“A filtering Mechanism for Normal Fish Trajectories” Resume

Motivation/Introduction ideas

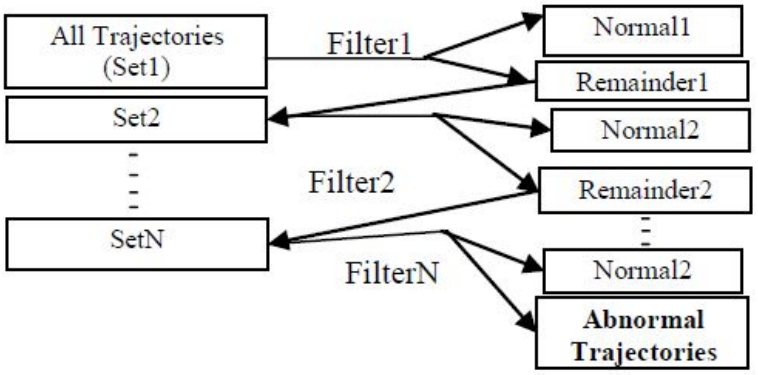
- Goal: identify abnormal fish behaviours, in order words: outliers, rare events, events of interest.
- The literature behind this subject is mainly related to human behavior analysis and surveillance contexts. It’s more limited in the context of fish behaviors.
- Fish behaviors can help detect problems in their habitat (water quality, pollution, climate change).
- In most cases, fishes are visually analysed by marine biologists. This has two drawbacks: it’s considered boring and time consuming, also it’s needed a huge team in order to go along the amount of data produced daily.
- Clustering approaches to this problem can have issues when dealing with huge amounts of trajectories (thousands, millions), where the considered normal ones could dominate all the others being difficult to detect abnormal behaviors.

Proposed Method

- The tracking module produces, for each fish, a trajectory. In this case, it’s defined as a sequence of frame positions where the fish was detected.

$$T_i = \{(x_1, y_1),\ (x_2, y_2),\ \ldots,\ (x_n, y_n)\}$$

- The proposed method is based on the application of several rules that describe normal behaviors. They are applied in a “cascade” way and are independent to each other. The first rule is enforced to all trajectories which will output a set of considered (according to this rule) normal behaviors and a set with the remaining. The set with the remaining ones is passed to the next filter and so on till the last filter. The ones that didn’t pass all the filters are considered abnormal behaviors.



Filters Definition

- Primitive motions:horizontal movement (left to right, right to left), vertical movement (upwards, downwards), stationary.
- Idea: while the fish is detected in the camera vision boundaries, there aren't more than 3 primitive motions. Fishes, in the perspective of the camera, have more less constant direction and usually do not change direction too many times.
- Each filter defines each of the possible movements (with different lengths):
    - horizontal - vertical - stationary (length 3)
    - horizontal - stationary (length 2)
    - vertical (length 1)
    - etc
- In addition, each primitive motion has associated a "search area". A trajectory, in order to pass the constraints of that filter, will have to have all the positions inside a given area ("search area").
- Finally, the position in a frame f must be inside an area that depends on the position on the last frame (f-1).
- The trajectories dataset was analysed "by hand" and splitted into normal and abnormal behaviors. In the training process the goal is to estimate the search area related to each primitive movement.

Results

- In general, it gave really poor results: 38% precision and 97% false negative rate
- Authors defend that it can be used as a preliminary step to another system.
- Different fish species were not considered and the dataset is composed by trajectories of different locations.

Table 1. Performance of Proposed Method

		Result of Method		
		Filtered	Maintained	Total
Actual Label	Normal	916	1524	2440
	Abnormal	6	40	46
	Total	922	1564	2486

Doubts relative to the approach

- In the paper, they also talk about cross movements (diagonal) but they didn't consider them in the filters (?)
- How are the search areas detected? (for each primitive motion and for position prediction)