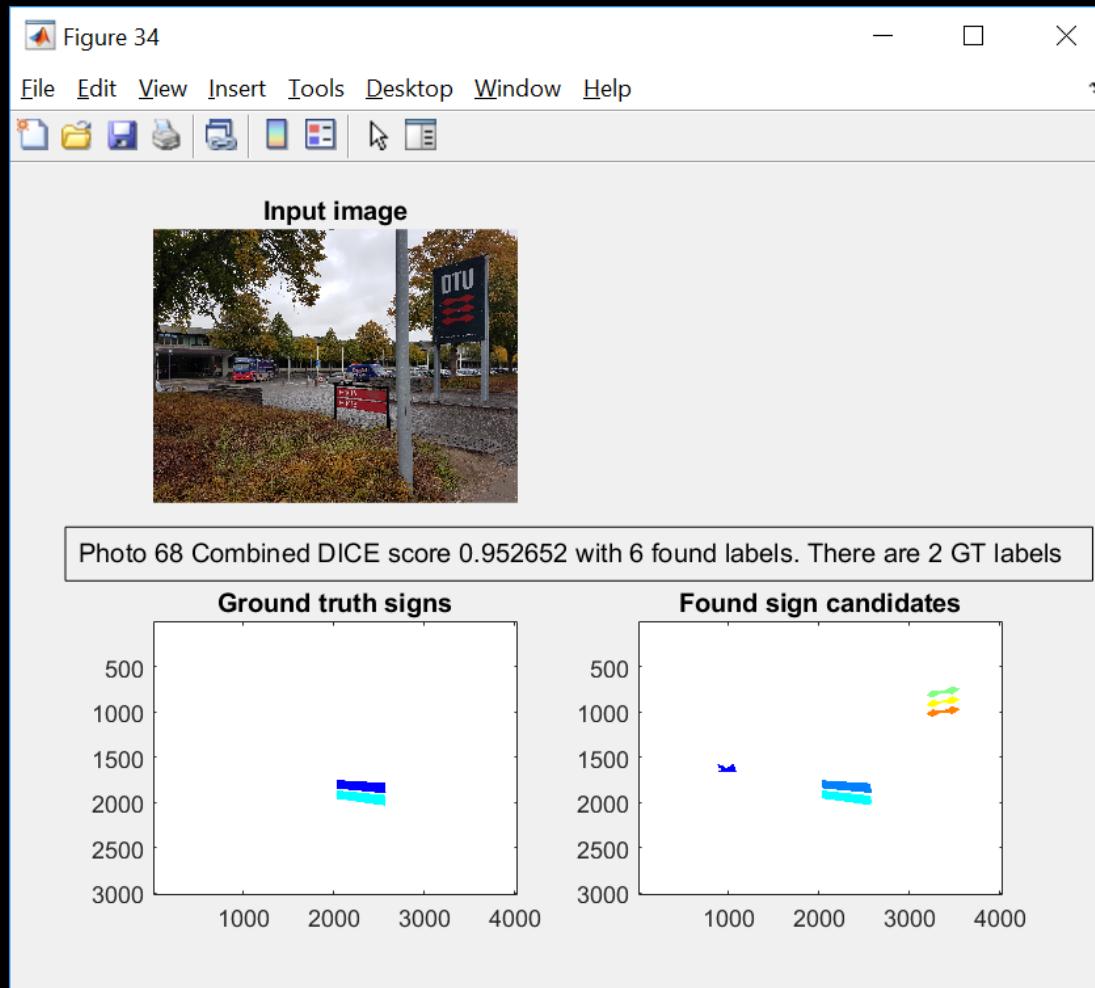
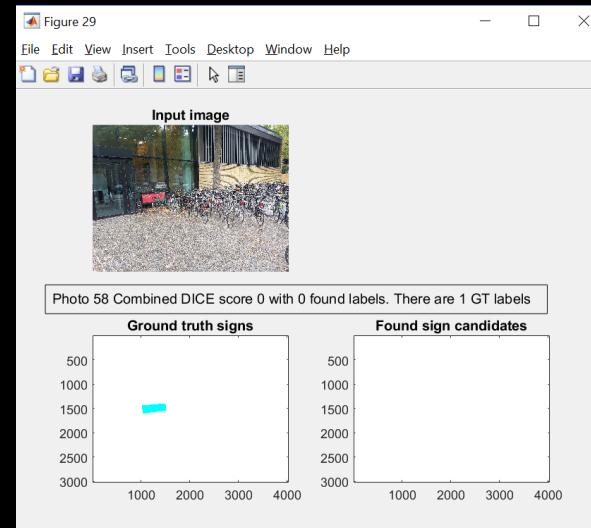
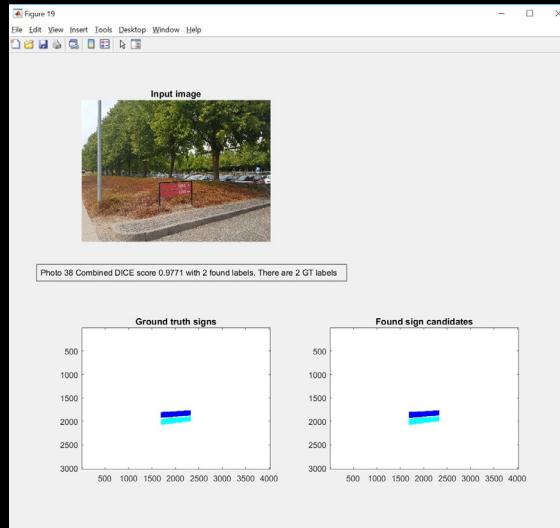


# DTU Sign Challenge Finals!



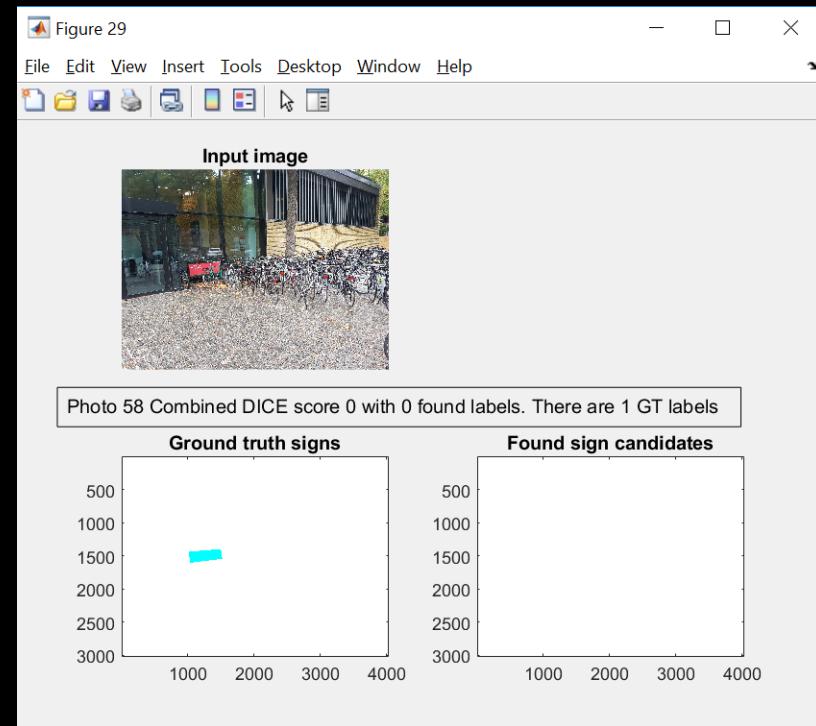
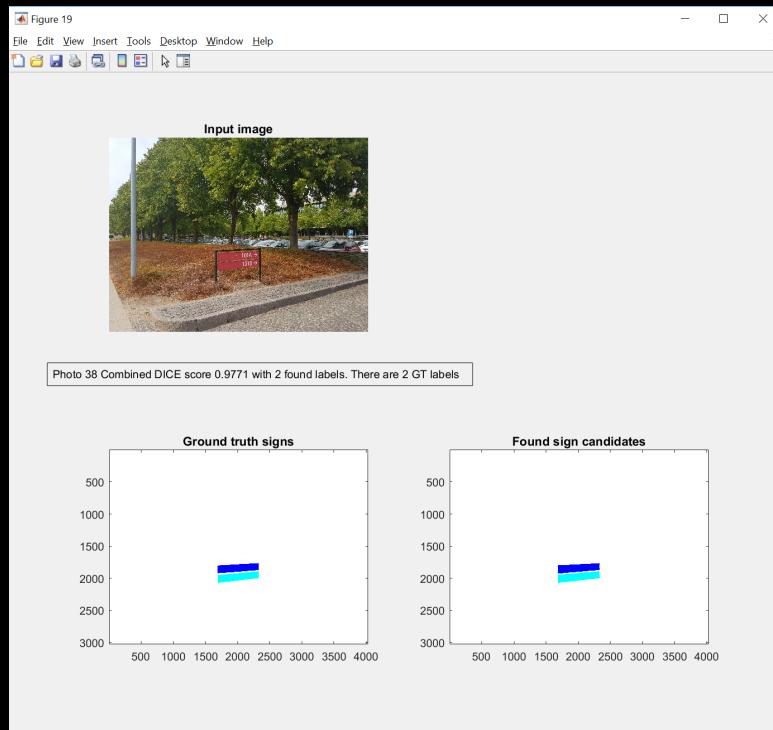
# Test of your programs

- Cleaned them a little
- Ran them on the secret images
- Got the output and compared with the ground truth
  - Combined DICE score
  - Number of false positive



