Eel-grass detection from under water Videos

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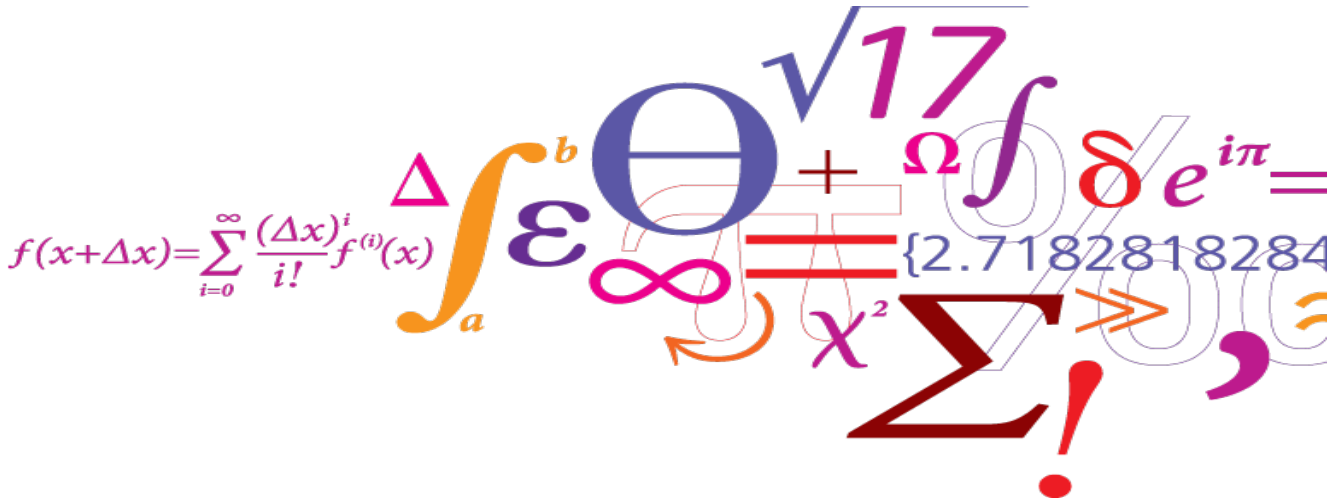
Statistics and Data Analysis



DTU Compute
Department of Applied Mathematics and Computer Science

SeaStatus

Innovative Technologies for Quantification of Sea Status

- SeaStatus combine innovative monitoring with new models for decision-making, and hence, support sustainable exploitation of the marine environment by improving the knowledge base and predictability of management scenarios.
- Apply broad range of classical and new statistical analyses, rooted in data mining and Big Data analytics, as well as greybox and mechanistic modelling approaches.
- Develop a framework for improved real time description and predictions of the marine environment.
- Funded with 10 mio. DKK from the Danish Innovation Fund(IFD).

