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GPS Pinning of Navigational IoT Data Streams in Compositional Kalman Filter

The problem of pre-processing multiple noisy data streams in IoT environment is considered employing Kalman filter (KF) algorithm. The suggested route starts from gathering the data streams in mini-groups on contextual IoT basis to minimize sets of state variables and ensure convergence of elementary KFs. The redundancy in the data streams is explored to reduce an error in parameters estimation. An example of navigational data streams is considered in 2D for the vehicle driving through the pre-defined route. Two types of elementary KFs were selected: 1) GPS/V-KF, i.e. the KF relying on GPS signal to retrieve coordinates, x and y , of the vehicle positioning as well as on speedometer and orientation meter to retrieve velocity components, v_x and v_y , and form the set $[x, y, v_x, v_y]$ of the state variables; 2) V-KF, i.e. same as GPS/V-KF but excluding GPS signal and operating via the set $[v_x, v_y]$ to monitor the state of the system. To achieve the goal, GPS/V-KF and V-KF are connected via an interface to form a compositional Kalman filter architecture of two interacting KFs with improved overall performance (Fig.1). The performance improvement is achieved via algorithmic solution, which, from one hand, gives preference to the more reliable estimate made by V-KF as compared to that of GPS/V-KF, but, on the other hand, does compensate the accumulated integration error of V-KF via GPS pinning procedure. It is found that pinning is most efficient after completion of the training period, i.e. at point B in our example.

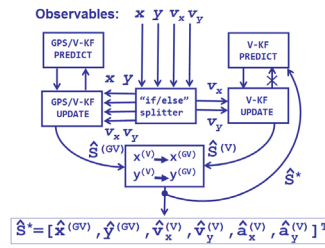
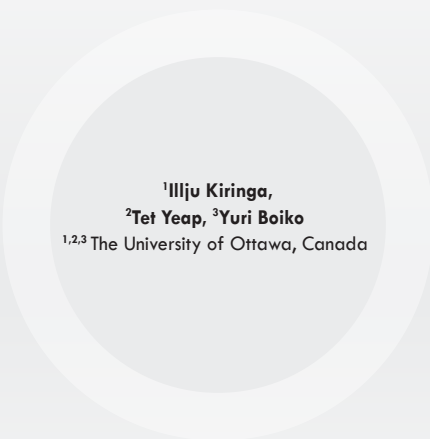


Figure 1: Compositional Kalman filter architecture for GPS pinning

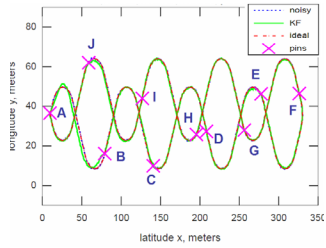


Figure 2: GPS pinning performance of the architecture of Figure 1

Biography

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