# Status

## ■ 16 submission





# How did it go?

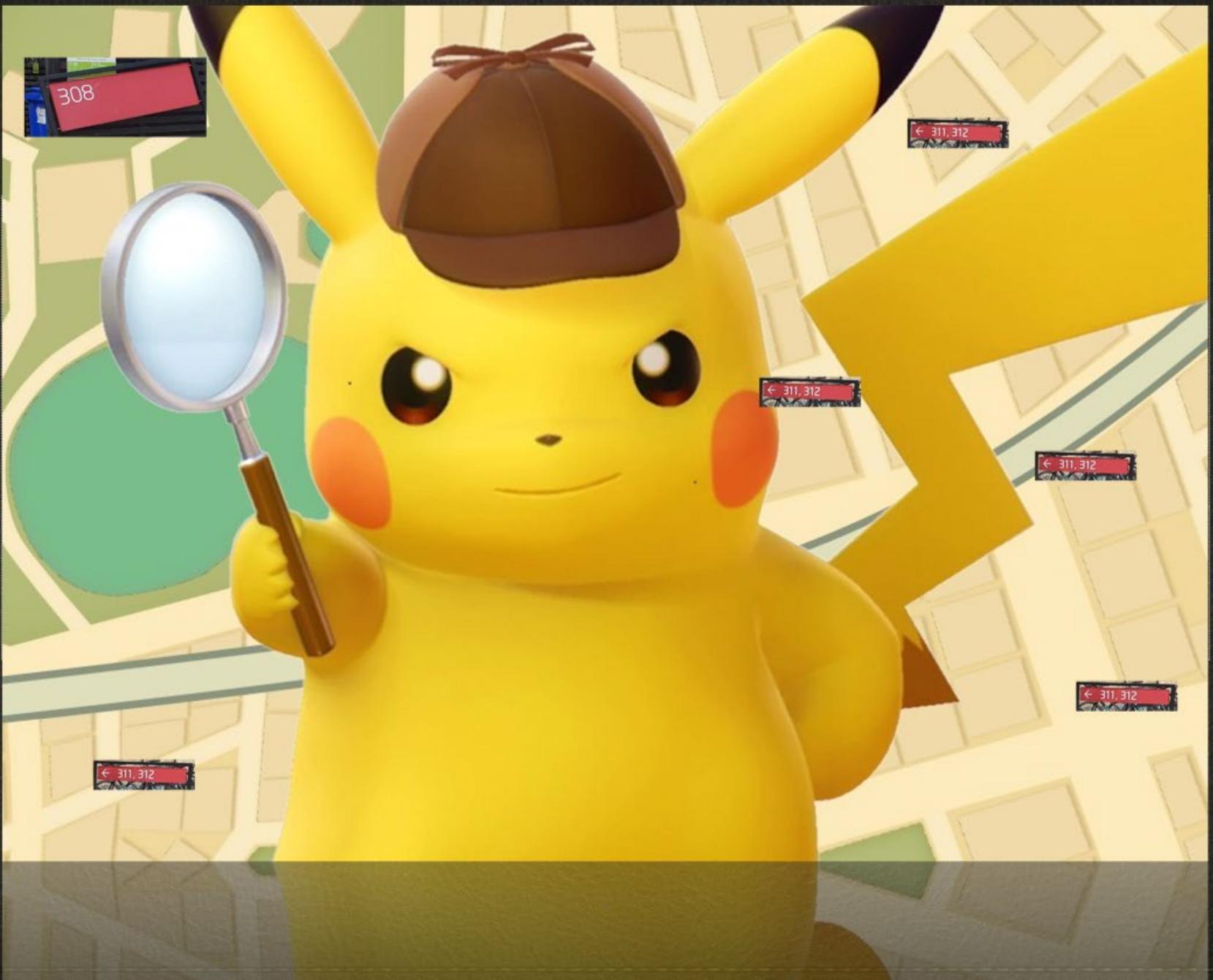


# SatisficeTheDice



s111975

Ragnar Sandberg Mikkelsen

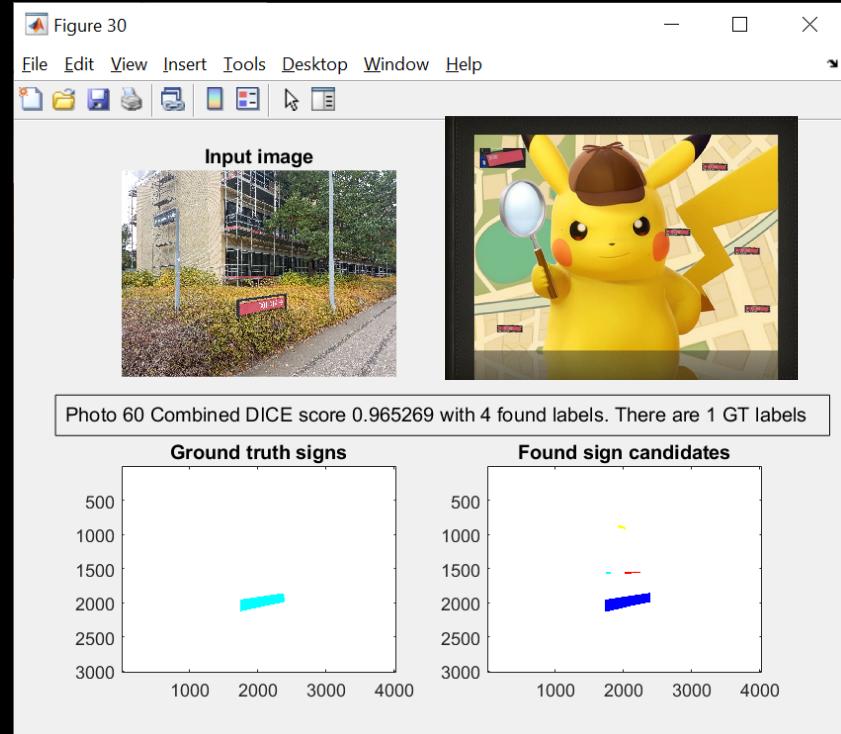
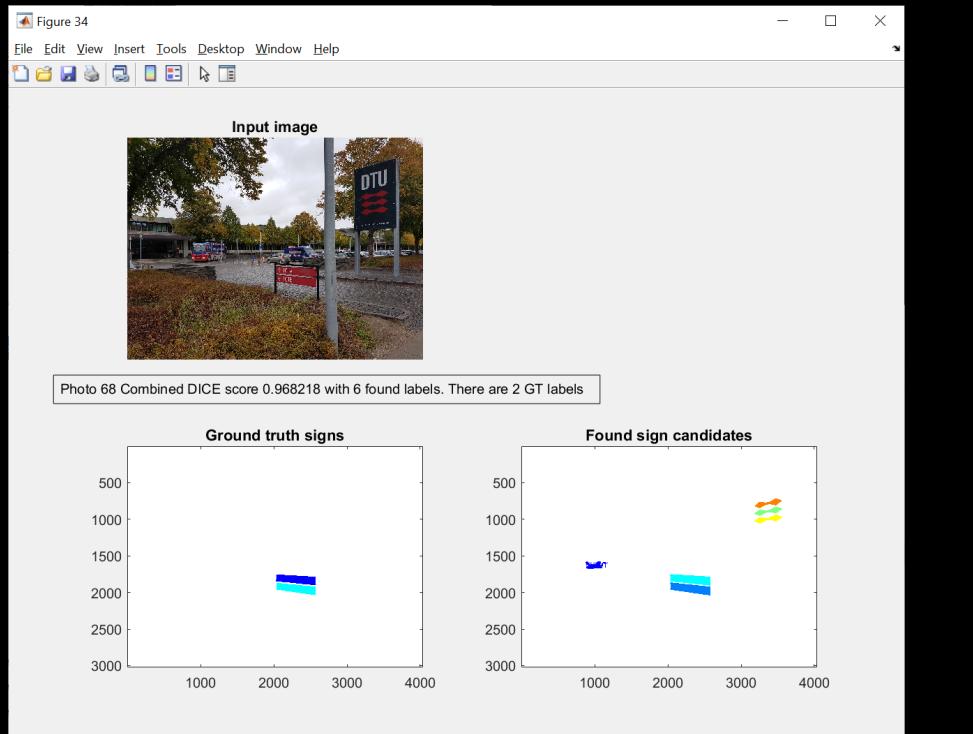


# SatisficeTheDice



s111975

Ragnar Sandberg Mikkelsen



DICE: Mean 0.91, min 0.46, max 0.99.  
False positive: Mean 1.68, min 0, max 7



signhere



s153686

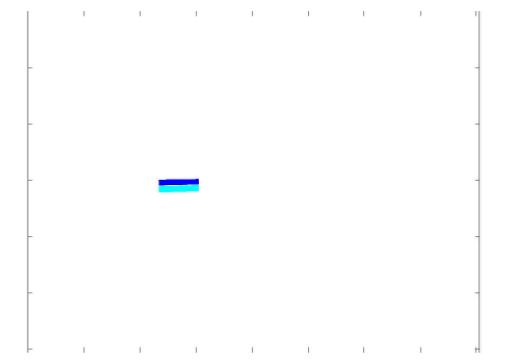
Loke Rantzau Olsen

Finding all “red” pixels in the image and makes it into a binary image



Removing all red objects that have a area less than 7.5 percentage of the biggest sign area.

Removing all red objects that are not same shape as a sign, rectangle with longer horizontal length then vertical length



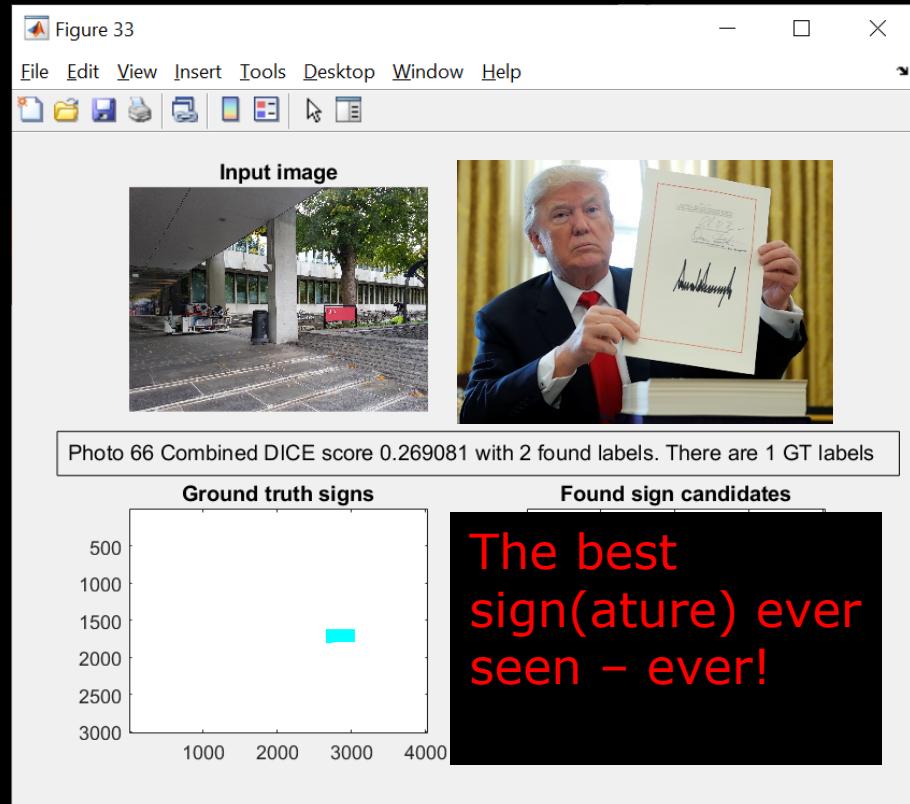
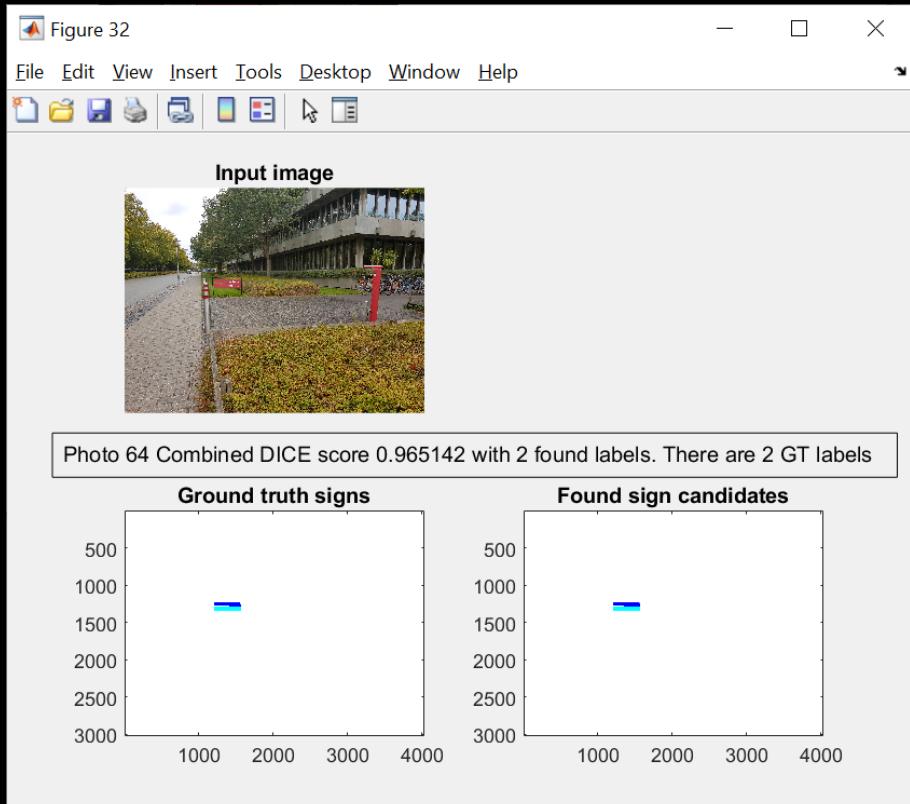


Finding red and making binary image

Finding all the signs individually and remove noise

Closing the signs, lable them and putting them back into one image.

# signhere



DICE: Mean 0.76, min 0.00, max 0.99.

False positive: Mean 0.44, min 0, max 3



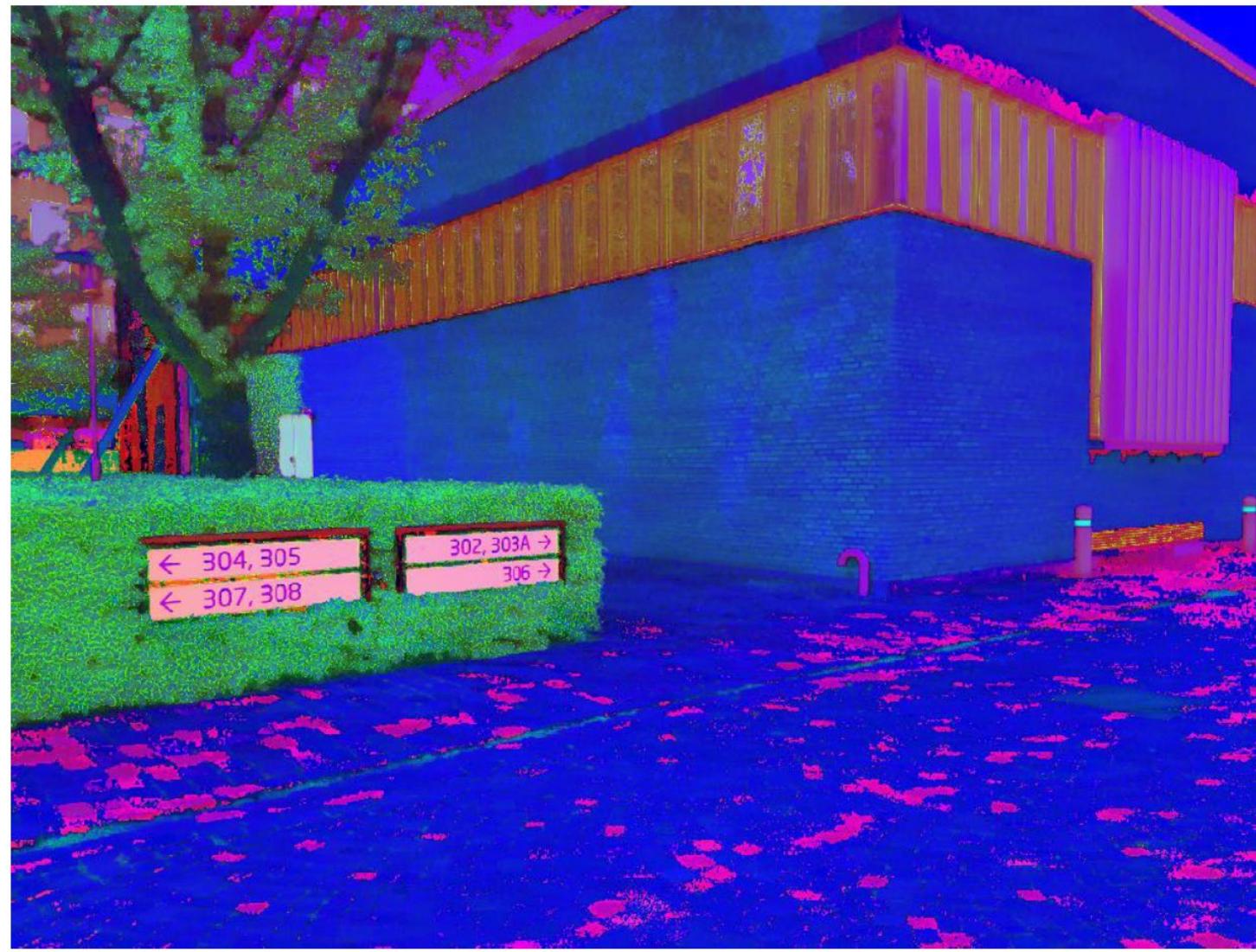
# SignMeIn



s173621

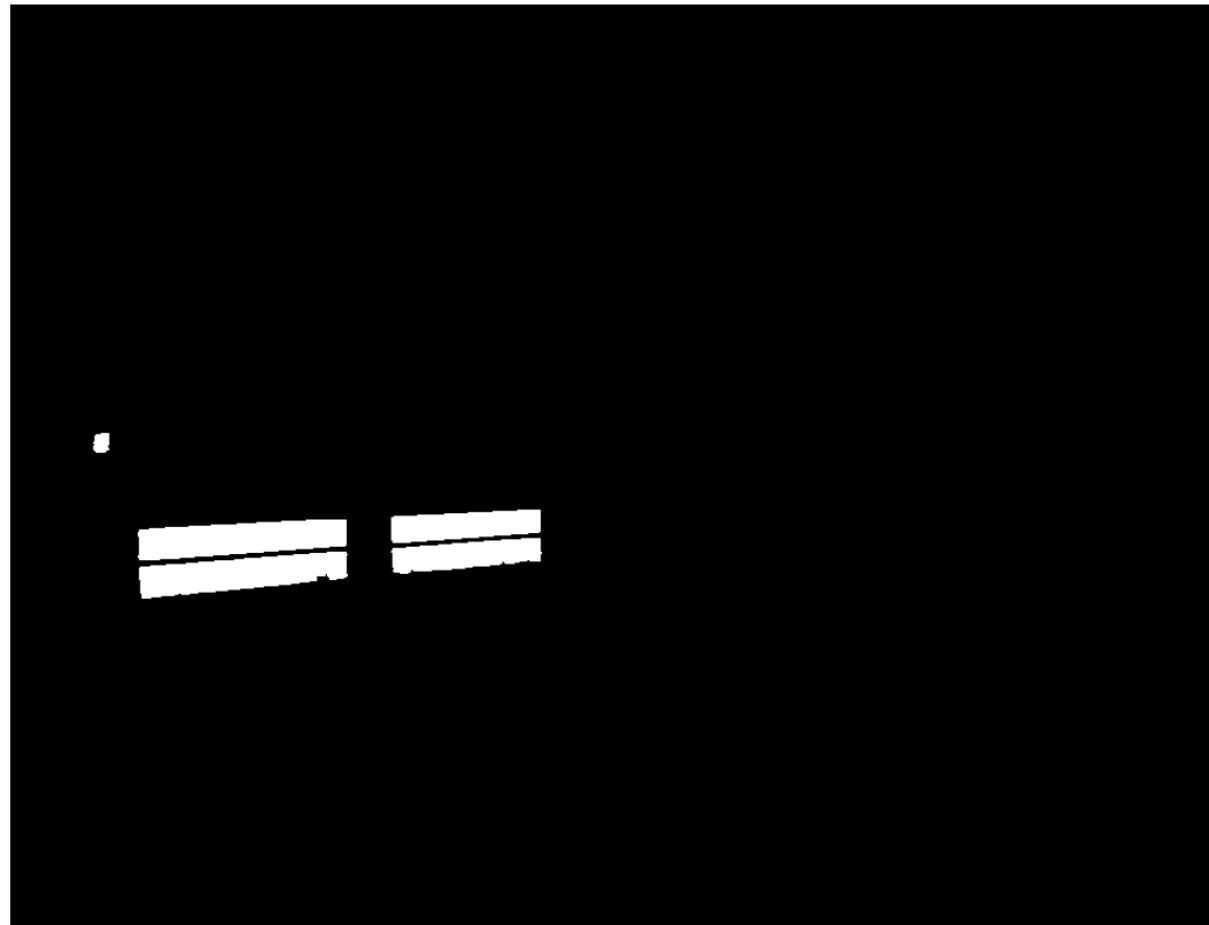
Thor Narvi Krogaard Hansen

## Convert to HSV



## Morphology

- Fill holes with imfill
- Open with 5x15 SE



## Labeling

- Labeling is conducted
- For each found object it's check if there is enough pixel with the v-value (in the HSV format) corresponding to white