Partners

DHI The expert in WATER ENVIRONMENTS

DTU Compute

COWI

Vejdirektoratet

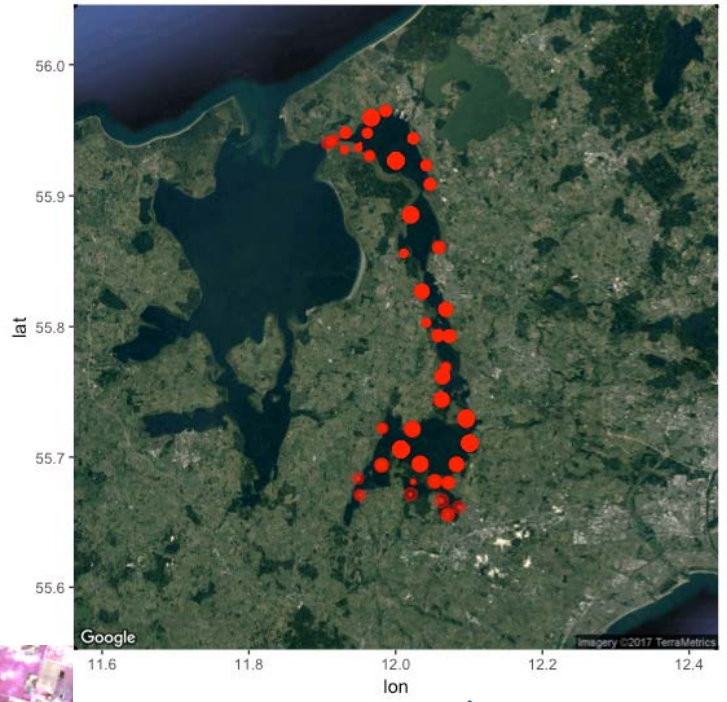
Miljø- og Fødevareministeriet

AARHUS UNIVERSITY

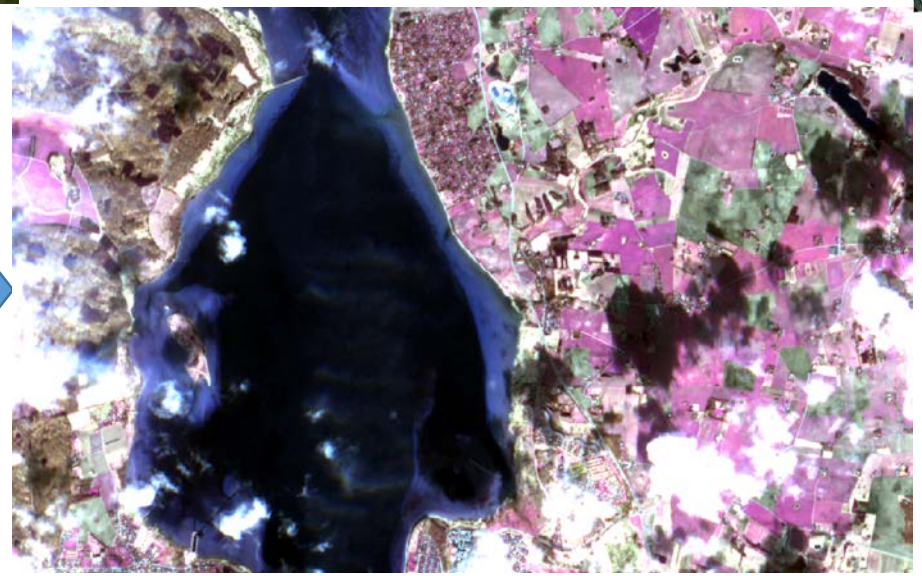
RAMBØLL

Data

Underwater Video Transects
Frame rate: 25 fps
Each videos: 1.25 GB
Resolution : 576x720x3



Sentinel 2A satellite Images
Multi band Geo Tiffs (10 Channels)
Each Images 2.5 GB
Pixel spacing of 10x10 m.



Other Sensors
Ferry-box data
On-line Sensors
Remote Sensing

Video Transects

Objective

Detect the presence or absence of Eelgrass.

Popular practice

Present

Expert-1

Absent

Expert-2

Present

Expert-3

Perception Bias

Waste of precious Man-hours.!!

We need a system that..

Find robust features not affected by noise

Automatizes the whole process of Eel-grass detection

Provides a way to quantify the expert bias

Fast computation (Online purpose)

Extract Text information from videos

About the data : Some challenges

Grass is green right ?

Environment changes colour quickly

Noisy objects

Data is not labelled

Algorithm for detecting Eelgrass

LSD: a Line Segment Detector

Rafael Grompone von Gioi[1], Jérémie Jakubowicz[2], Jean-Michel Morel[3],
Gregory Randall[4]

LSD is a linear-time Line segment Detector giving subpixel accurate results. Aimed at detecting locally straight contours on Images. Contours are zone of image where the gray level is changing fast enough from dark to light or vice-versa(fig.1).

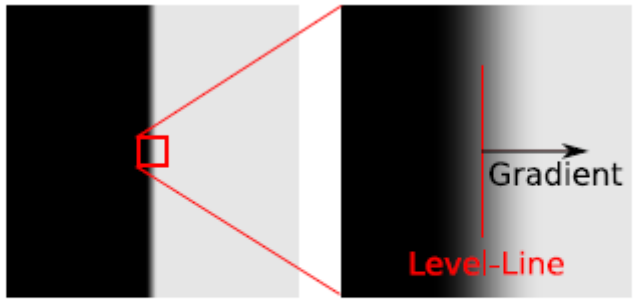


Figure 1: Image gradient and level-lines.

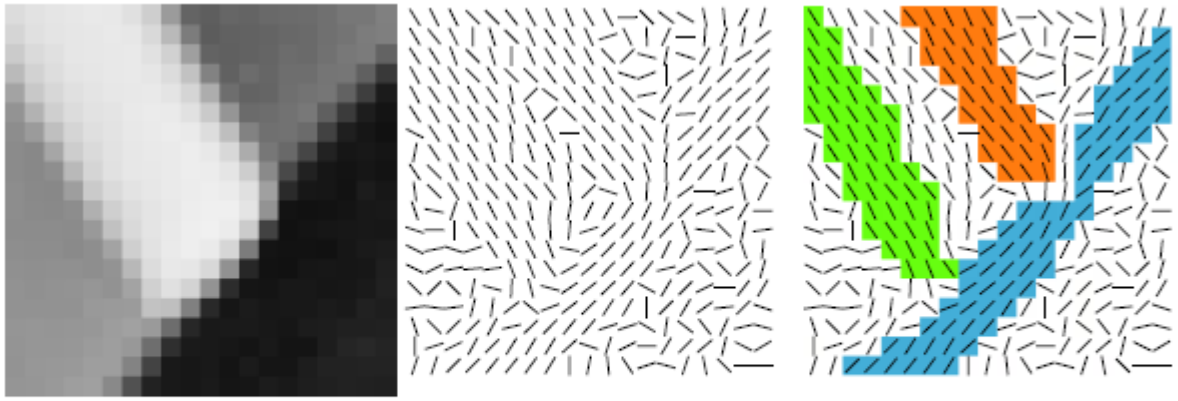
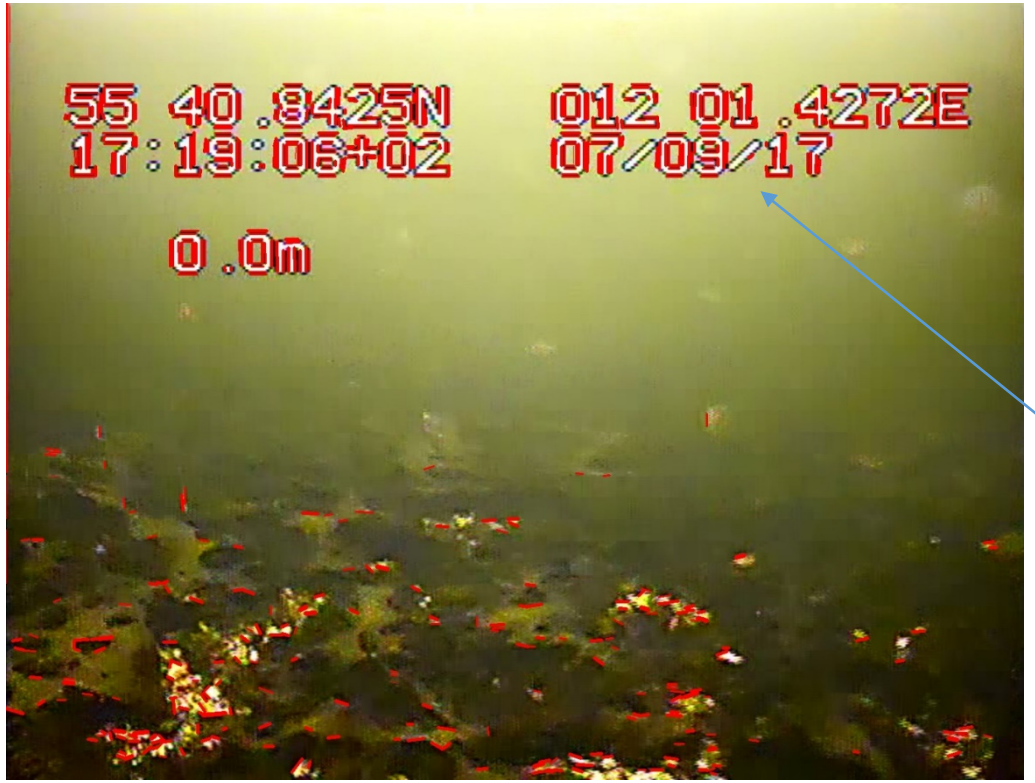


