A Contribution in Multi-Object tracking based on Kalman Filtering Combining Radar and Image Measurements

3D object tracking has a wide range of applications such as human-computer interaction, intelligent video surveillance, robotic and vehicle navigation. This task is a fundamental component in computer vision.

Problematic

In the object tracking study, the problem has remained due to various factors due to;

- Processed data
  - Appearance changes of the object,
  - Clutter of background elements,
  - Variable motion velocity
- Acquisition system
  - Cheap radar: Limited resolution of bearing angle measurements,
  - Camera CCD:
    Inability to extract the radial distance information,
    Difficulty in calibration depending on the scenario, etc.

Proposed work

This work aims to develop a tracking system of multi-objects. The tracker design based on multiple Kalman filters which combines a set of measurements of two different kinds of physical sensors: a cheap of radar module and CCD camera.

Due to the mentioned problems above, the CCD measurements will be introduce to compensate for the limited radar angle resolution. All the measurements from those modules will be processed using a data fusion method.

The multisensor data fusion task will be applied to efficiently utilize the radial measurements of objects from the radar module and location measurements of objects in image space to improve the tracker accuaracy.

To achieve desirable tracking results regarding these challenging conditions, many research axis will be conducted;

- Object modeling,
- Multi-Object motion prediction (multiple-Kalman filtering) ,
- Radar resolution and measurement processing,
- Data fusion of extracted measurements.

In this work, the student is invited to develop a more performant approach to overcome the problem mentioned above. The research study is divide into three tasks:

1. Develop a data fusion method for radar and image measurements and select most representative features to reduce the effect of the appearance changes of the tracked objects. In this step the goal not only to increase the relevance of the descriptor but also to reduce the consuming time calculation.
2. Object tracking and motion predicting method using a Kalman filtering approaches (extended Kalman filter, quadratic Kalman filter etc). Her, the student search for the optimal filter parameters depending on the tracked objects, sequence resolution, and the other elements of the background.
3. Implementation of the proposed method using the NI myRio development board. The proposed tracking system will be experimentally evaluated through a multi-objects tracking scenario.

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