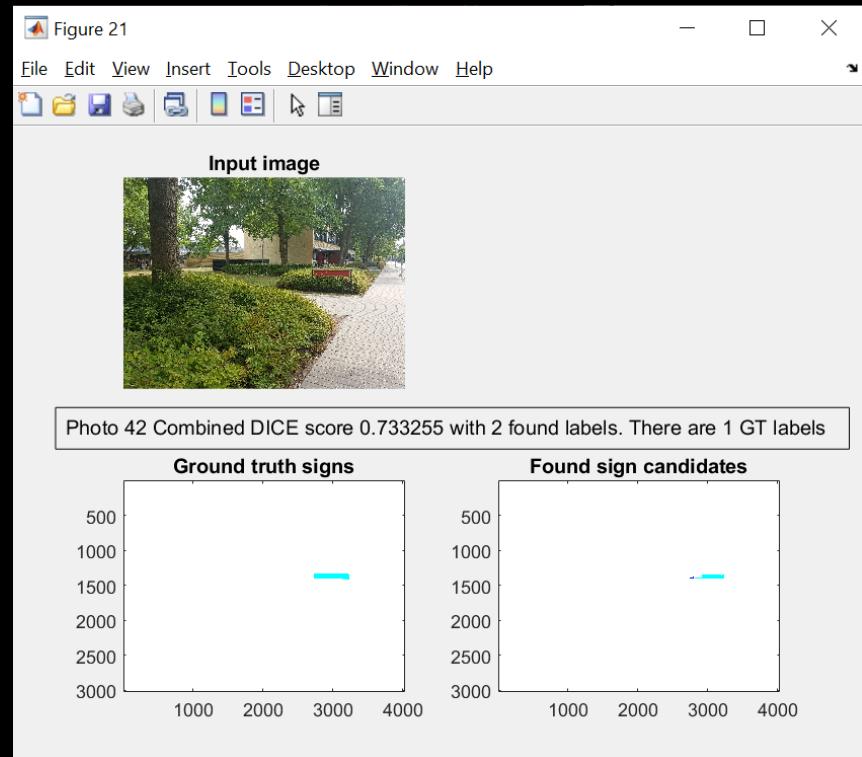
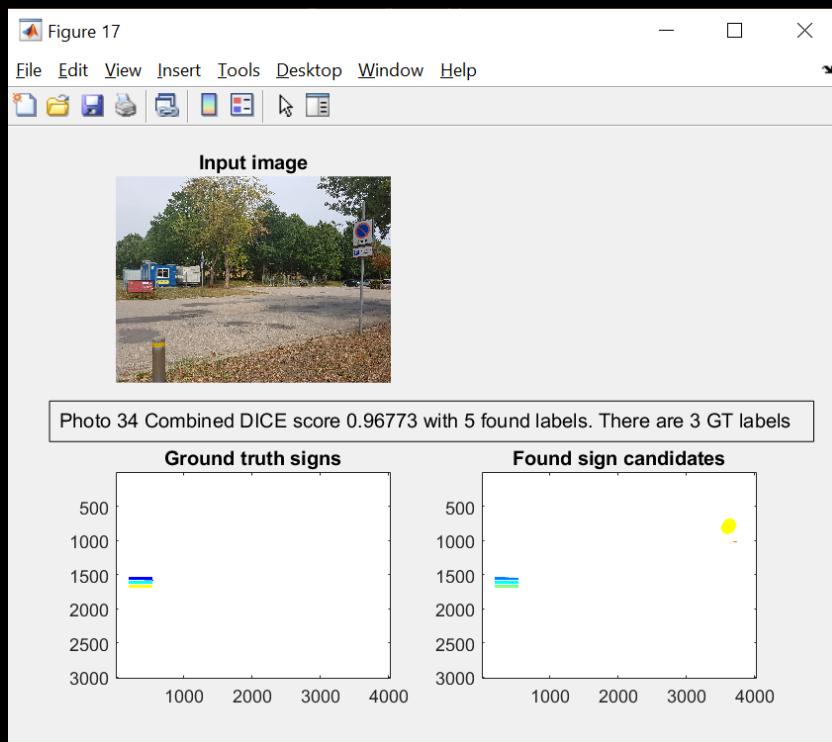


# SignMeIn



s173621

Thor Narvi Krogaard Hansen



DICE: Mean 0.79, min 0.00, max 0.99.

False positive: Mean 2.32, min 0, max 13



# RandomLabelGenerator



s173910  
Rasmus Tuxen



# Random Label Generator

- A DTU sign detector that works (ish)



Humans  
understandably have a  
hard time finding  
signs.



So let machines do it  
instead.



Clearly  
impossible  
to locate  
sign, right?





# How it works

**HSV colour space:**

High hue -> That's a sign !

**BLOB analysis:**

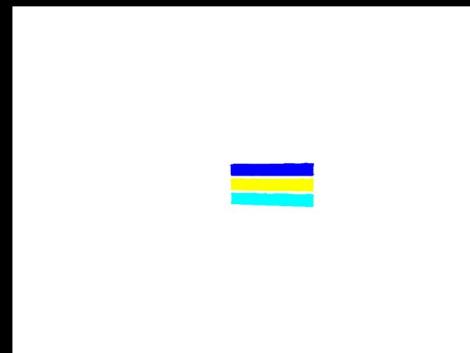
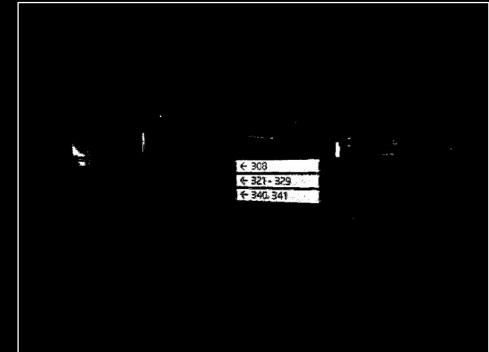
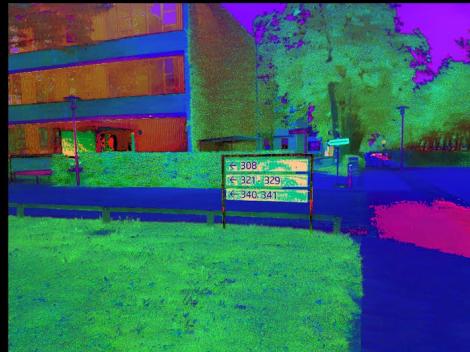
Low circularity, low orientation, high solidity -> that's a sign !

**Morphology:**

Fill holes in negative space for each sign.

If sign is small chop !

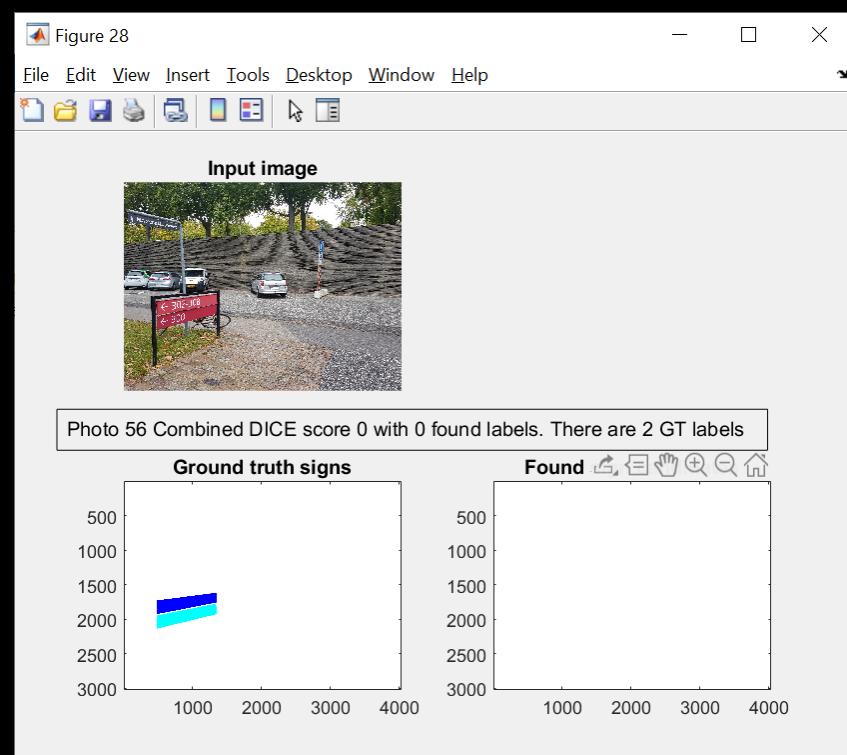
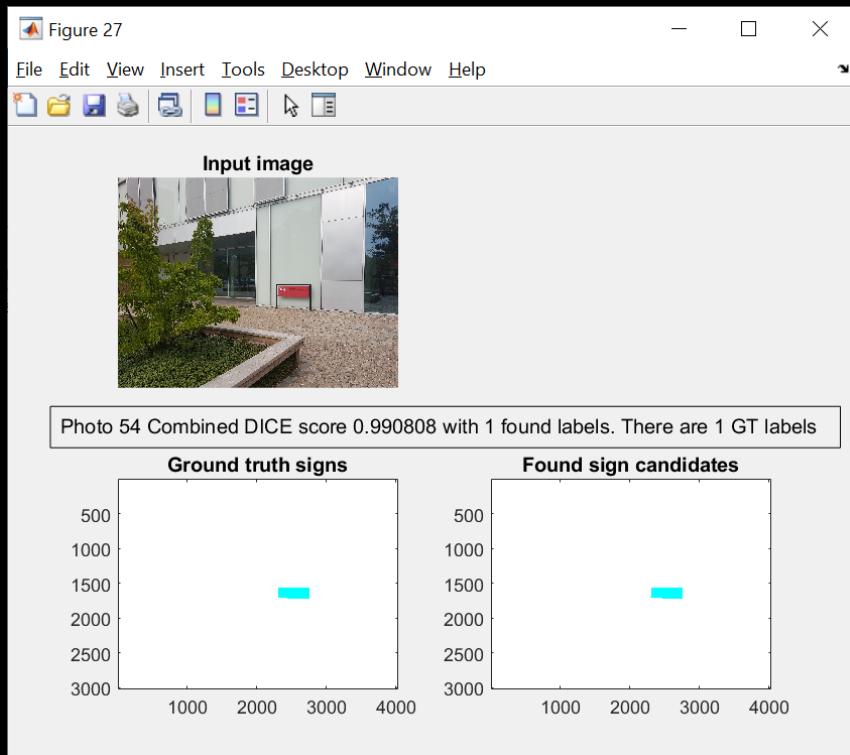
To maximize DICE-score



