1. Abstract
2. Introduction
3. Notation
4. Case Background

Objective (filter highly noisy data)

* 1. Feature of Option Data
  2. Method for Option Pricing (BS)
     1. Assumptions for BS
     2. BS SPDE
     3. BS formula
     4. Alternatives (Heston Model) and why we’re not using them

1. Model Specification
   1. ESN

Statement of model

* + 1. Echo State Property and Initialization of weight
    2. Modification of control, mean shift, and activation function
  1. UKF

Statement of model

* + 1. Unscented Transform
    2. Forward Filtering
    3. RTS Smoothing

1. Model Parameter Inference
   1. Off-line learning
      1. EM algorithm derivation (2 or 3 ways of derivation)
      2. Regularization (LASSO, sparsity)
      3. Algorithm graph
   2. On-line learning

Reasonings for doing this

* + 1. Algorithm graph

1. Experiments
   1. Data Specifics
   2. Off-line learning results

Observations on behavior of theta\_dim, alpha, confidence interval

* 1. On-line learning results

Observations on behavior of data length

1. Main Results and Contributions
2. Further Thoughts

Deep ESN; LSTM rather than ESN; Dynamic Output Variance v

1. Appendix
   1. Theta\_dim graphs
   2. Alpha\_dim graphs
   3. Hyper-parameters for short and long data