# Dynamic Auction End-price Forecast With Neural Networks

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## Objective

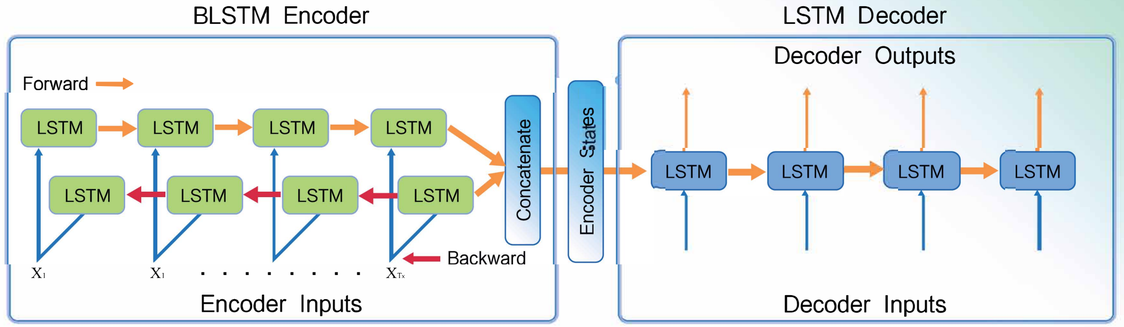
- Construct a system that forecasts the end–price of an auction dynamically using price movements
- Incorporate both dynamic features (historical bids & timestamps) and static features (opening bid & auction duration) in the inputs for a Recurrent Neural Network
- Outperform existing literature on static predictions using neural network models

## eBay Auction Data Set

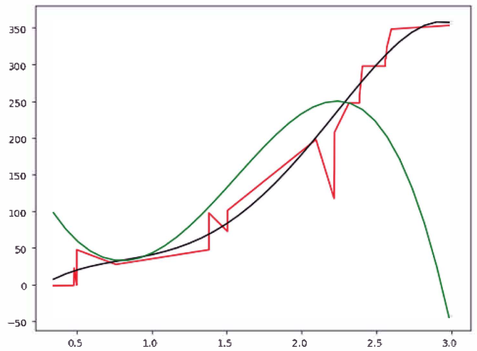
- Consists of auctions on wristwatch, Xbox, and Palm PDA
- 618 auctions with 10681 total bids
- 40% training, 40% validation, 20% testing

## Architecture


- **Neural Network**
  - Bi–directional LSTM network with Encoder–decoder structure
  - 128 units, 60000 trainable parameters
  - Introduced LeakyReLU activation to prevent exploding gradient
  - Walk–forward training: splitting a sequence into multiple steps




- **Feature Engineering**
  - Employing functional data analysis (FDA) to extract continuous functions from discrete data
  - Apply smoothing filters to price movements (Red) and obtain the speed of price (Black) and acceleration of price (Green)




## Prelimenary Results

- **Continuous Prediction**: 26% average error when give first 3 bids
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- **End–price Prediction**: 15% average error when given 70% of the bids