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# **STSM Report**

## **Behavioral Classification of Oystercatchers by Combining Interactive Visualization and Machine Learning**

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### **Purpose of the STSM**

The purpose of the STSM was further research about the classification of animal behavior (here oystercatcher) according to spatial- and accelerometer sensor data. In more detail we wanted to test different models that would result in a better classification of animal behavior than that one previously published.

In order to fashion the assessment of different models by domain experts in an easy way, an appropriate visualization of these models is required. Hence, modeling a suitable visualization and defining necessary interactions represent the second task of this STSM.

## Work carried out

The STSM involves three research groups: Dr. E.E. van Loon's group at the Institute for Biodiversity and Ecosystem Dynamics at the University of Amsterdam (host of the STSM), Prof. R. Weibel's group at the University of Zurich, and Prof. D. Weiskopf's group at the Visualization Research Center at the University of Stuttgart (home institution).

On the first day, Monday 22.04.2013, we discussed briefly what we were planning to do together with Emiel van Loon. After that Ali Soleymani and I started setting up the data, in particular extracting trajectories with a sample frequency less than 60 seconds. The rest of the day I spent with implementing the basic data structure for selecting a subarea containing GPS locations to be displayed and therefore also a basic visualization of the spatial distribution of the GPS data.

On Tuesday the 23.04.2013, Ali Soleymani and I discussed with Emiel van Loon how we can make use of a segmentation of the trajectories and incorporate this information in the classification process. Regarding the visualization part we talked about what functionalities domain experts would like to have and how they would use them. In more detail experts want to get some feedback about a classification label that will be assigned to a GPS location by different models. Also the possibility to assign a label to a GPS location is desired. Therefore, it is important to investigate the model parameter in order to find some correlations or other features that indicate a certain behavior. I was told that 2D scatterplots of a selectable subset of arbitrary parameters as well as parallel coordinates would be helpful. After the meeting I started implementing first interaction methods with the spatial visualization of the GPS data.

On Wednesday the 24.04.2013, I extended the data structure in order to handle multiple classification models.

On Thursday the 25.04.2013, I have designed a glyph that shows the classification results of all models added for all GPS locations in order to get a visual impression about the results. Ali Soleymani and I also attended a talk about acquiring a probability model about oystercatcher foraging at different areas, depending on the amount of available prey. Furthermore, it was shown how the tide influences the movement behavior of the oystercatchers.

On the last day, Friday the 26.04.2013, we had a meeting with Willem Bouten, Adriaan Dokter and Emiel van Loon in the morning to present what we did so far and how we want to proceed and to get some feedback from them. Concerning the visualization the glyph was found to be quite nice. Furthermore it was mentioned that the framework should be no black box. Experts really want to get feedback thought e.g. concepts like brushing and linking. Afterwards I started to work on the relabeling/manipulation mechanism for single GPS locations.

## **Main results**

Concerning the visualization and interaction framework, I got some feedback about what a domain expert expects from a visualization in this case and which sort of interactions would be useful to get an insight into the model parameter. With this insight experts also want to be able to label data in an easy way according to their observations. The new labeled dataset is intended to be used as input for a classifier training which itself will be used to update the predicated visualized class labels.

## **Future collaboration**

The duration of this STSM was not long enough to implement all functionalities. Therefore I will go on implementing the remaining parts and provide the framework to Emiel van Loon and his colleagues and further improve and extend, if there will be some feedback.

## **Foreseen publications**

We discussed briefly that there is a certain potential for a publication that consists of the visualization framework, a comparison of different classification models including a model that contains features obtained from segmentation.

The journal PLOS ONE, where already several articles about classification of animal movement were published, would be one possible option for a publication. If we want to focus on interdisciplinary aspects the journal Interface would be a good choice. We also can consider publishing our results at the journal IEEE Computer Graphics and Application as an application paper.

Suitable conferences for a publication for machine learning or information visualization issues could be the IEEE VIS (VAST or InfoVis) or the European Conference on Computer Vision.