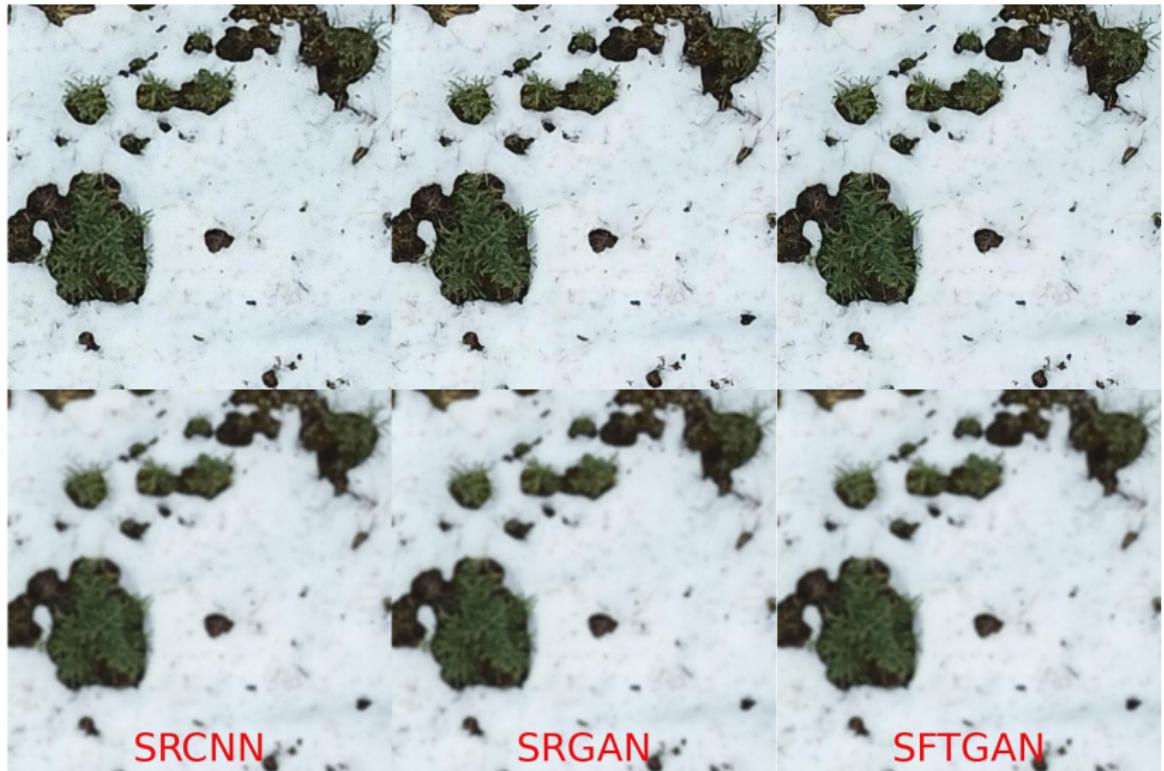
5m images  $\rightarrow$  *gaussblur(radius = 2)*  $\rightarrow$  *resize*

- ▶ Bicubic Interpolation
- ▶ SRCNN  $\rightarrow$  3 conv layers
- ▶ SRGAN  $\rightarrow$  residual blocks + up-sampling block, G vs. D
- ▶ SFTGAN  $\rightarrow$  priors, segmentation maps, G vs. D

## Data augmentation

- ▶ SRCNN  $\rightarrow$  random rotation, & flipping
- ▶ SRGAN  $\rightarrow$  random cropping
- ▶ SFTGAN  $\rightarrow$  random cropping, rotation, & flipping