Figure 2: Line Support Regions.

Algorithm computes level-line angle at each pixel to produce a *level-line field*. This field is segmented into connected regions of pixel that share same angle to certain threshold. Connected regions called *Line Support Regions*(fig.2)

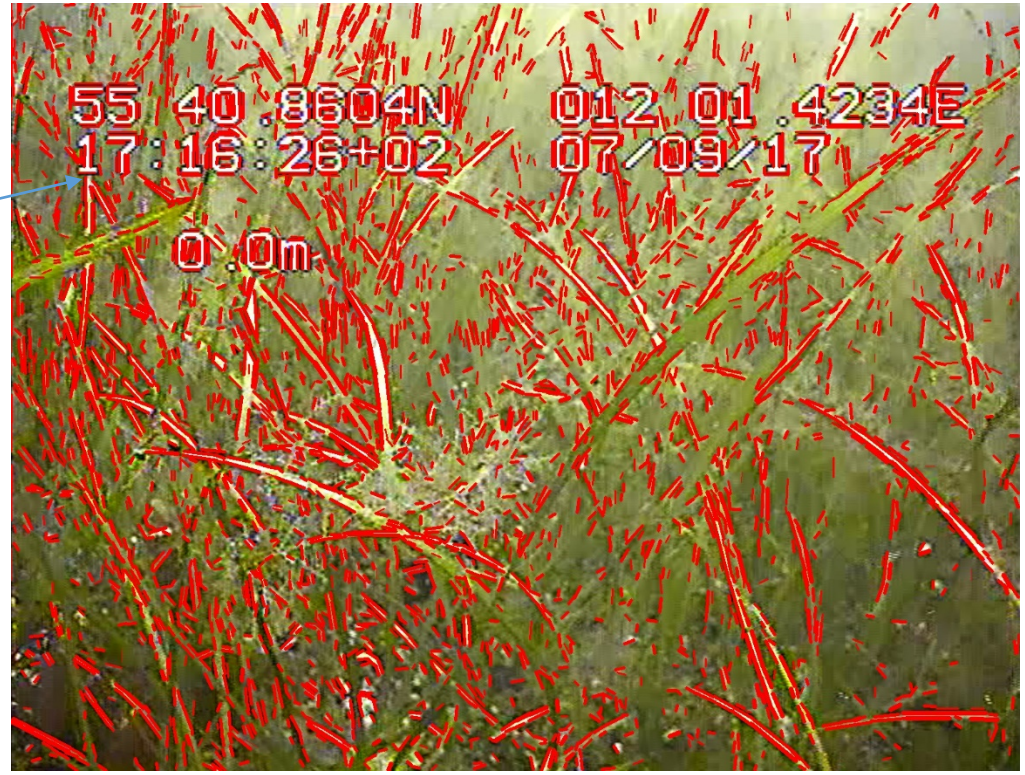
How does it look ?



Seems pretty decent..!!!

BUT..!!!