# RandomLabelGenerator



s173910  
Rasmus Tuxen

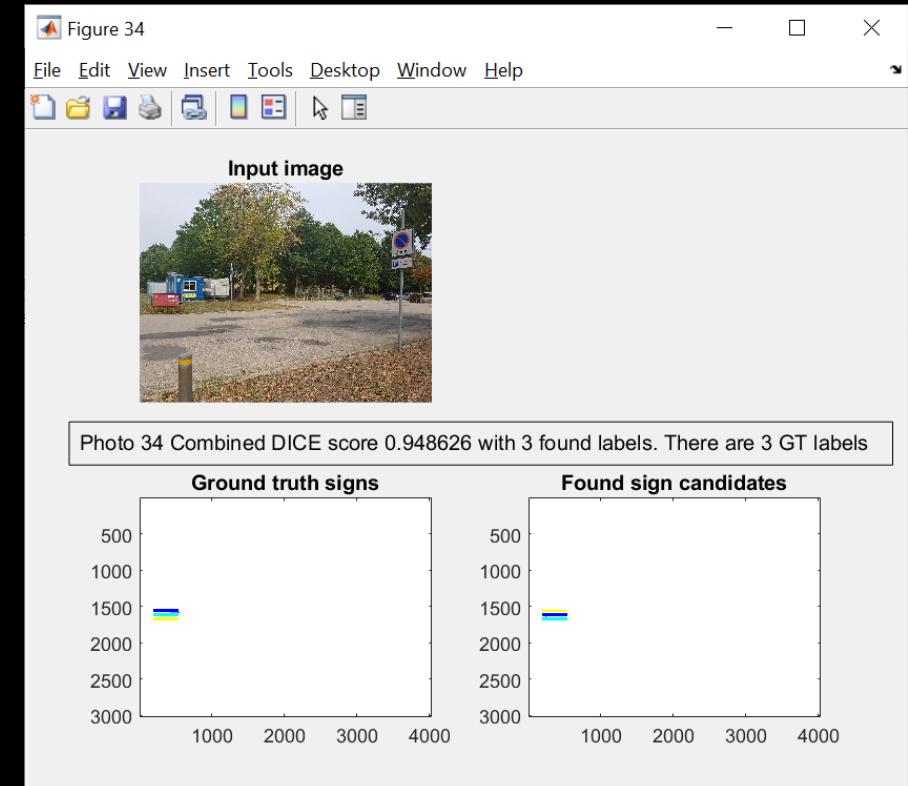
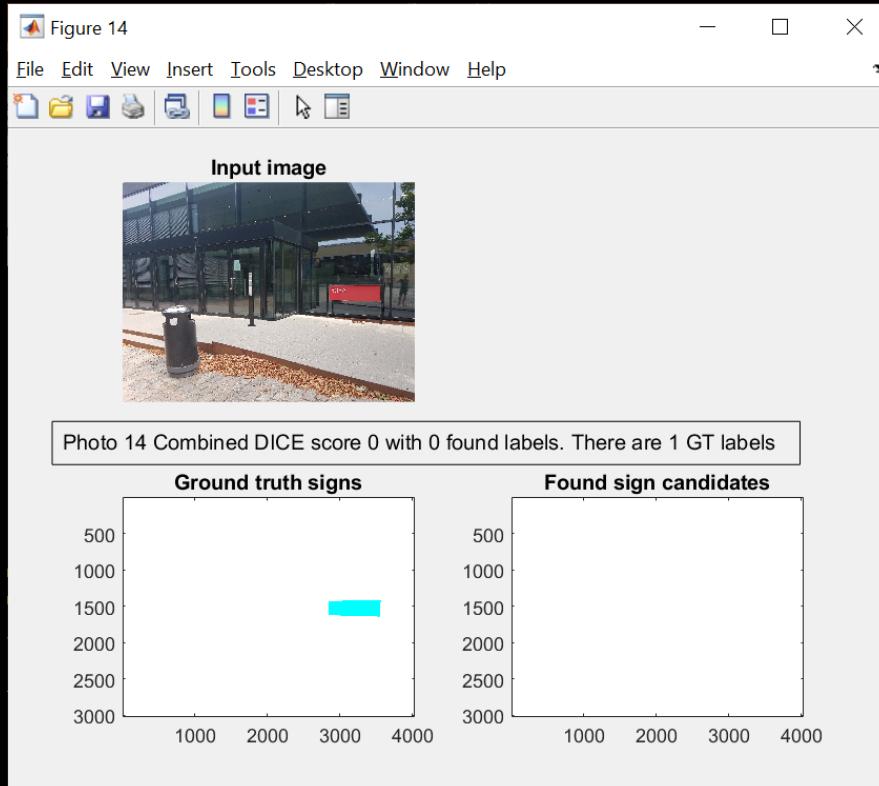


# MyDTUSignFinder



s174306

Signe Nedergaard Mikkelsen



DICE: Mean 0.20, min 0.00, max 0.96.

False positive: Mean 0.24, min 0, max 2



# MyDTUSignFinder



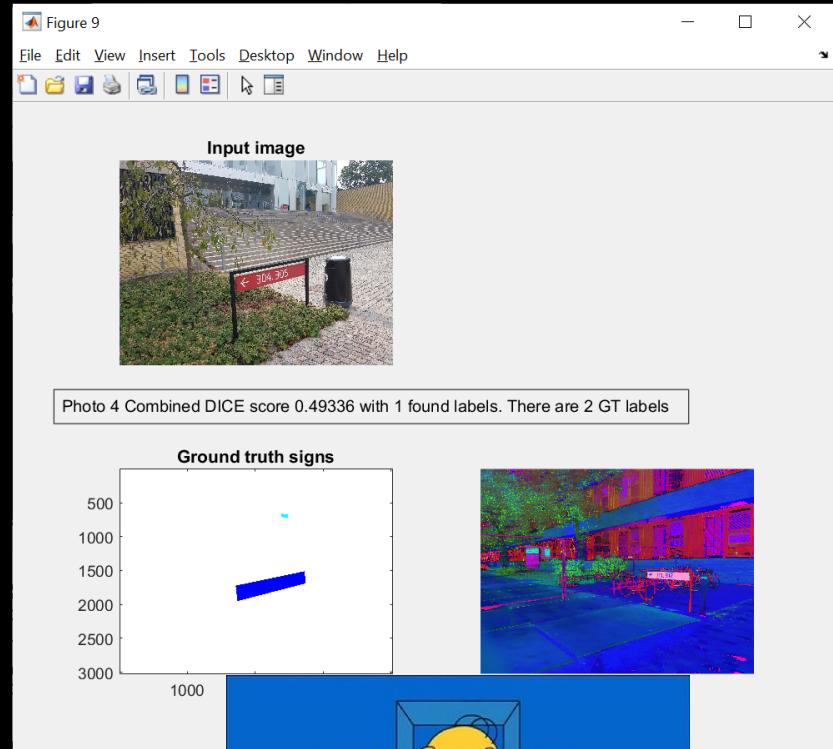
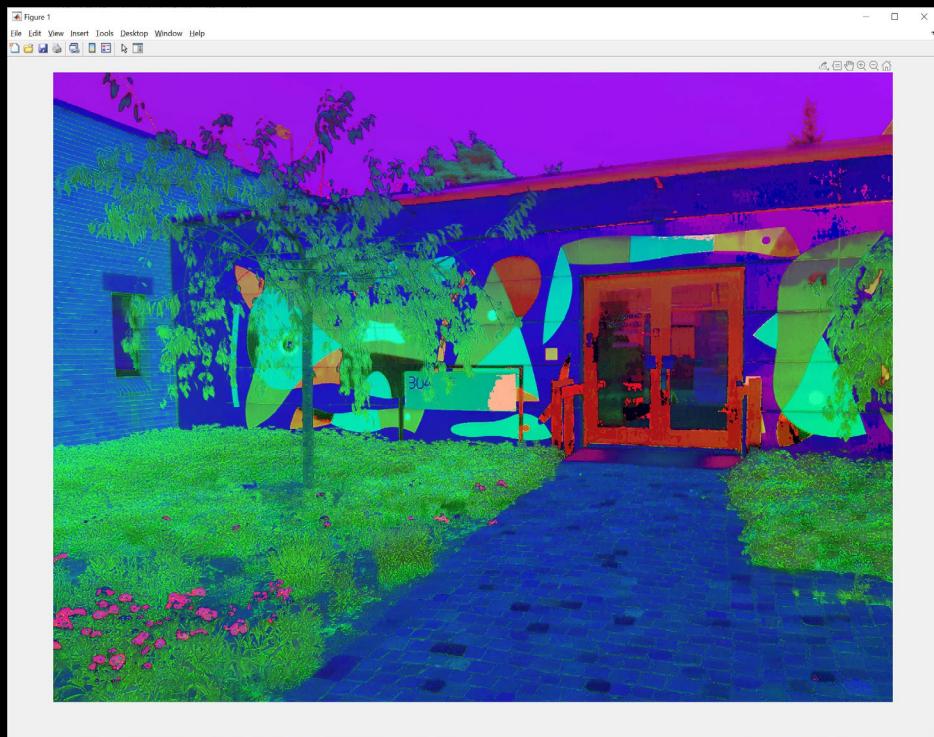
s174382  
Marian Petroc



# MyDTUSignFinder



s174382  
Marian Petroc

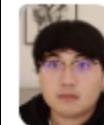


DICE: Mean 0.61, min 0.00, max 0.99.  
False positive: Mean 2.85, min 0, max 52

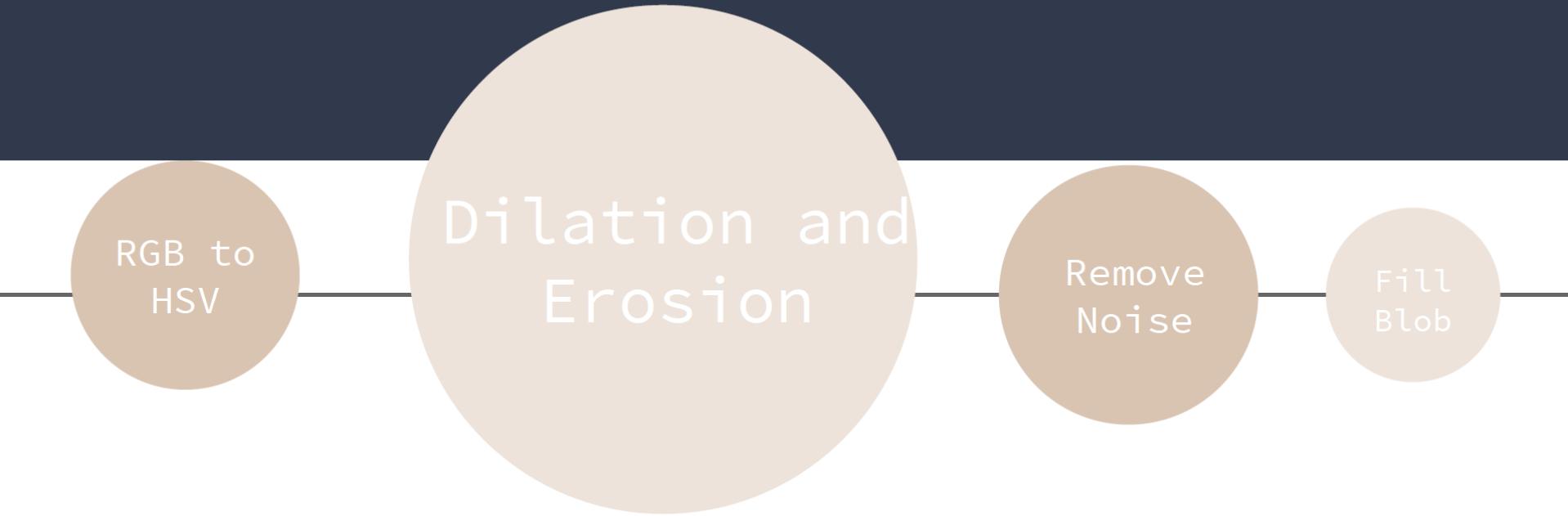




# myalgorithmtest



s181300  
Xu Zhenghao  
s182354  
Xiaohan Lyu



## Possible improvements

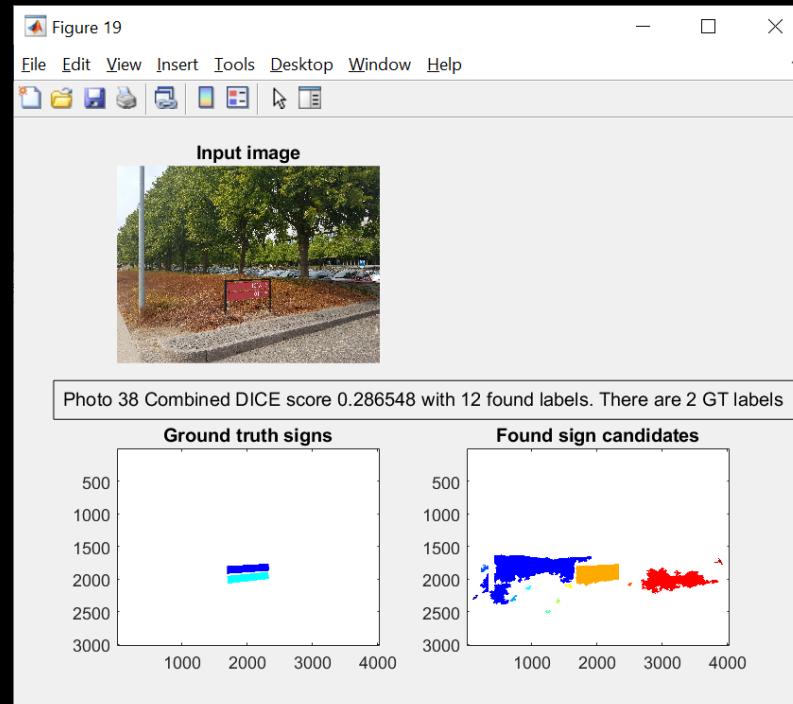
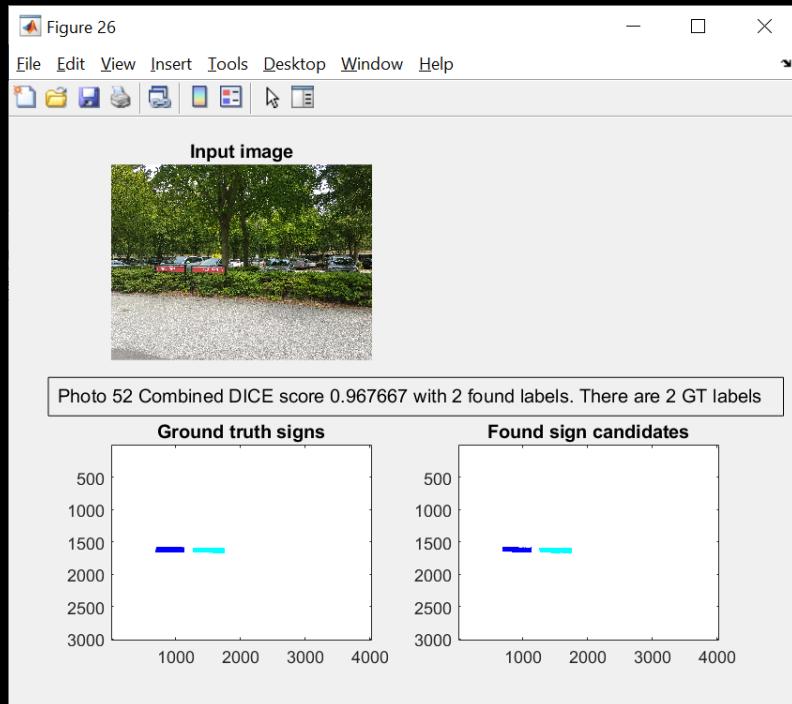
- 1) Now we fill the sign by filling the blob. A kind of possible improvement is find the smallest rectangle and then fill it. The edge maybe more sommoth.
- 2) Using Delta E algorithm. Through define color to find sign.



# myalgorithimtest



s181300  
Xu Zhenghao  
s182354  
Xiaohan Lyu



DICE: Mean 0.85, min 0.00, max 0.99.