# Superresolution - 5m results

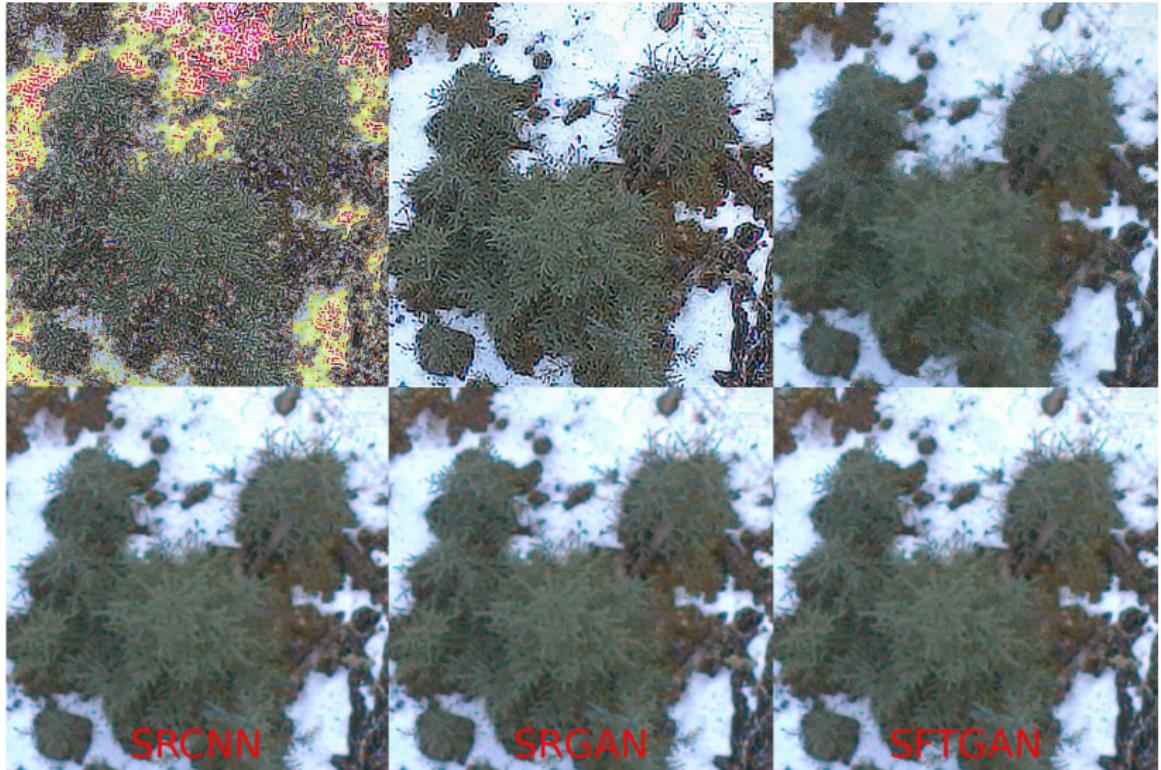


SRCNN

SRGAN

SFTGAN

# Superresolution -30m results





## Training

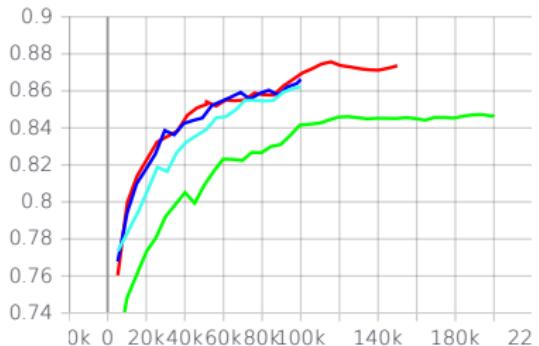
- ▶ 5m images → down-sampling → SR
- ▶ Train object detection on reconstructed images

## Evaluation for each SRM

- ▶ reconstructed 5m images
- ▶ superresolved 30m images

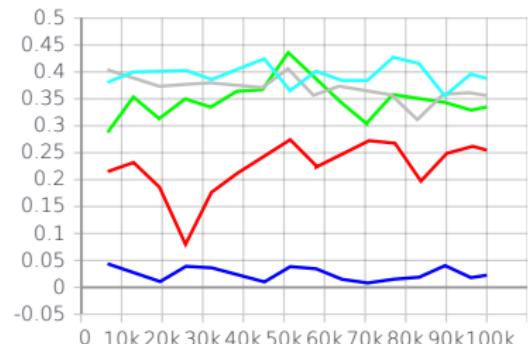
## 5m mAP@.50IoU

- ▶ 0.8757 SRGAN
- ▶ 0.8697 SRCNN
- ▶ 0.8637 BICUBIC
- ▶ 0.8481 SFTGAN



## 30m mAP@.50IoU

- ▶ 0.4359 SFTGAN
- ▶ 0.4245 BICUBIC
- ▶ 0.4060 RAW
- ▶ 0.2742 SRGAN
- ▶ 0.0404 SRCNN





## Failed

- ▶ train object detection on raw 5m images
- ▶ evaluate on superresolved 30m images

Failed miserably:

- ▶ Object detection model, trained on raw images, learned different features, than the super resolution models generate.



## Future Work

- ▶ Model optimization
- ▶ Automatic early stopping on 30m images
- ▶ Train GAN for down-sampling

## Conclusion

**It works and can be useful!**

# Thank you!



We & the caribous thank you for your attention!