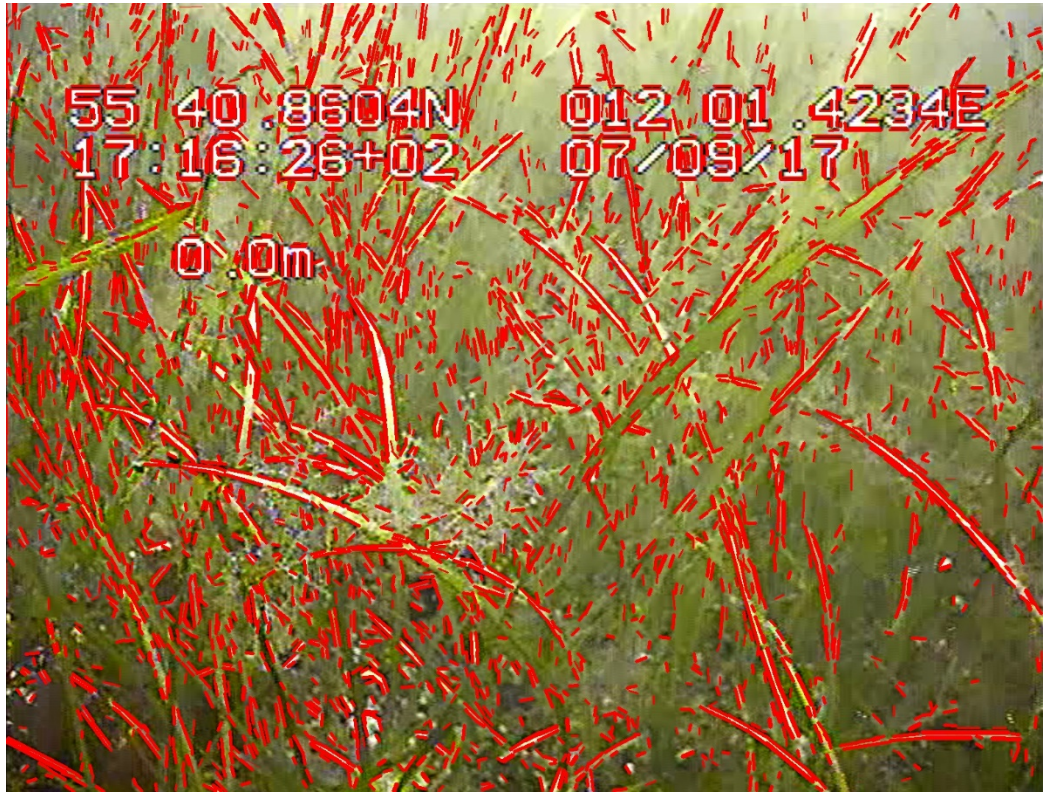
Lines on the printed texts needs to be removed.



Eliminating Lines from Text

Removing lines of certain angles (with slope 0, Infinity and 1) +- έ(small value). Also limited the length of the line detected to be above certain threshold.

