Estimation of Penguin Mass using a Kalman Filter

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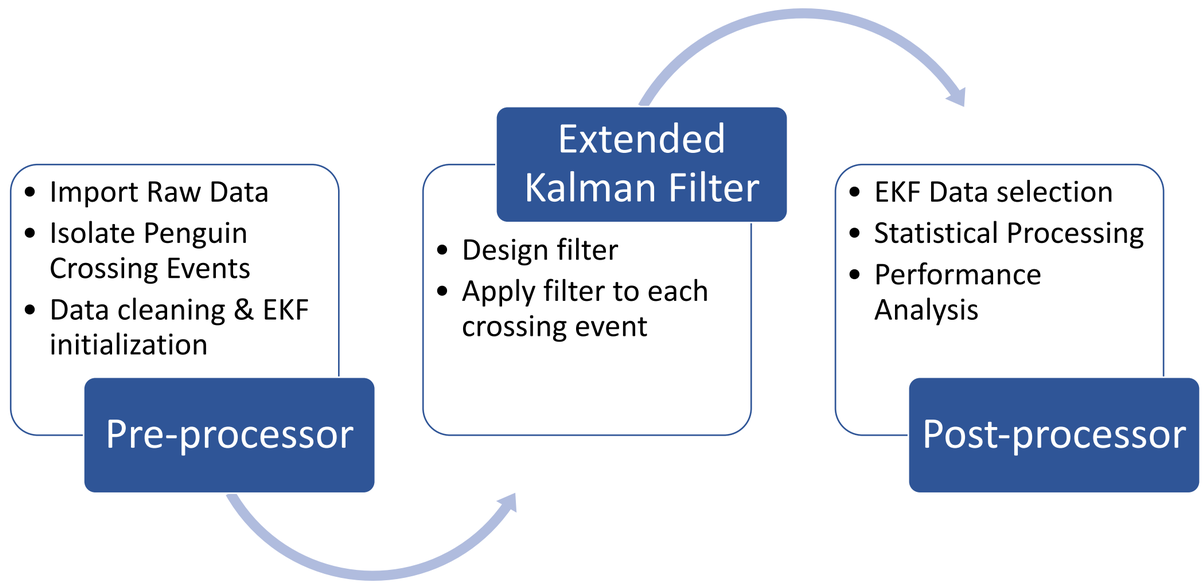
Background

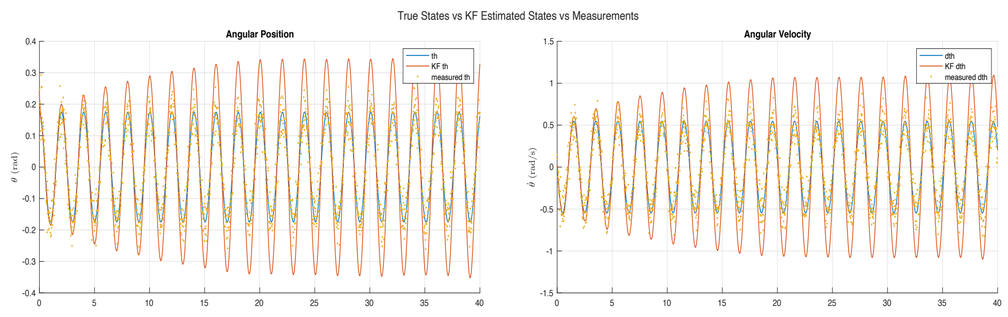
- African penguin population declined 95% since pre-industrial era = endangered species
- Accurate and reliable data required to determine factors affecting penguins to prevent extinction
- Mass is a significant parameter = indicates availability & variability in food sources and eco-system changes
- Kalman filter (KF) applied to
  - judge feasibility in handling noise and nonlinearities
  - produce accurate, reliable and repeatable results

