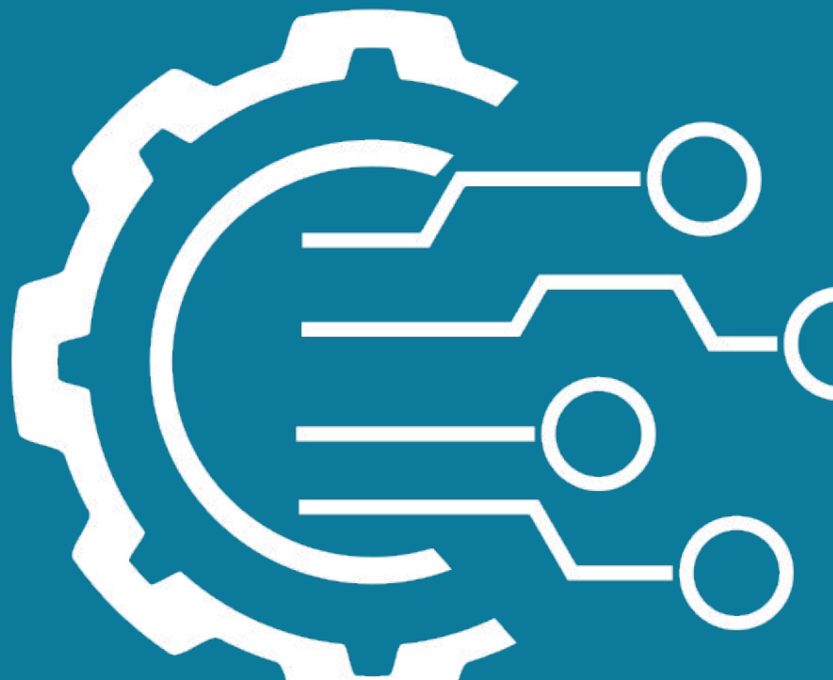# Technitute_

Advanced Kalman Filtering and Sensor Fusion

Linear Vehicle Tracker: Initial Conditions

LKF Exercise 3

Linear Vehicle Tracker:

Initial Conditions Exercise

Overview

Implement the *Kalman Filter State and Covariance initialisation* on the first *GPS Measurement*.

Step 1 (Setup)

- Open your last kalman filter file from the previous exercise which had the prediction and update steps completed.
- Run the simulation as is with Profile 2 (Non-Zero Initial Conditions). Issues should be seen when assuming a known initial state and covariance when they are inconsistent.

Step 2 (Initialise filter on first measurement)

- Change the variable INIT_ON_FIRST_PREDICTION to false.
- Modify the function *handleGPSMeasurement()* function to initialise the filter state and covariance on the first update.

```
else
{
    // Implement the State Vector and Covariance Matrix Initialisation in the
    // section below. Make sure you call the setState/setCovariance functions
    // once you have generated the initial conditions.
    // Hint: Assume the state vector has the form [X,Y,VX,VY].
    // Hint: You can use the constants: GPS_POS_STD, INIT_VEL_STD
    // ------------------------------------------------------------------- //
    // ENTER YOUR CODE HERE
    VectorXd state = Vector4d::Zero();
    MatrixXd cov = Matrix4d::Zero();


    setState(state);
    setCovariance(cov);
    // ------------------------------------------------------------------- //
}
```

$$x_0 = \begin{bmatrix} z_0 \\ 0 \\ 0 \end{bmatrix}$$

$$P_0 = \begin{bmatrix} \mathbf{R} & \vdots & \vdots \\ \dots & \sigma^2_{vel} & 0 \\ \dots & 0 & \sigma^2_{vel} \end{bmatrix}$$

Linear Vehicle Tracker: Update Step Exercise

Step 3 (Run the Simulation)

- Re-run the simulation (with Profile 2) and notice the new response

X Position RMSE: 119.88 m
Y Position RMSE: 120.55 m
Heading RMSE: 101.20 deg
Velocity RMSE: 156.98 m/s

X Position RMSE: 1.11 m
Y Position RMSE: 1.30 m
Heading RMSE: 13.10 deg
Velocity RMSE: 0.56 m/s