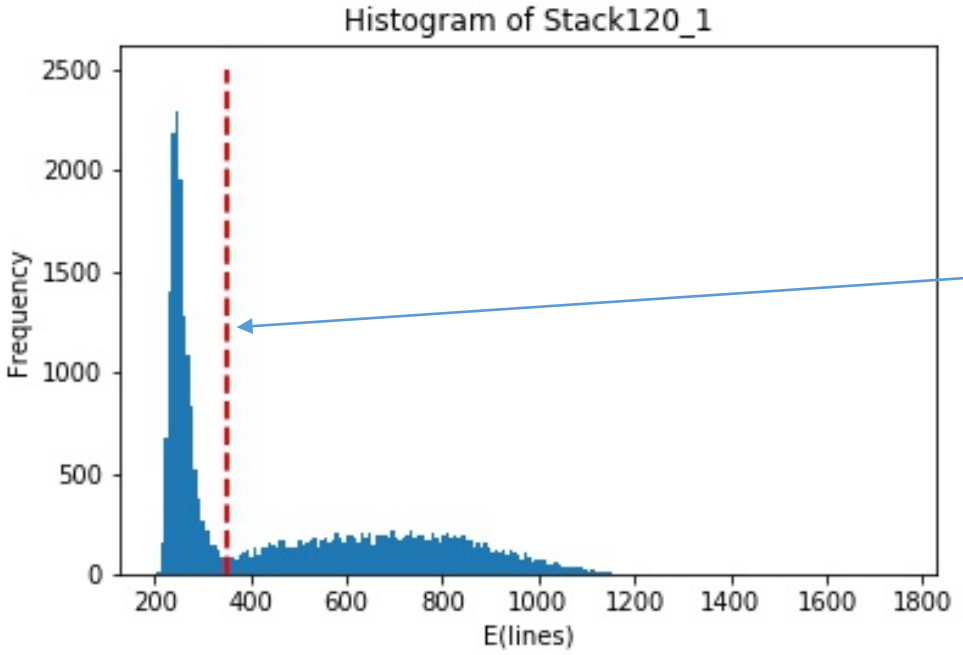
Previous



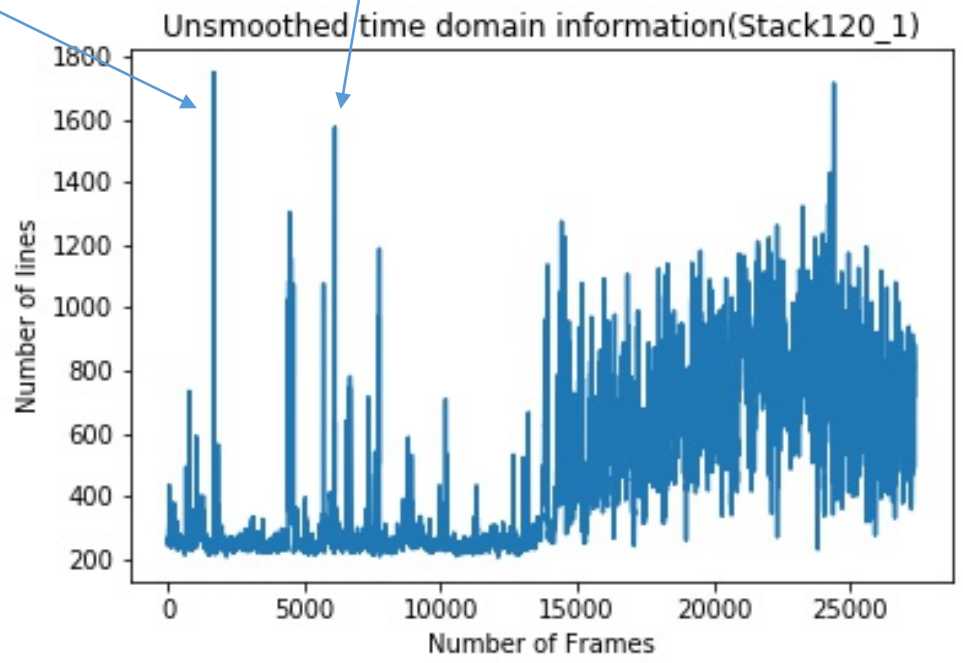
After

Finding the right threshold

Fluctuations due to noise/random patch of Eel-grass

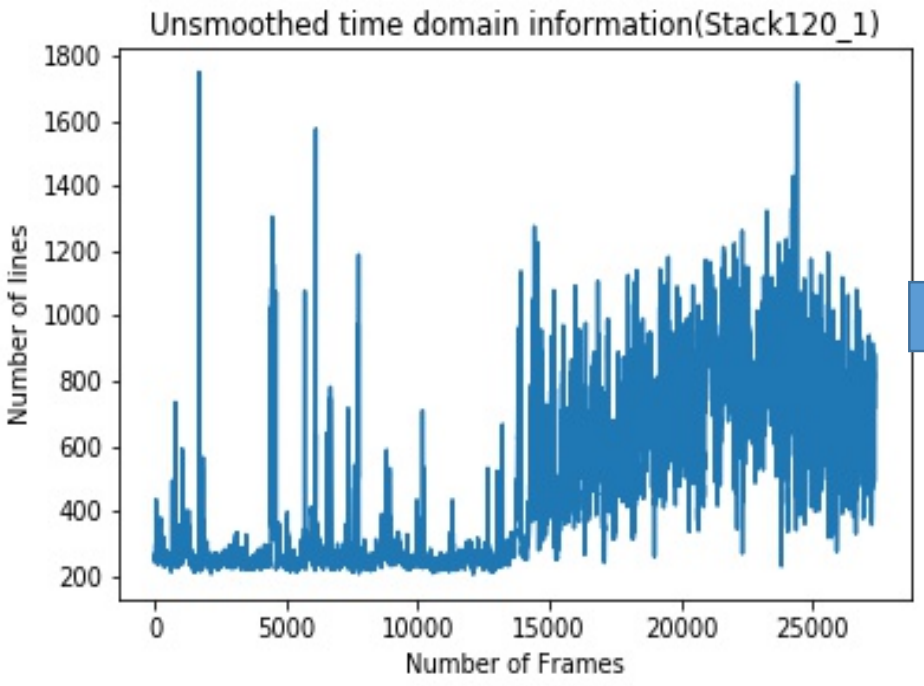


Perfect Separation

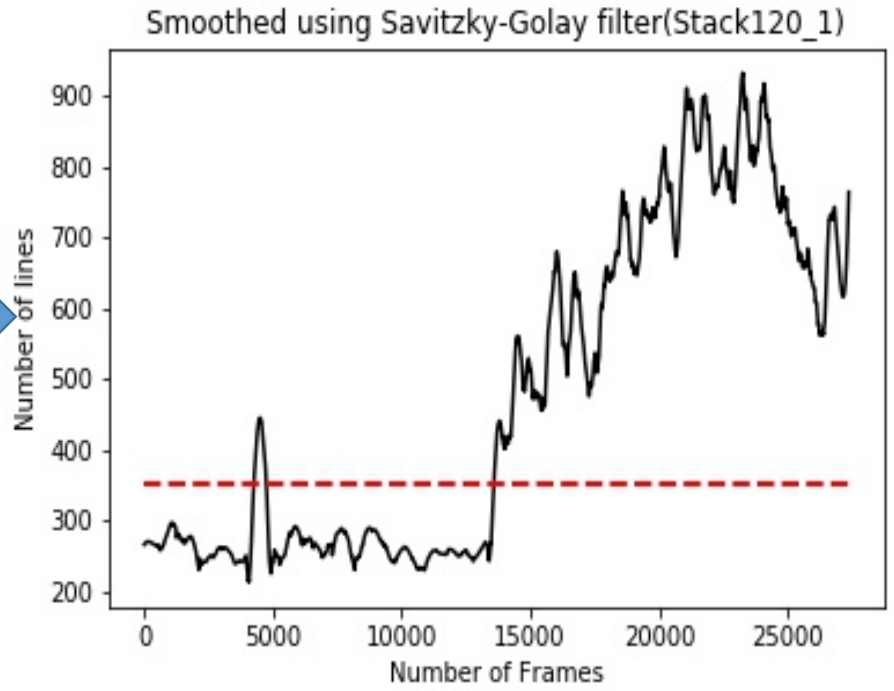


Extract from each frame: Number of lines

Removing random fluctuations

