Eel-grass detection from under water Videos

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Statistics and Data Analysis
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
Data

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

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

**Other Sensors**
- Ferry-box data
- On-line Sensors
- Remote Sensing
Video Transects

Objective
Detect the presence or absence of Eelgrass.
Popular practice

Expert-1: Present

Expert-2: Absent

Expert-3: Present

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, Jérémy Jakubowicz, Jean-Michel Morel, Gregory Randall

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).

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) \(\pm \epsilon\) (small value). Also limited the length of the line detected to be above certain threshold.
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

**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

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

EEL—GRASS
55 53 1315N 012 01 1950E
14:39:39+02 11/09/17
0.0m

NO EEL—GRASS
55 42 5241N 012 00 6588E
12:54:16+02 07/09/17
5.3m
Thank You