Approach

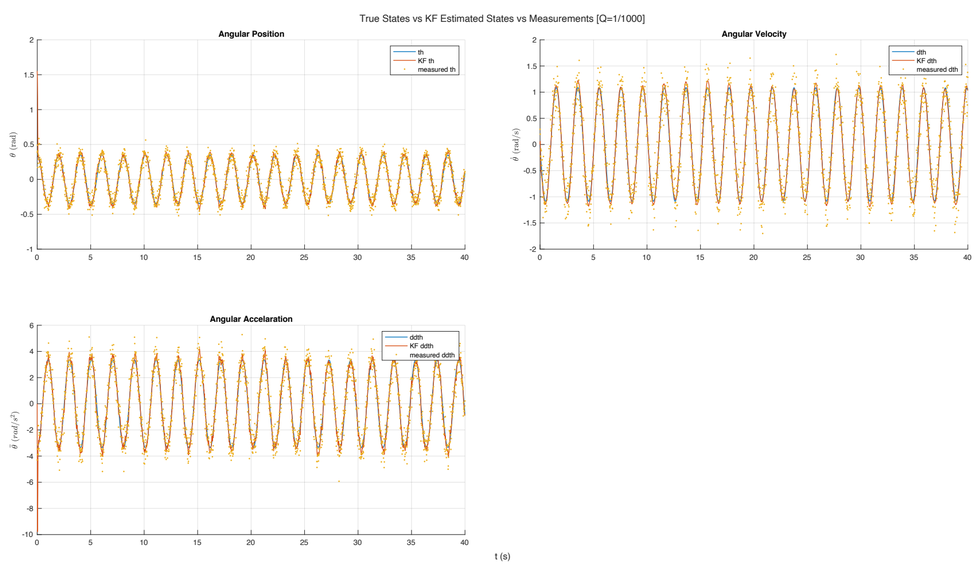
- KF designed & applied to track simulated motion of linearized pendulum
- Extended Kalman filter (EKF) designed & applied to track simulated motion of nonlinear pendulum
- EKF, pre-and post-processor designed & applied to estimate the mass of a penguin