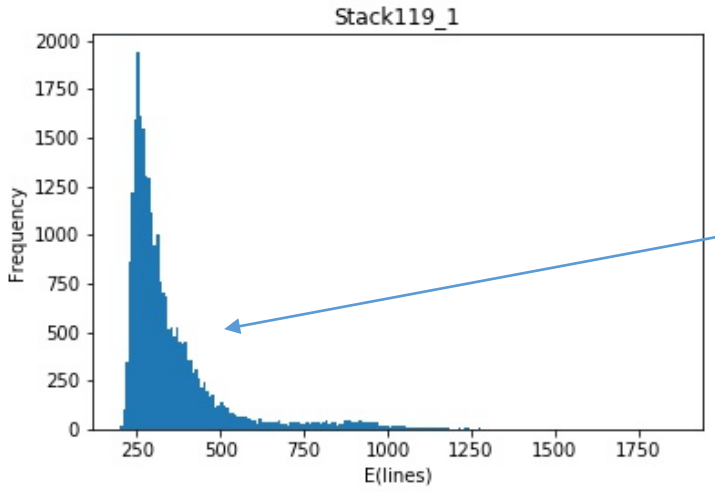


Smoothing filters

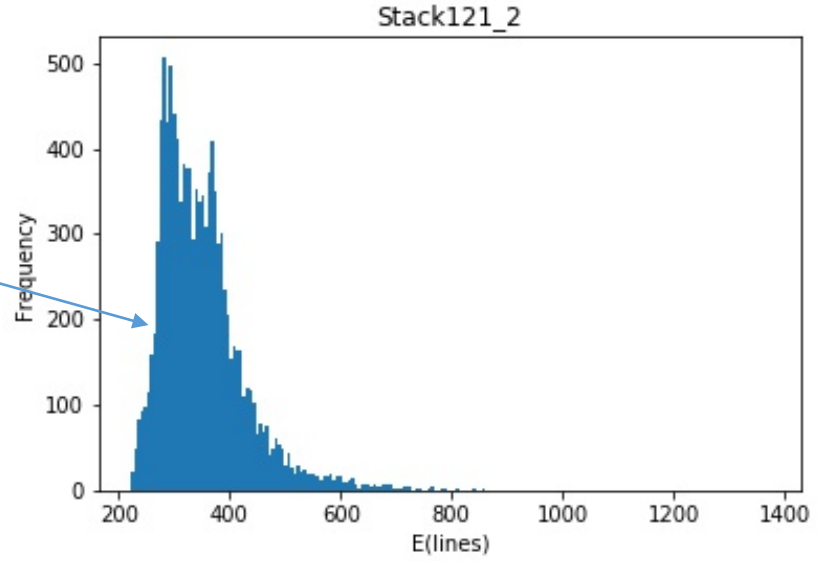


Savitzky-Golay Filter (Kernel size: 501, Order of Polynomial: 3)

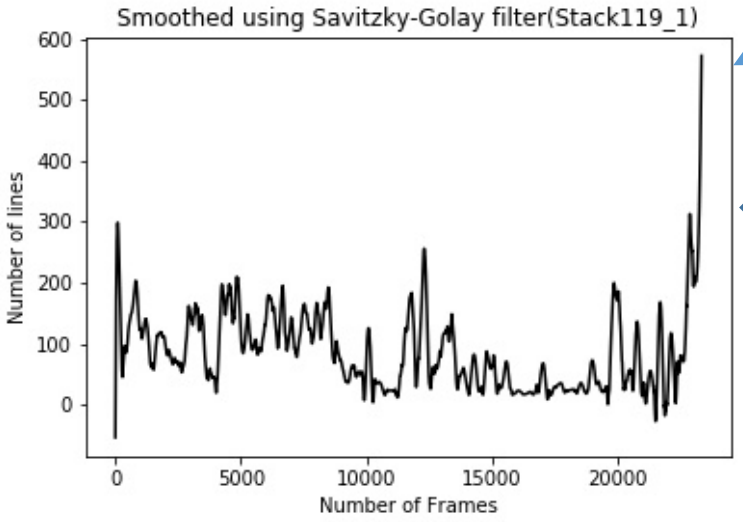
When histogram is inconclusive..



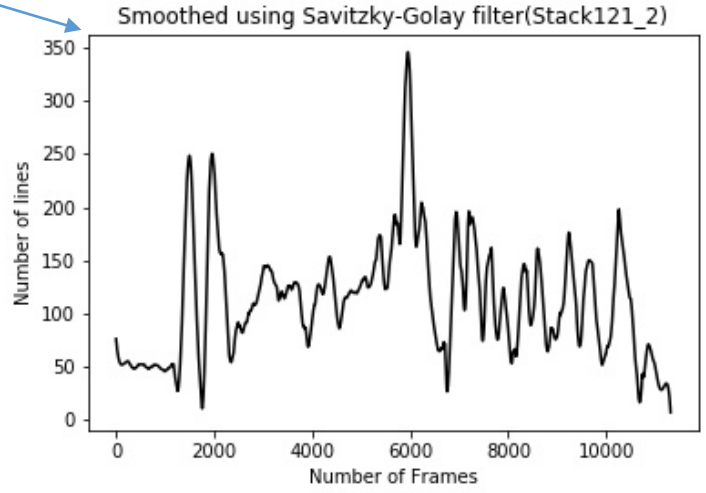
No Clear Line of separation from histogram.