False positive: Mean 3.47, min 0, max 14



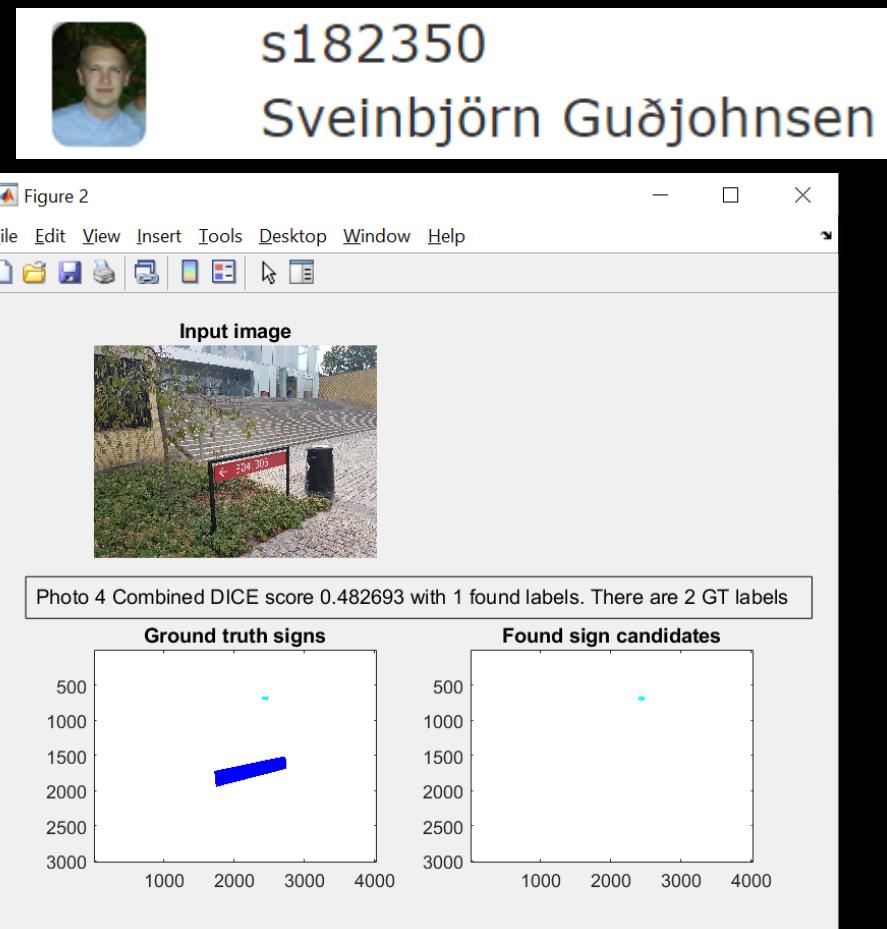
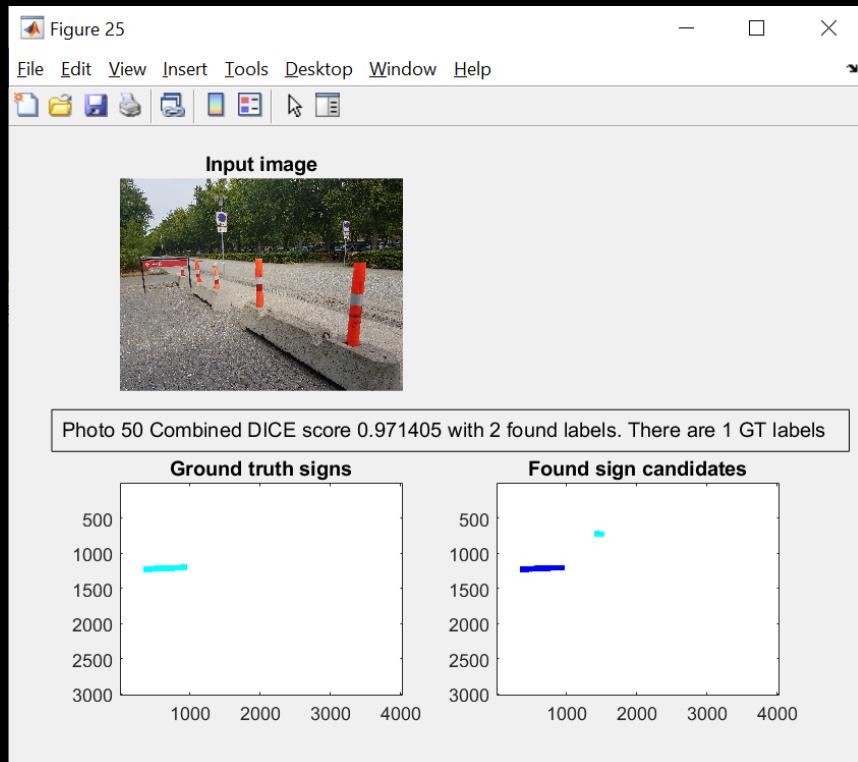
DTUSF



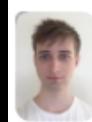
s182350

Sveinbjörn Guðjohnsen

## DTUSF



DICE: Mean 0.80, min 0.00, max 0.99.  
False positive: Mean 1.12, min 0, max 6

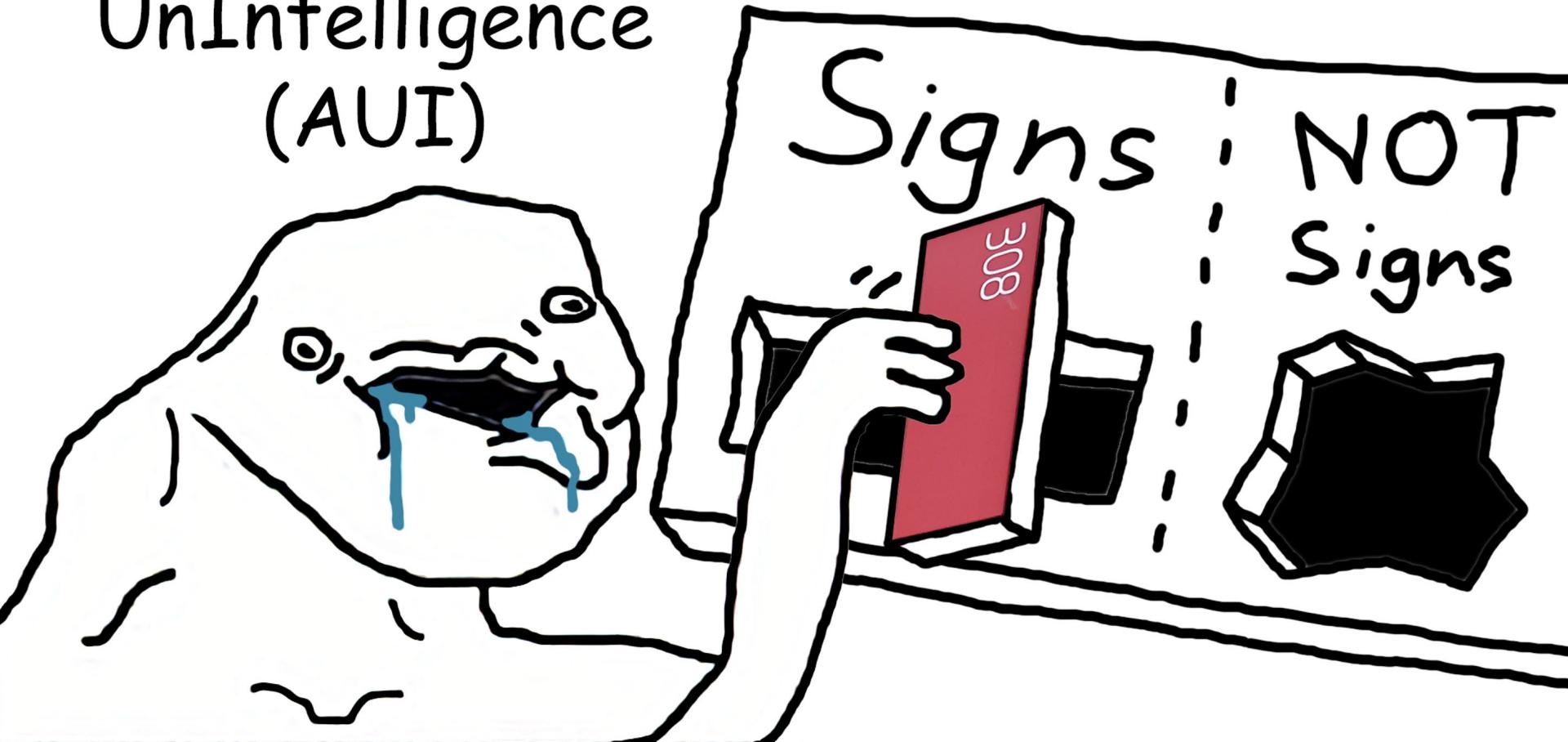


s183985

Jakob Lønborg Christensen

# ArtificialUnIntelligence

# Artificial UnIntelligence (AUI)

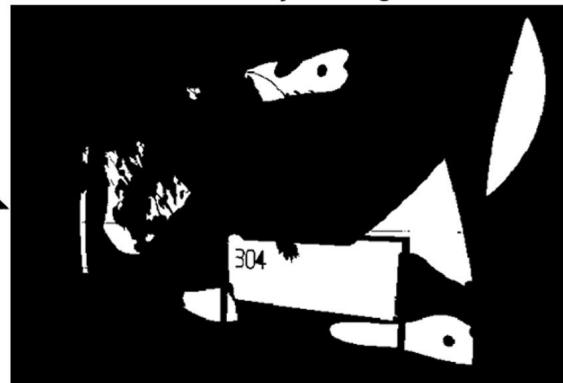


## How does ArtificialUnIntelligence.m work?

Input image



Binary Image



Blob sign probabilities



Use both RGB and HSV mapping to get a nice binary conversion. Small objects are removed afterwards using opening+closing.

10 parameters are computed for each blob. (shape, color, etc.)

An AUI classifier assigns blobs a sign probability value between 0 and 1. Signs above a threshold are treated as signs.



DSC\_avg = 0.9476  
(avg over training set)

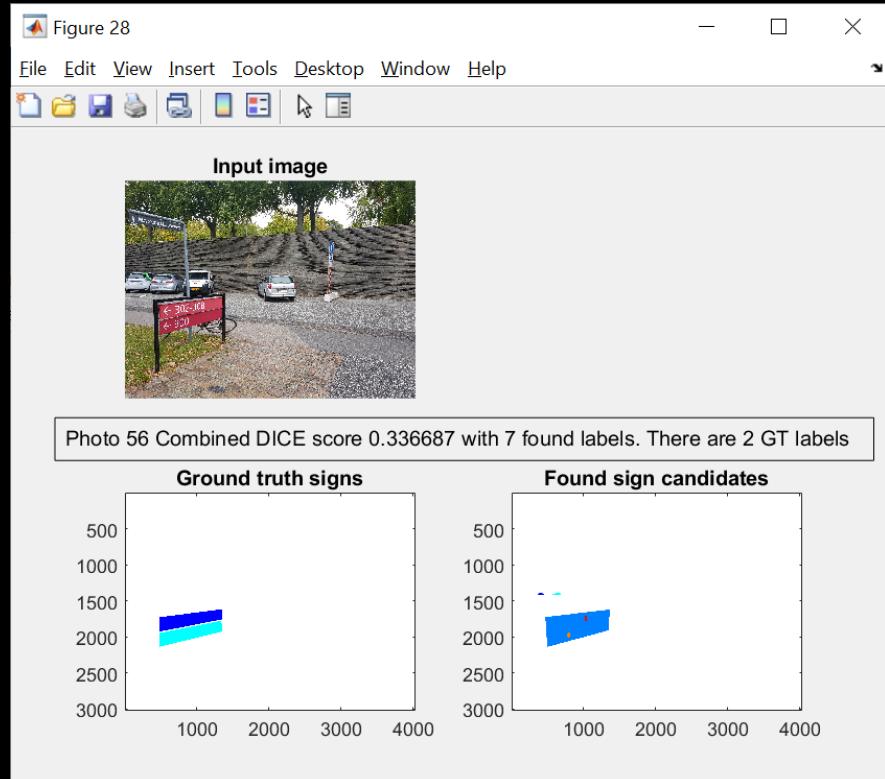
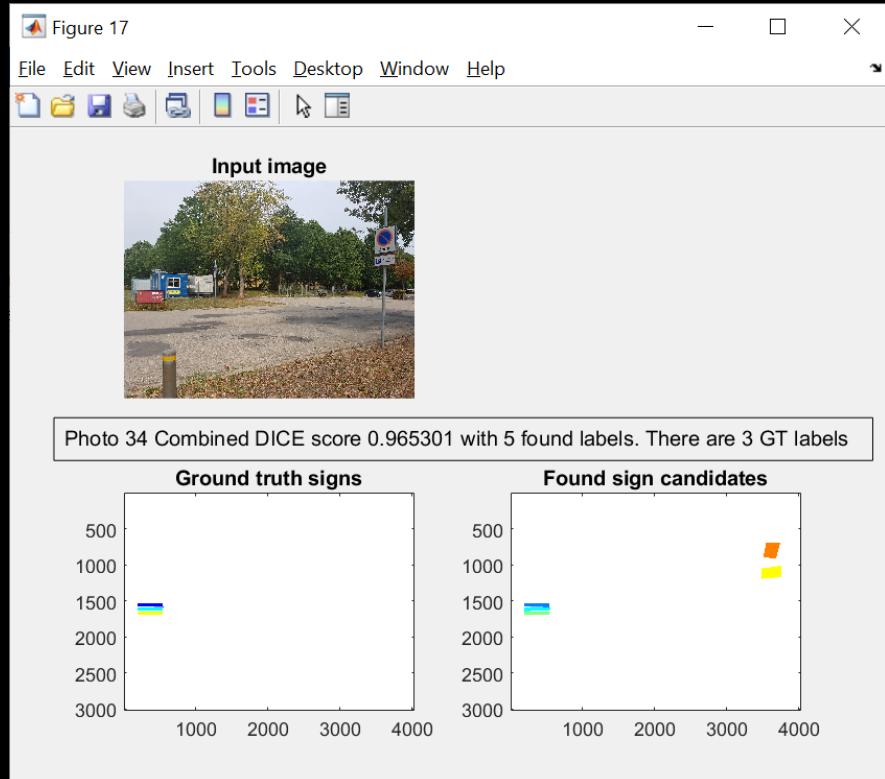
Make LabelMap of likely signs using corners



s183985

Jakob Lønborg Christensen

# Artificial UnIntelligence



DICE: Mean 0.91, min 0.34, max 0.99.