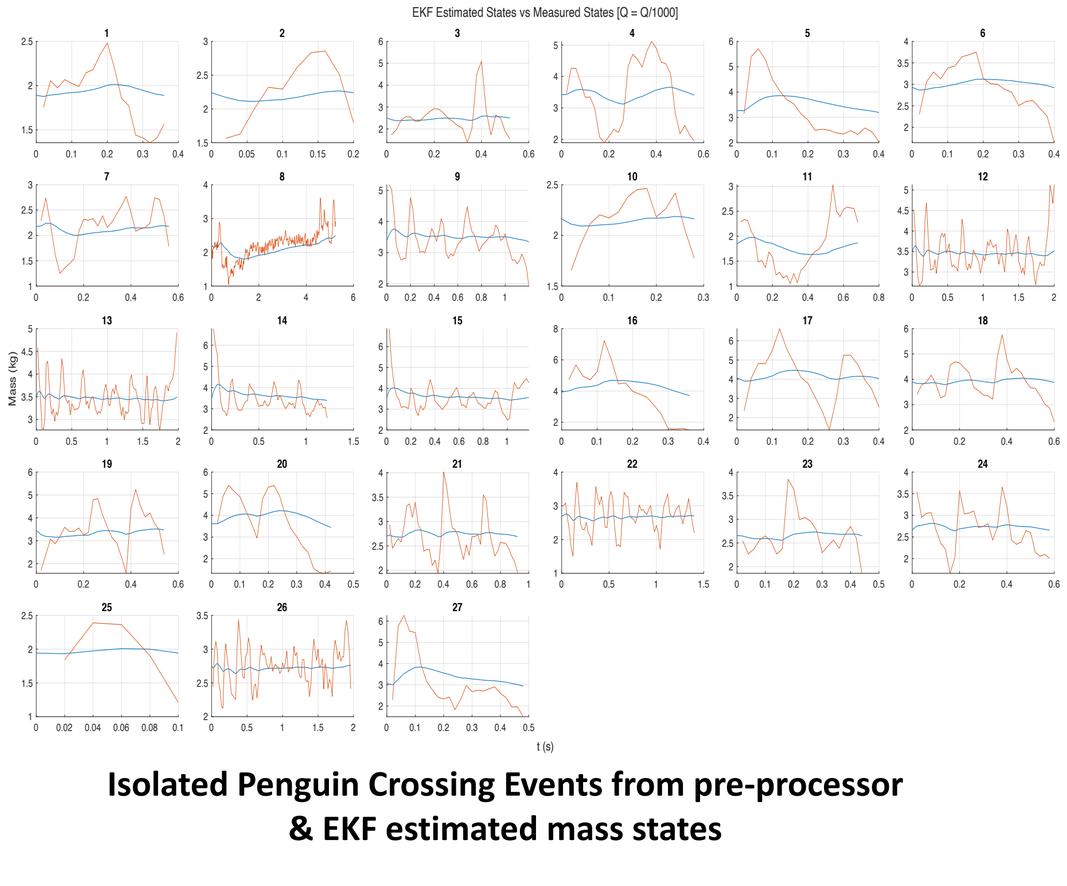
Results



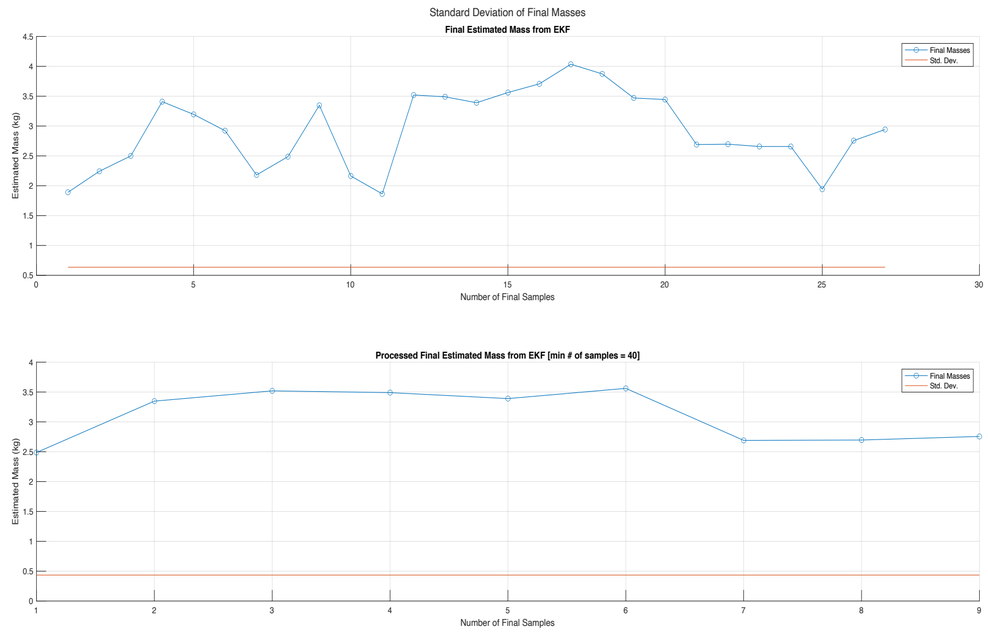
KF estimated states vs true states for linear pendulum motion



EKF estimated states vs true states for nonlinear pendulum motion



Isolated Penguin Crossing Events from pre-processor & EKF estimated mass states



Final estimated mass from EKF & standard deviation within set after post-processing

Conclusions

- Feasible to use EKF to estimate the mass of a penguin
- Provides reliable and repeatable results
- EKF can be generalized for multiple penguins but flexible to unique conditions
- EKF handles process & sensor noise and nonlinearities easily
- EKF provide in-built performances indicators
- Requires good pre-processing to isolate penguin crossing events
- Requires post-processing to analyze EKF output in statistical manner

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