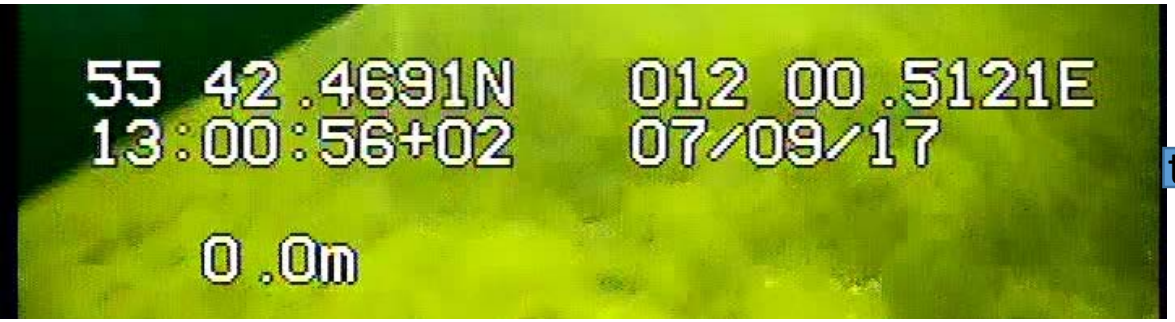
Videos with no Eel-grass



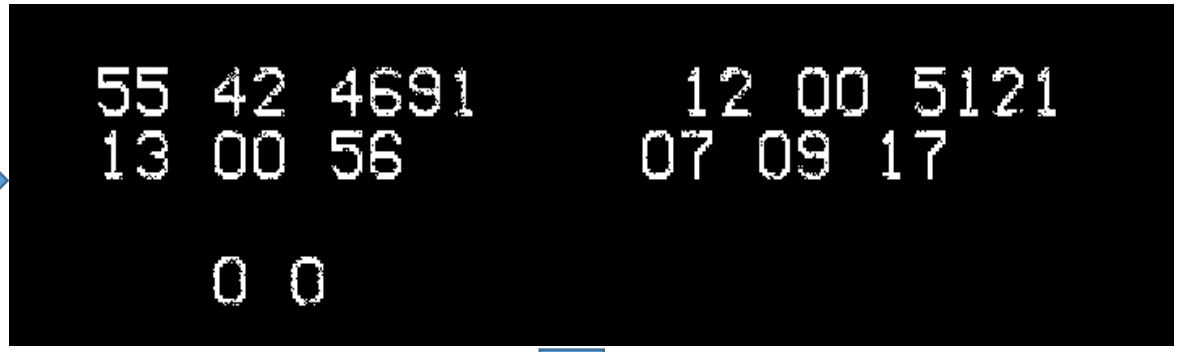
Smoothing helps and maintains consistency



