Smart Fish Tracking

in live video using image processing
and video analytics

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Overview

- Track moving fishes in the live stream of the aquatic life in ponds, rivers, lakes and backwaters.

- Count the number of fishes being detected.

- Type of fish under study : Guppy Fishes

Minimum Requirements

OS : Windows 8.1

Processor : Intel i5

RAM : 8GB

Software : Matlab

Components Required

- Aquarium for miniature aquatic life

- Camera with LED for live recording

- Monitoring System

Techniques Implemented

- Noise reduction

- Kalman Filters

- Background Subtraction

- Linear Regression

- Histogram of Oriented Gradients

Noise Reduction

Digital images are prone to various types of noise. Noise is the result of errors in the image acquisition process that result in pixel values that do not reflect the true intensities of the real scene.

Noises seen in live video for fish tracking:

- Sea - Weeds

- Water Bubbles

Median Filter

- Median filtering is used for noise reduction.

- It sets the value of the output pixel to the median of the pixel values in the neighborhood around the corresponding input pixel.

- It is a specific case of order-statistic filtering, also known as rank filtering

Kalman Filter

- Kalman filtering, also known as linear quadratic estimation (LQE), is an algorithm that uses a series of measurements observed over time, containing statistical noise and other inaccuracies, and produces estimates of unknown variables that tend to be more accurate than those based on a single measurement alone, by estimating a joint probability distribution over the variables for each timeframe.

- Here, Kalman Filter is used for the object detection and object tracking.

Background Subtraction

- Background subtraction, also known as foreground detection, is a technique in the fields of image processing wherein an image's foreground is extracted for further processing (object recognition etc.). Generally an image's regions of interest are objects in its foreground. After the stage of image preprocessing (which may include image denoising, post processing like morphology etc.) object localisation is required which may make use of this technique.

- Background subtraction is a widely used approach for detecting moving objects in videos from static cameras. The rationale in the approach is that of detecting the moving objects from the difference between the current frame and a reference frame, often called "background image" or "background model".

Linear Regression

A data *model* explicitly describes a relationship between *predictor* and *response* variables.
Linear regression fits a data model that is linear in the model coefficients. The most common type of linear regression is a *least-squares fit*, which can fit both lines and polynomials, among other linear models.
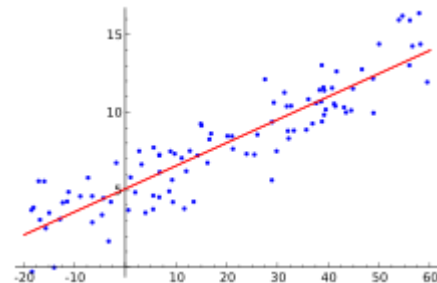
Histogram of Oriented Gradients

- The histogram of oriented gradients (HOG) is a feature descriptor used image processing for the purpose of object detection. The technique counts occurrences of gradient orientation in localized portions of an image.

- This method is similar to that of edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but differs in that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy.

Future Scope

Further classification of the detected fishes can help in prevention of capturing of female carrying fishes which otherwise would give birth to 10+ baby fishes, saving the aquatic ecosystem. This technique will help fishermen to opt for better jobs and provide multiple source of income. The system can be mounted onto a smart boat.

Thank You

Please do visit the 2nd floor research lab for a demo.