Visual Prediction of Projectile Motion via Kalman Filtering

Simulating Neurobiological Systems

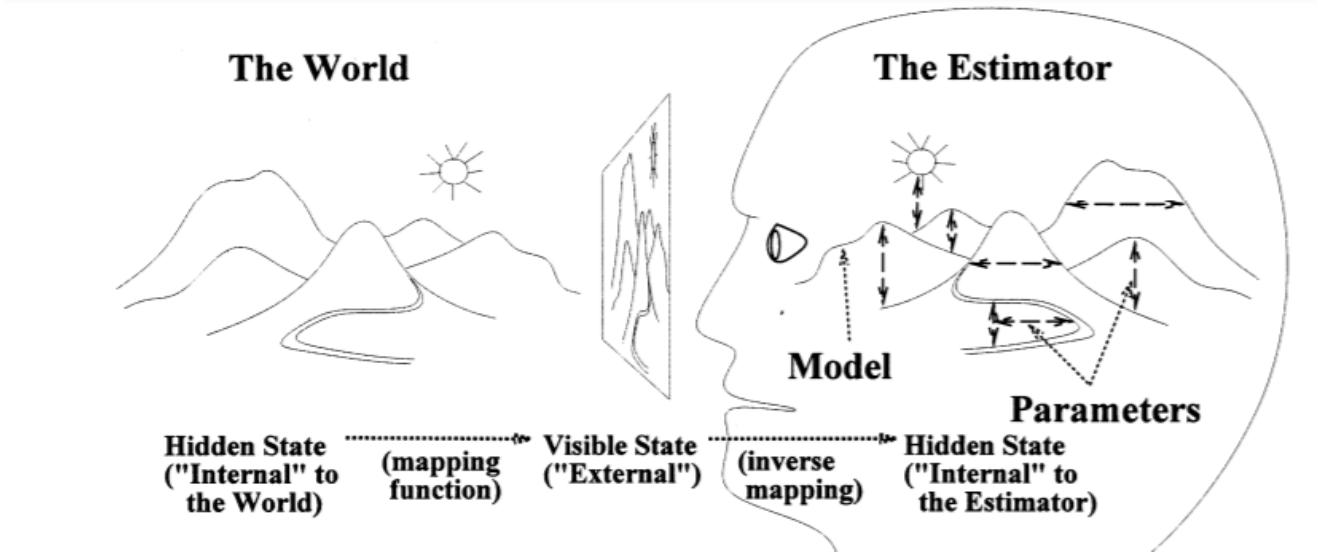
Project Description

Sam Newhook

20507509

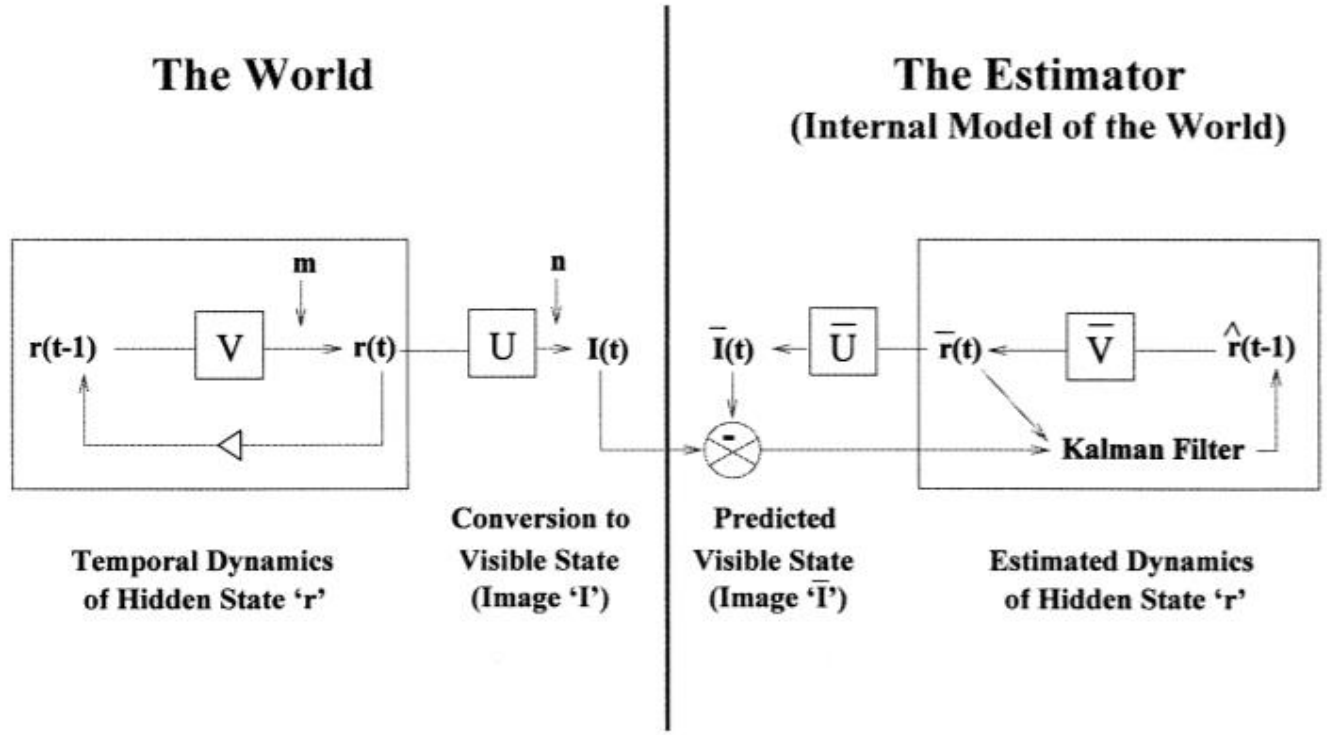
Neurobiological Kalman Filtering

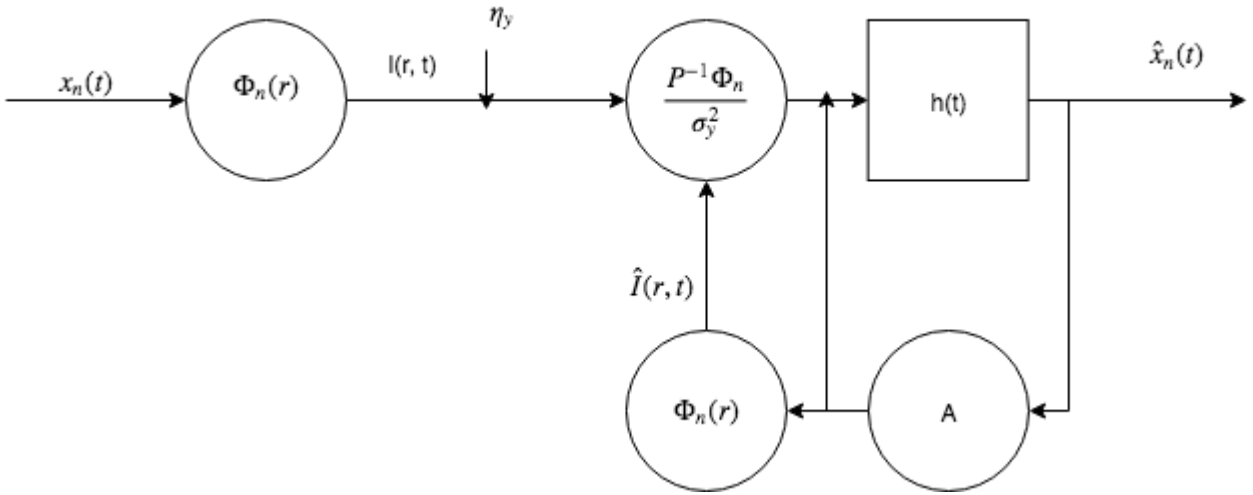
- Visual System →Estimate a hidden state given an image
- Predict the next state
- Filter noise due to encoding or visual distortion
- Interpolate lost information



Approach

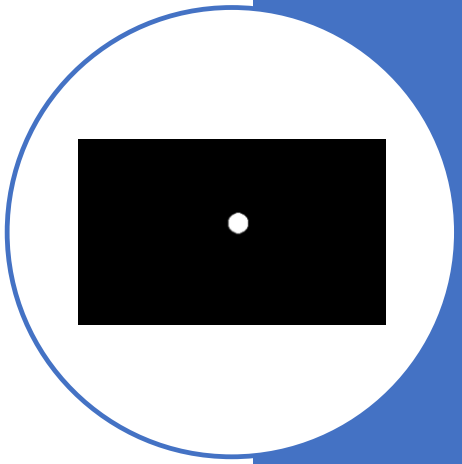
- Image encoding:
  - $I(r,t) = \sum_n x_n(t)\,\Phi_n(r)$
    - Hidden state encoded using optimal encoders (SVD analysis)
- State Behaviour Assumption
  - The state $x_n(t)$ evolves given a governing physical equation
  - Projectile motion equations
  - Noise is known and accountable for using a model of physical noise





Testing

- Input:
  - 1 ‘ball’
  - Many ‘balls’
- Change calculation of P and A matrices
- Develop a method of center detection
  - NEF implementation?
- Learn and update covariance matrix



External References

- R. P. N. Rao, “An optimal estimation approach to visual perception and learning,” *Vision Research*, vol. 39, no. 11, pp. 1963–1989, Jun. 1999.