False positive: Mean 2.68, min 0, max 12



# Significant



s190064

Gudni Matthíasson

# Having trouble finding signs on campus?

- Significant will help you
- It uses revolutionary technology
  - *Pixel classification*
    - RGB and HSV!!!
  - *Morphology*
  - *BLOB analysis*
- Designed according to recommended standards
- Tuned with rigorous testing

# Algorithm

- Separate script takes histogram averages of ROIs in RGB and HSV
- Manual tuning of color thresholds
- Morphological operations to remove noise and fill holes
- BLOB analysis filtering on following features:
  - *Boxiness* (*bounding perimeter / perimeter*)
  - *Solidity* (*convex hull area / area*)
  - *Aspect ratio* (*major dimension / minor dimension*)
  - *Circularity* (*perimeter / most compact perimeter for area*)
  - *Orientation* (*angular deviation of main dimension from horizontal line*)

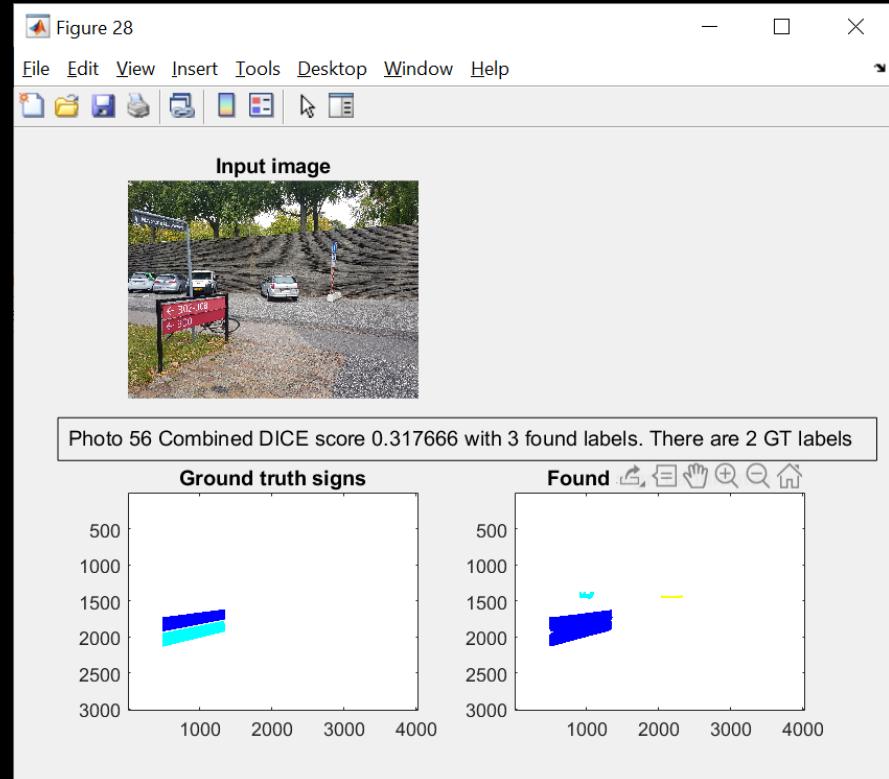
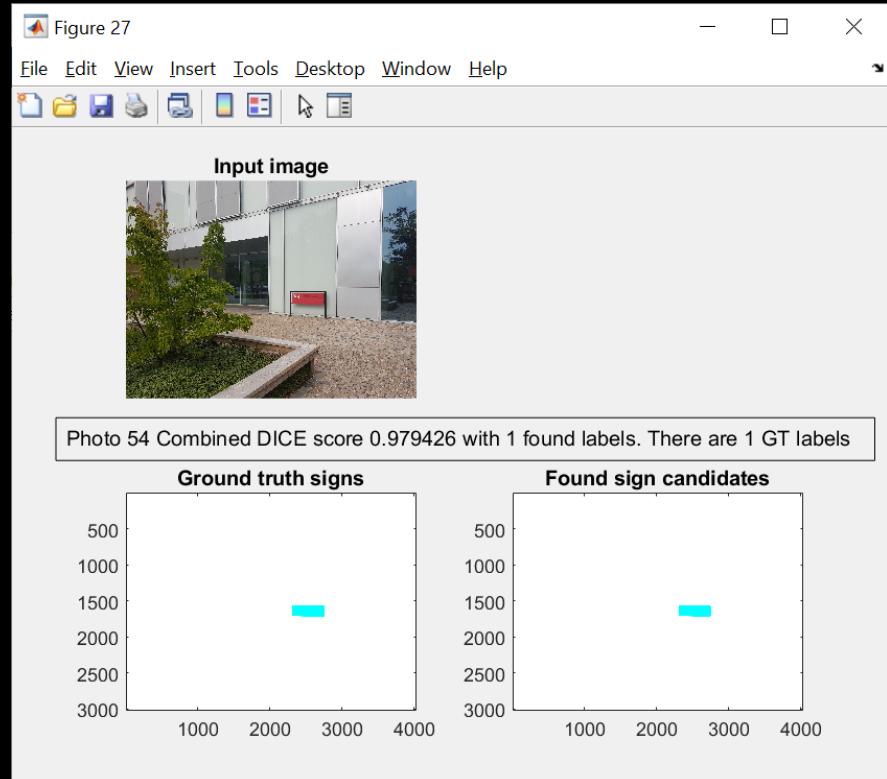
# Tuning Process

- Set wide limits to BLOB features
- Do for each feature until reasonably optimal limits are found:
  - *Test on validation set*
  - *Narrow parameter range and check the following:*
    - Score, false positives, false negatives
- Results:
  - *> 0.8 score on validation data*
  - *26 false positives*
  - *5 false negatives*

# Significant



s190064  
Gudni Matthiasson



DICE: Mean 0.70, min 0.00, max 0.99.  
False positive: Mean 0.91, min 0, max 4



# OKSignFinder



s190388

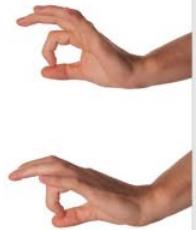
Ionela Marinuta

<https://knowyourmeme.com/memes/but-its-honest-work>

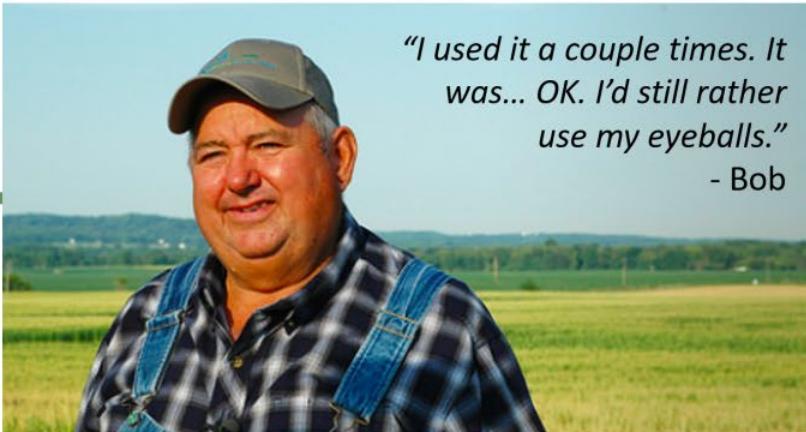
<https://media.pixcove.com/L/9/6/Good-Decent-Green-Light-Approval-Joy-Free-Image-Ok-9343.jpg>

# OKSignFinder™

75% of the time, works every time ;)



**Our promise:** three out of four people who use it will probably find at least some part of a sign among other things at some point during use. Check out our honest reviews:



*"I used it a couple times. It was... OK. I'd still rather use my eyeballs."*  
- Bob

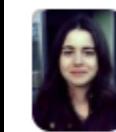
***"This is THE BEST DTU sign finder out there!"***

-nobody

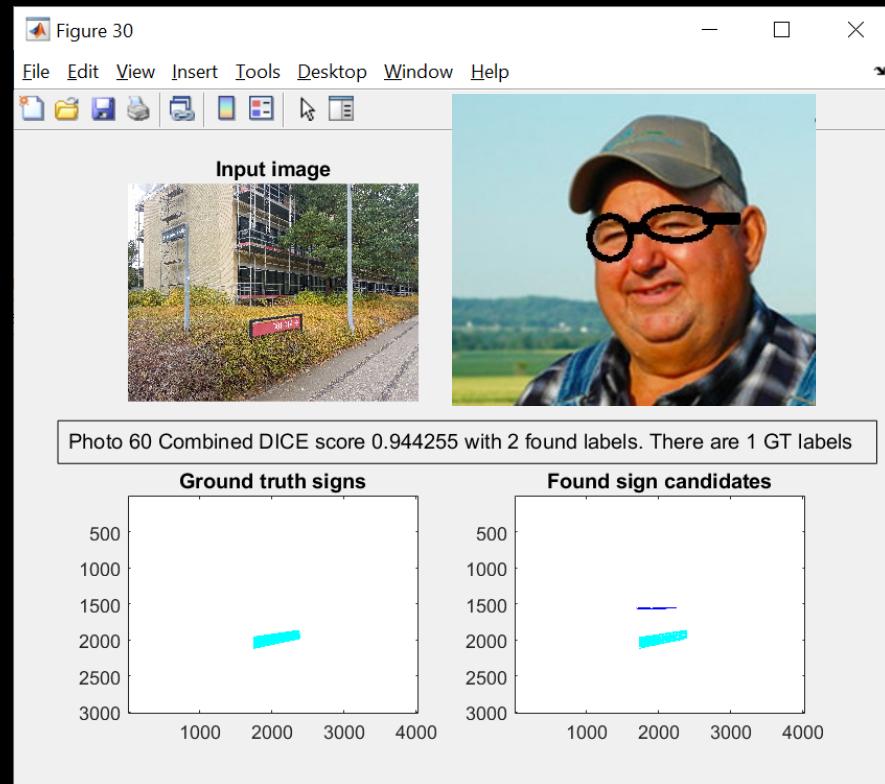
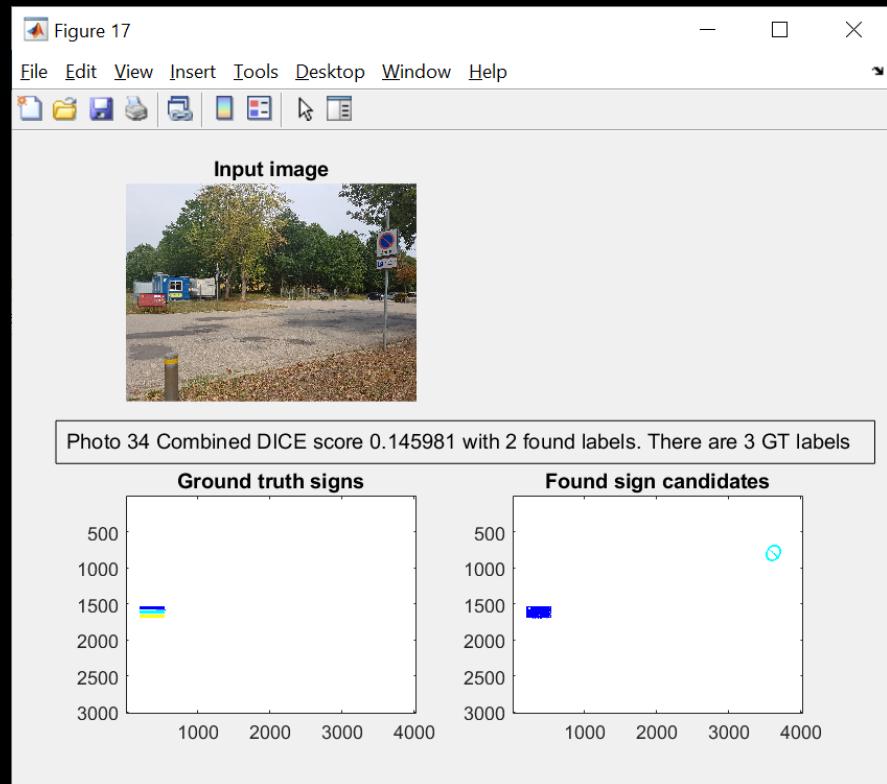
*"Based on their advertising I thought it detected the "OK" hand gesture. Now they won't give me a refund. I don't even go to DTU..."*

- non-DTU goer

# OKSignFinder



s190388  
Ionela Marinuta



DICE: Mean 0.69, min 0.00, max 0.99.  
False positive: Mean 1.06, min 0, max 6



# lookAtThisPhotograph



s173403

Alexander Mizrahi-Werner

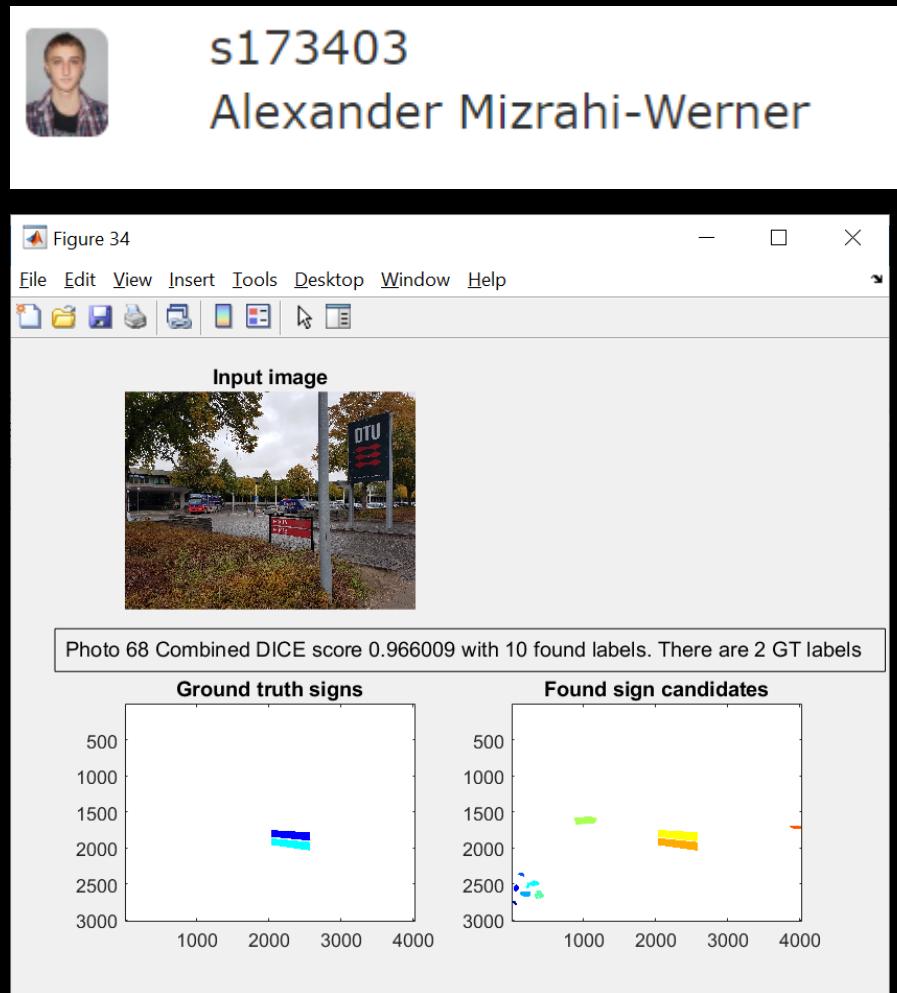
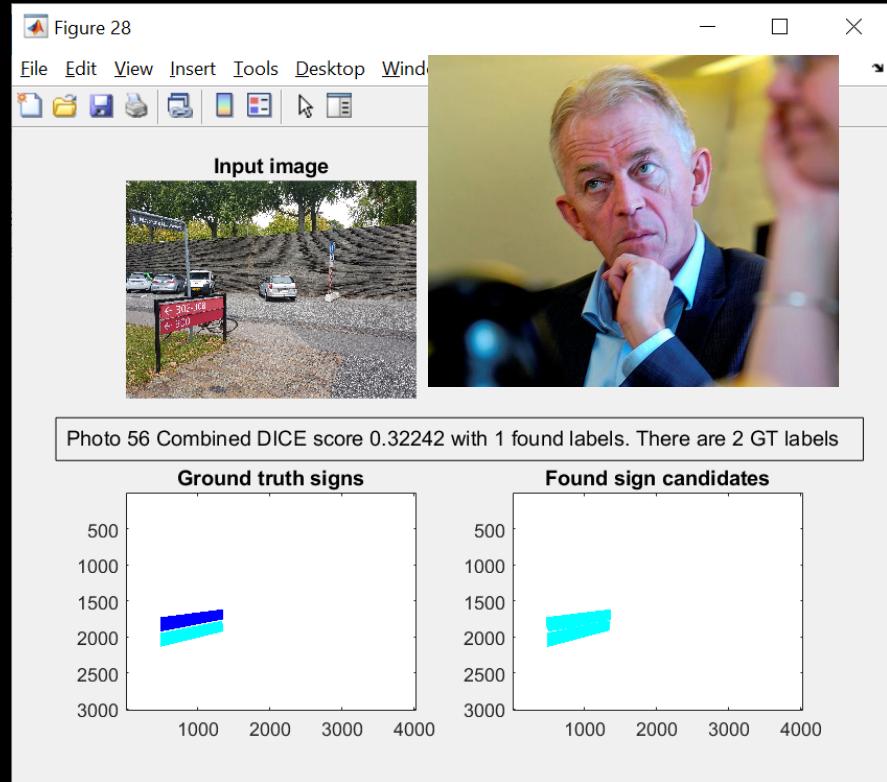
# Finding the right sign

