Main Goal
Tracking pedestrians robustly under occlusion and appearance change.

Applications
- Pedestrian Aware Cars
- Surveillance
- Activity Recognition
- Assisted living

Challenges
- Occlusions
- Cluttered background
- Different poses
- Appearance change during motion

System Overview

Proposed Approach
We model the appearance and motion of the pedestrian as an output of a Hammerstein system. That is, a linear dynamic system followed by a static nonlinearity. Linear system outputs a low dimensional (low rank) manifold and a static nonlinearity maps the points on the manifold to a high dimensional space representing the appearance of the target.

System Overview

Contribution 1 - COMPLETION OF MISSING DATA WITHOUT SYSTEM IDENTIFICATION
Hankel matrix captures the dynamics of the sequence and missing data is completed such that rank of Hankel matrix is minimized.

\[
\min_{H} \text{rank}(H) = \frac{1}{n} \begin{bmatrix} y_1 & y_2 & \cdots & y_{n/2} \\ y_2 & y_3 & \cdots & y_{n/2+1} \\ \vdots & \vdots & \ddots & \vdots \\ y_{n/2} & y_{n/2+1} & \cdots & y_n \end{bmatrix}
\]

subject to \( V^T H W \)
where \( V = V^T \) and \( W = W^T \)

Convex. Often Exact

Contribution 2 – APPEARANCE CHANGE ADAPTATION and OCCLUSION HANDLING
The manifold of the appearance is updated with new measurements so tracker can adapt the appearance changes.

Conclusion & Future work
The system can track pedestrians that change appearance, turn, leave or lift an object. The track is consistent under mild occlusions.

We want to decrease the system sensitivity on background subtraction and distinguish occlusion from appearance change more accurately.
Pedestrian Aware Cars

Tracking under occlusion and appearance change