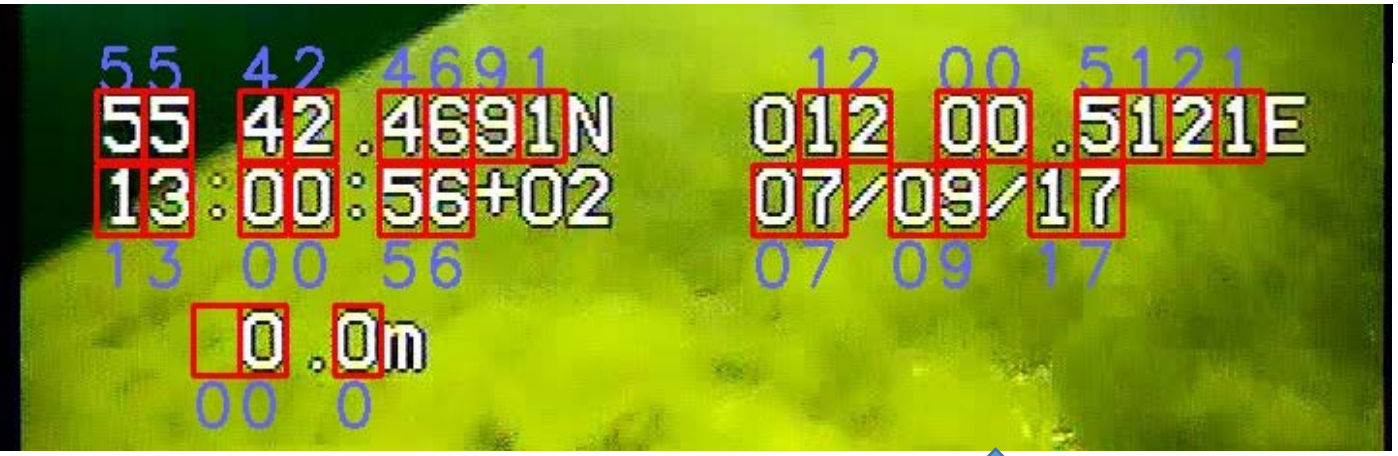
Text Extraction Procedure



threshold



Create dataset

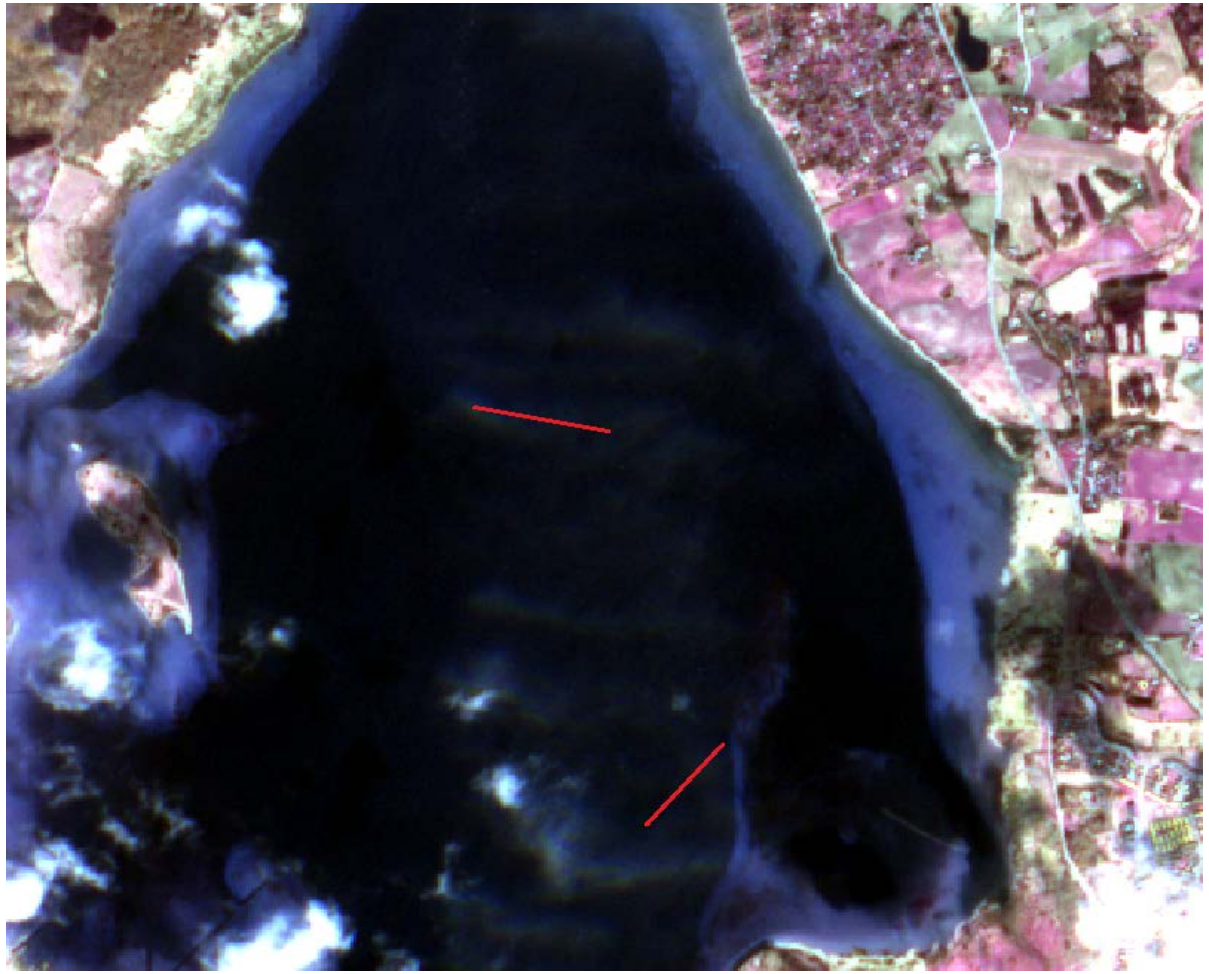


Neural Network

260 images handcrafted
220 for training/validation, 50 testing

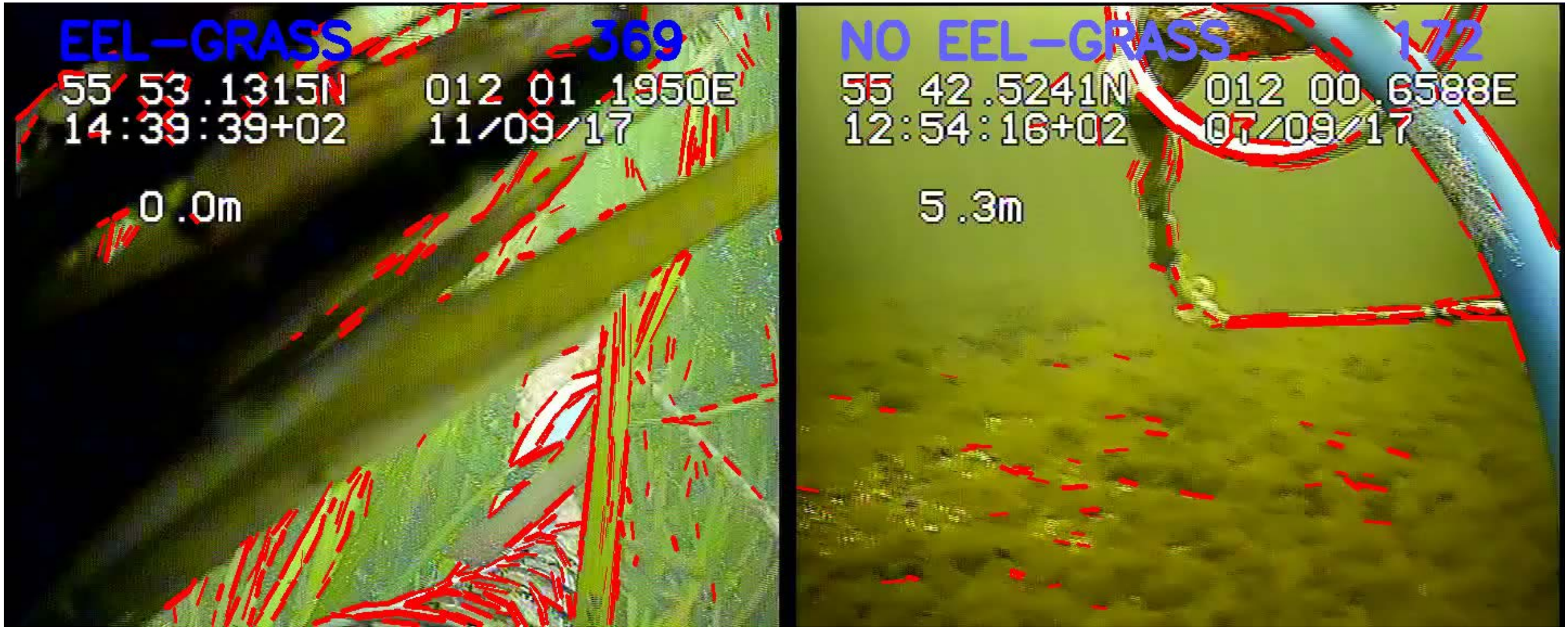
Neural Network Accuracy : 98%

Future Plans



Extrapolating on unknown regions from satellite images

Cool Demo : Real time Visualization



Thank You