When finding a sign in life or on DTU, do you ever wonder if it is the right one?  
Wonder no more an bewonder this new alghorithm instead!

- ▶ Advanced HSV color detection
- ▶ Old proven techniques like blob analysis
- ▶ New cross-correlation tech to validate sign-writing
- ▶ Detects signs you did not even know where there



# lookAtThisPhotograph



DICE: Mean 0.78, min 0.00, max 0.99.

False positive: Mean 1.74, min 0, max 10



# MyDTUSignFinder

	s191346 Yifei Xue
	s191217 Jin Yang
	s192113 Mengge Hu

# METHODS

## Pixel classification

- **Conversion:** form RGB domain into HSV domain
- **Extraction:** the HSV values of all target domain pixel points
- **Thresholds selection:** 3 sigma rule for H and V component; Select the left and right most H components, as H components are highly concentrated at both ends;

## morphological operations and BLOB analysis

- For each image, do closing and opening in order from the lower to higher order kernel

# RESULTS

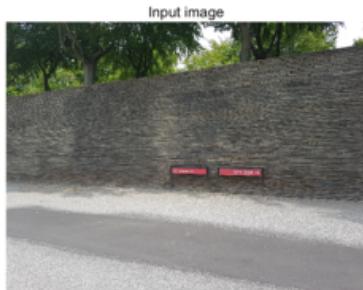
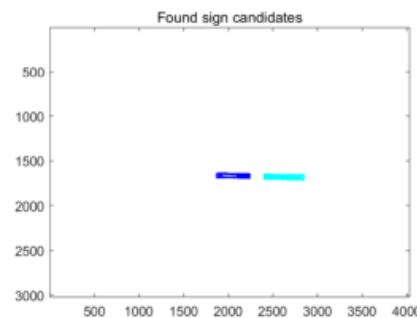
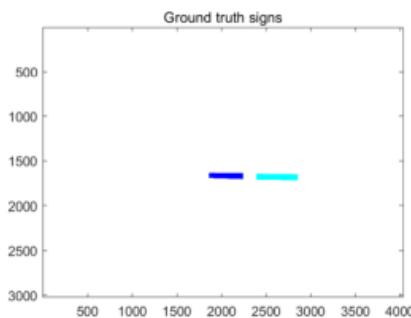
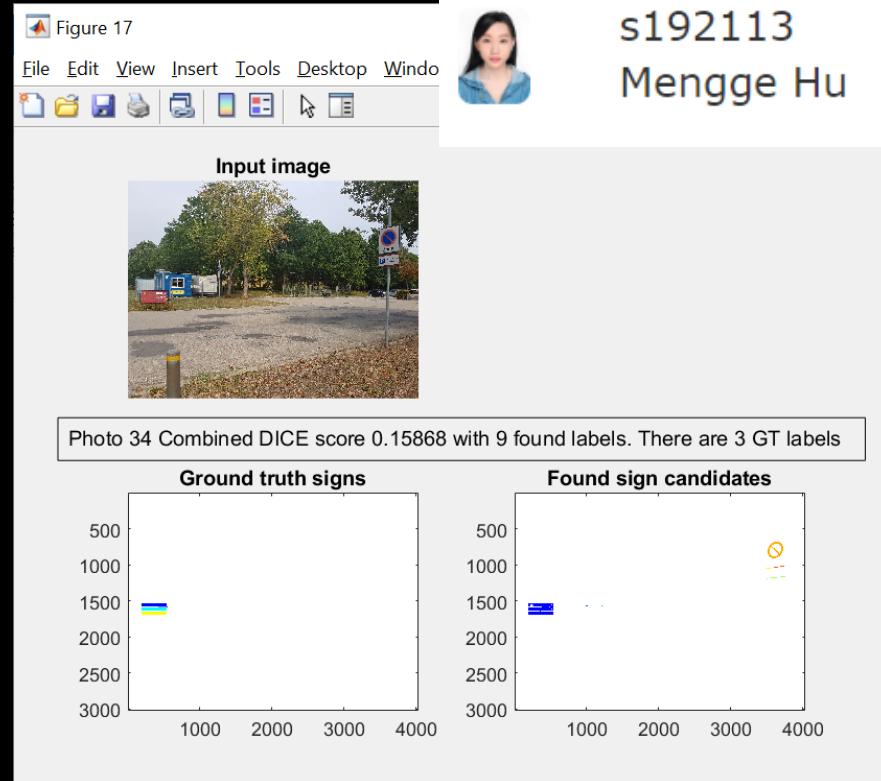
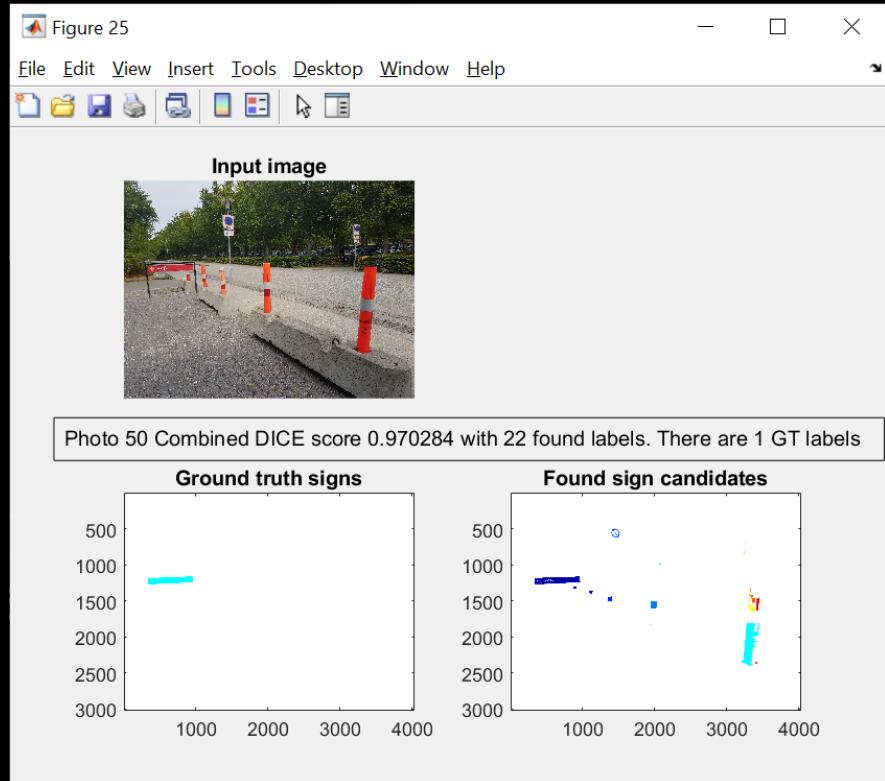


Photo 21 Combined DICE score 0.953762 with 2 found labels. There are 2 GT labels

- Using Image 33 to 67 as the training set and the others as the test set, a combined DICE score of 0.9599 was reached.
- Following is an example of a detected image compared to the original. Attached is a screenshot of the program running. (<https://youtu.be/3eXLtVH36Sk>)



# MyDTUSignFinder



DICE: Mean 0.89, min 0.16, max 0.99.

False positive: Mean 14.06, min 0, max 54



# SIGNusInfection



s191413

Cara Ditmar



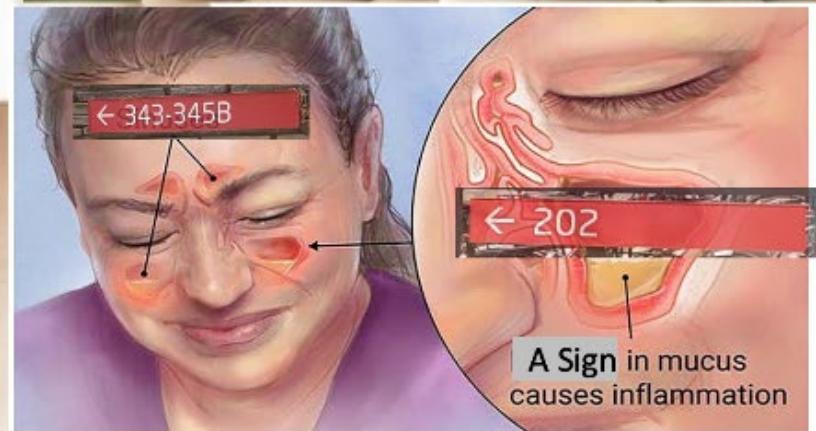
s191547

Christopher Lyke

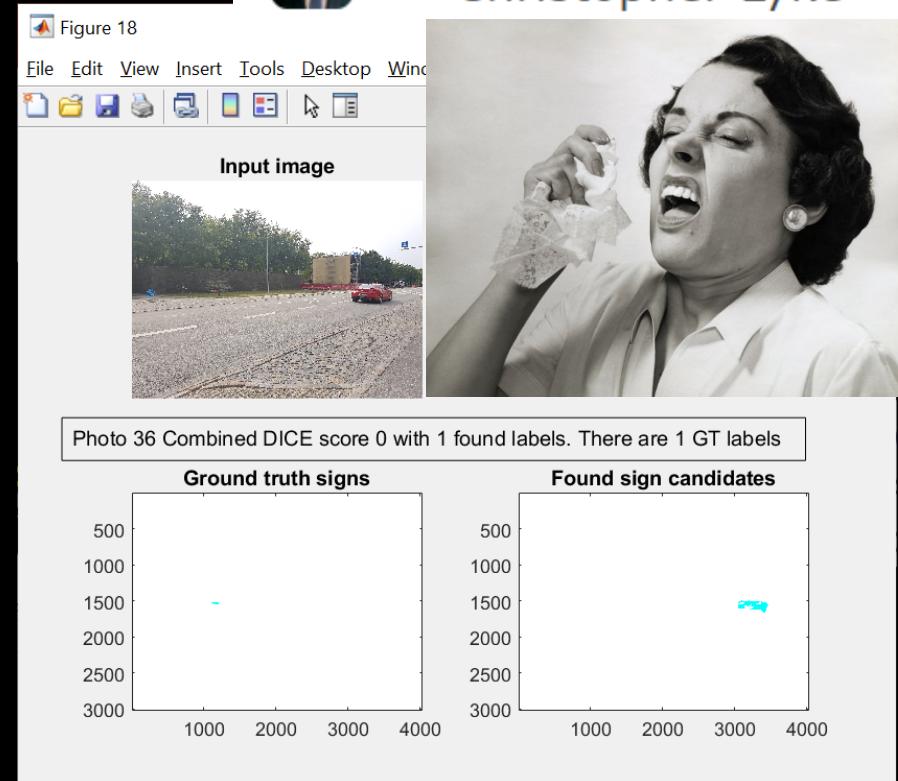
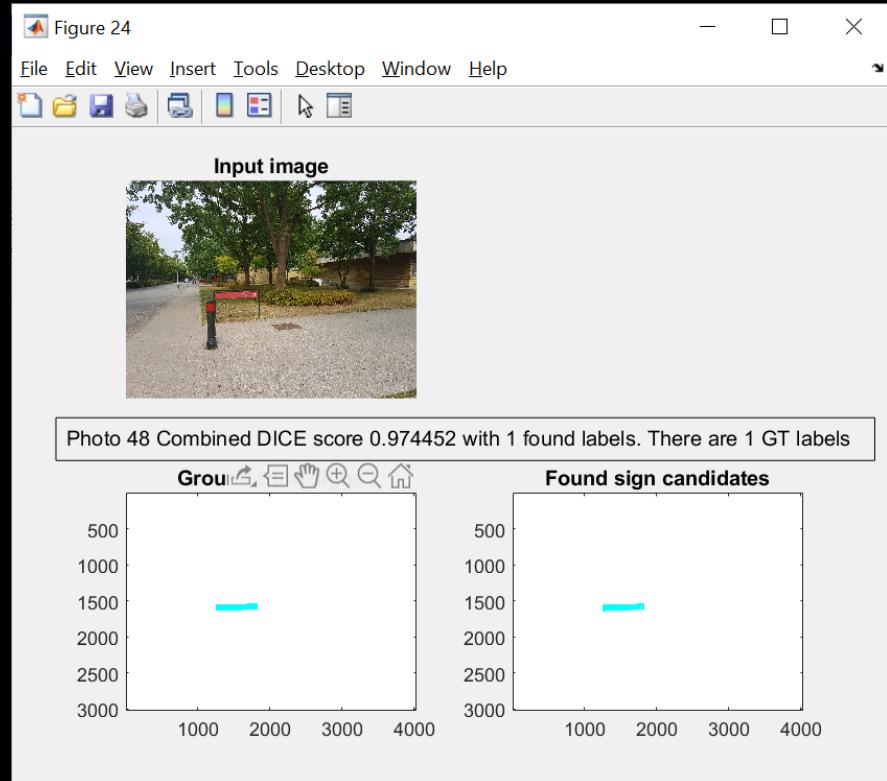
# SIGNUS Infection



We can't smell the signs, but  
we can find them with matlab!



# SIGNusInfection



DICE: Mean 0.68, min 0.00, max 0.98.  
False positive: Mean 0.85, min 0, max 6



# WhereIsSign



s192230  
Manxi Lin  
s191468  
Biliang Wang  
s191952  
Haoying Yu  
s192186  
Bodi Bodi

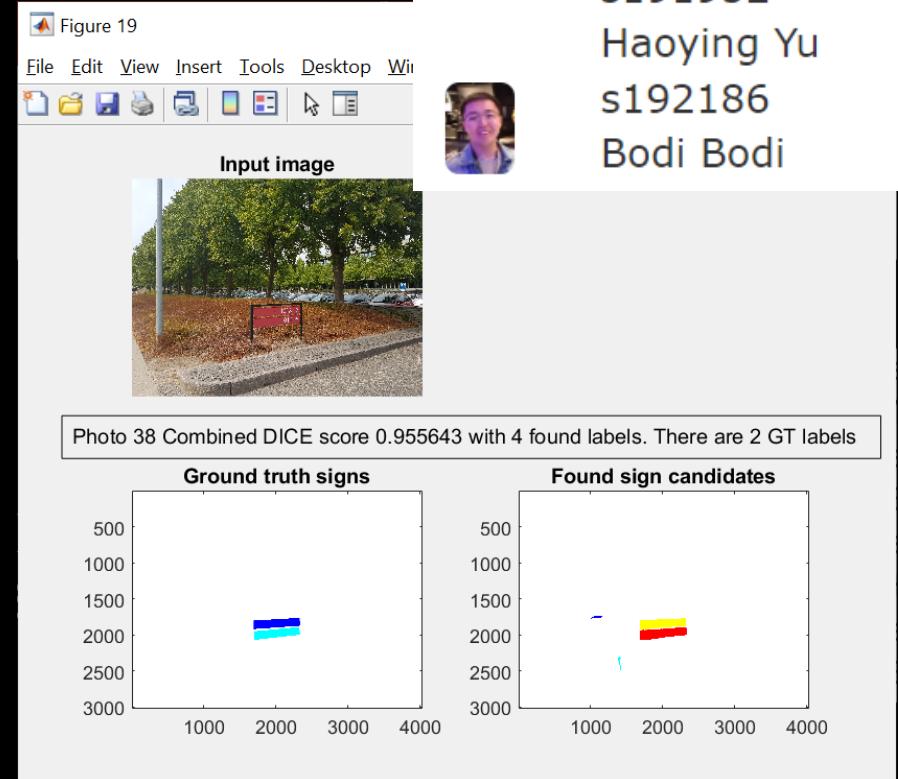
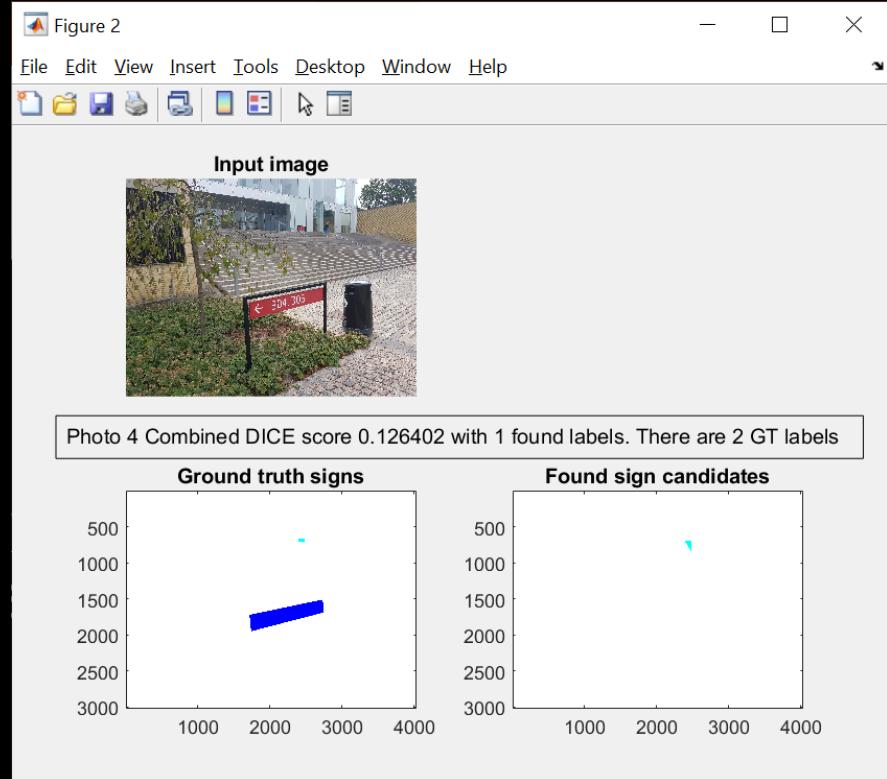
# Main Process

- find RGB range
- find HSV range
- find LAB range
- blob analysis
- find qualified segments
- recognize incomplete segments and complete them
- output results

# Training based on penalty strategy

- See *training.mlx*
- Use all the images as training sets.
- Calculate each images' RGB and HSV features
- To calculate the weighted mean of RGB and HSV features, define parameter as the weights
- Loss = sum(sum(img-label));
- **img**: extracted images      **label**:ground truth
- Each image's new parameter is equal to  $\ln(1+loss)/s$ ;
- S is equal to the sum of all images'  $\ln(1+loss)$
- Loop until the parameters never change

# WhereIsSign





# SignMyFinderPlease



s193415

Søren Kolbye Jensen

# SignMyFinderPlease

*As part of the SignFinder challenge in course  
02502 Image Analysis E19*

By

Søren K. Jensen (s193415)

Daniel J. Nielsen (s193416)



# Implementations

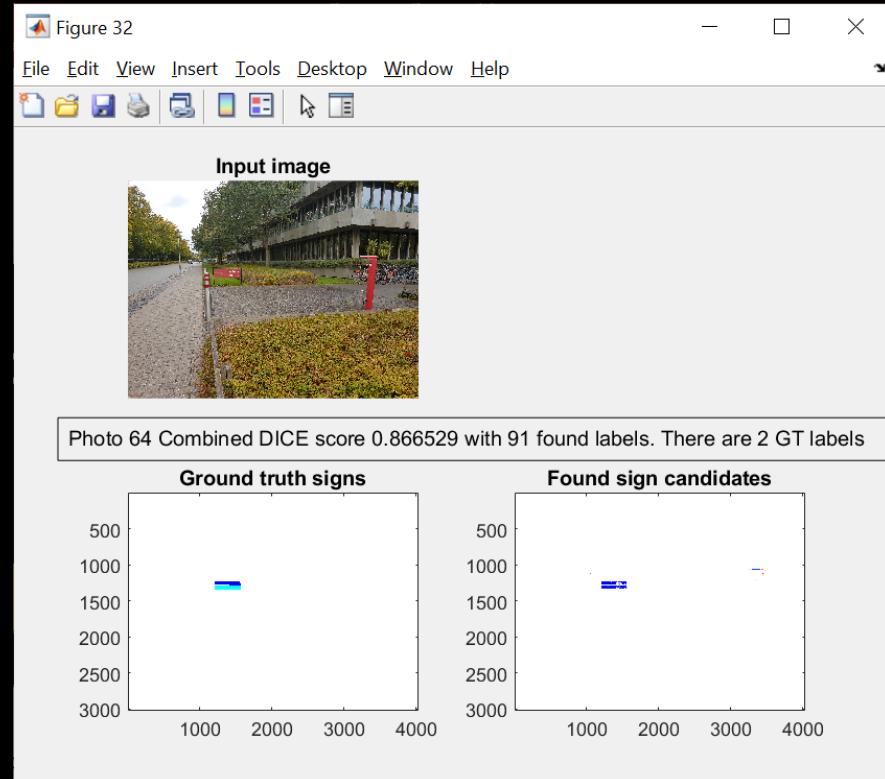
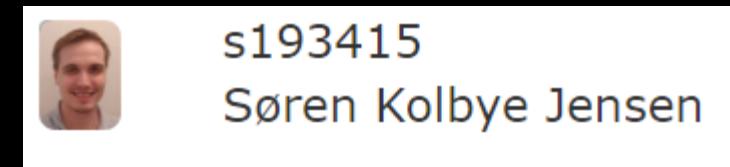
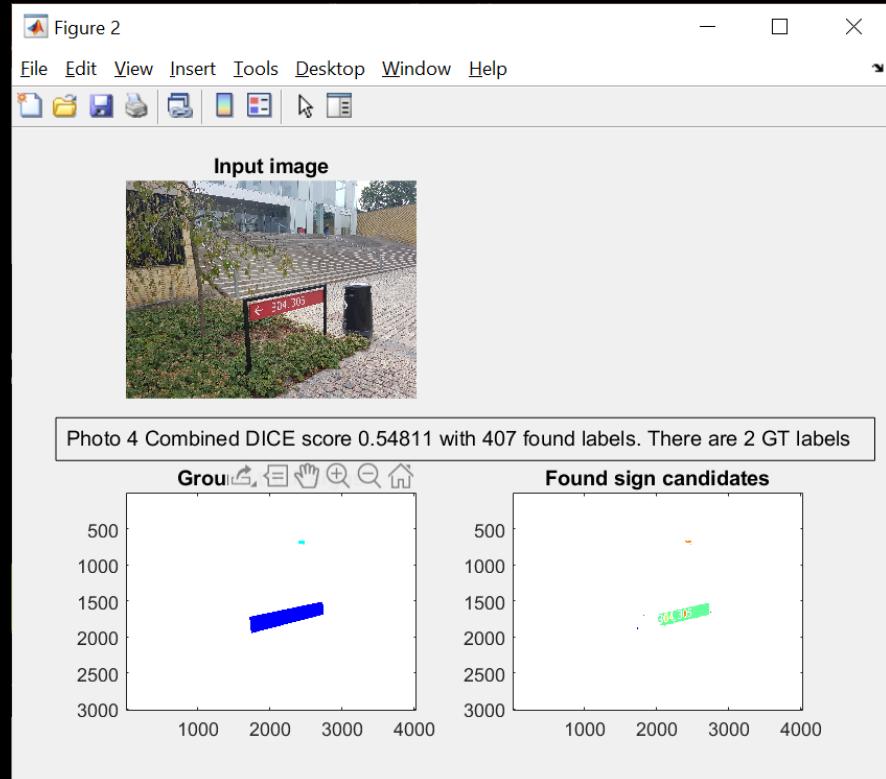
- ◊ Optimized RGB Treshold for parametric classification.
- ◊ Morphological structuring (`strel`) with `rectangl` as parameter
- ◊ Morphologically close (`imclose`)
- ◊ Blob extraction using 8-connectivity

## Combined DICE score (F1-score)

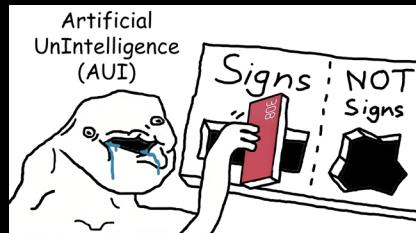
- ◊  $0,1081 = 10,81\%$
- ◊ Lowest = 0,0 (photo 1) | Highest 0,8356 (photo 65)



# SignMyFinderPlease



DICE: Mean 0.19, min 0.00, max 0.87. False positive: Mean 161.15, min 0, max 254



s183985

Jakob Lønborg Christensen

# ArtificialUnIntelligence

**1**

s111975

Ragnar Sandberg Mikkelsen

# SatisficeTheDice

**2**

s191346

Yifei Xue



s191217

Jin Yang



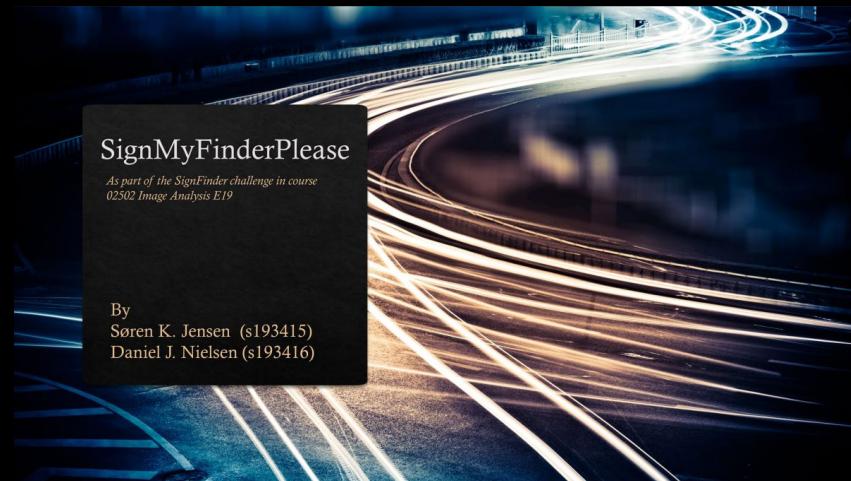
s192113

Mengge Hu

# MyDTUSignFinder

**3**

# Fighter prisen



## SignMyFinderPlease



s193415  
Søren Kolbye Jensen

# Overall rankings

Algorithm	Mean DICE	Min DICE	Max DICE	Mean FP	Min FP	Max FP
ArtificialUnIntelligence	0.91	0.34	0.99	2.68	0	12
SatisficeTheDice	0.91	0.46	0.99	1.68	0	7
MyDTUSignFinder-Yifei, Jin, Mengge	0.89	0.16	0.99	14.06	0	54
myalgorithmtest	0.85	0.00	0.99	3.47	0	14
DTUSF	0.80	0.00	0.99	1.12	0	6
RandomLabelGenerator	0.79	0.00	0.99	0.24	0	3
SignMeIn	0.79	0.00	0.99	2.32	0	13
lookAtThisPhotograph	0.78	0.00	0.99	1.74	0	10
WhereIsSign	0.77	0.00	0.99	2.18	0	17
signhere	0.76	0.00	0.99	0.44	0	3
Significant	0.70	0.00	0.99	0.91	0	4
OKSignFinder	0.69	0.00	0.99	1.06	0	6
SIGNusInfection	0.68	0.00	0.98	0.85	0	6
MyDTUSignFinder-Marian	0.61	0.00	0.99	2.85	0	52
MyDTUSignFinder-Signe	0.20	0.00	0.96	0.24	0	2
SignMyFinderPlease	0.19	0.00	0.87	161.15	0	254