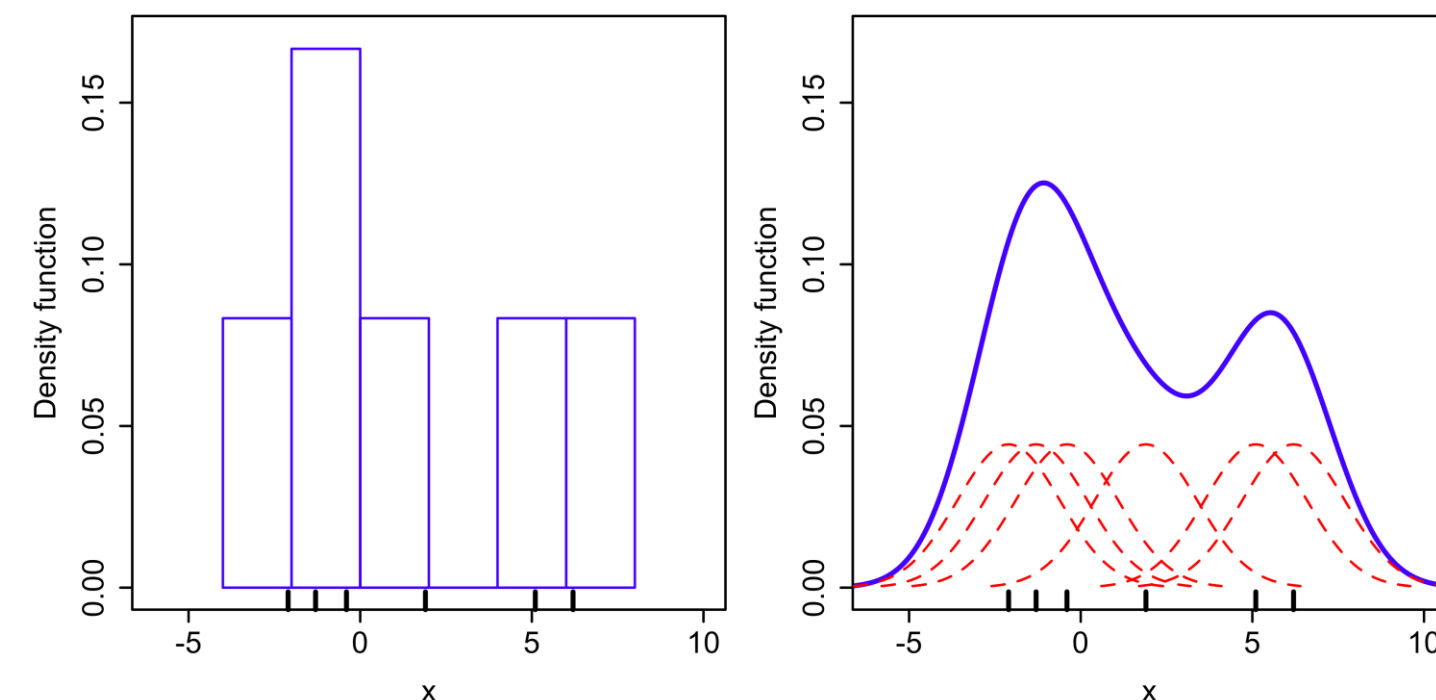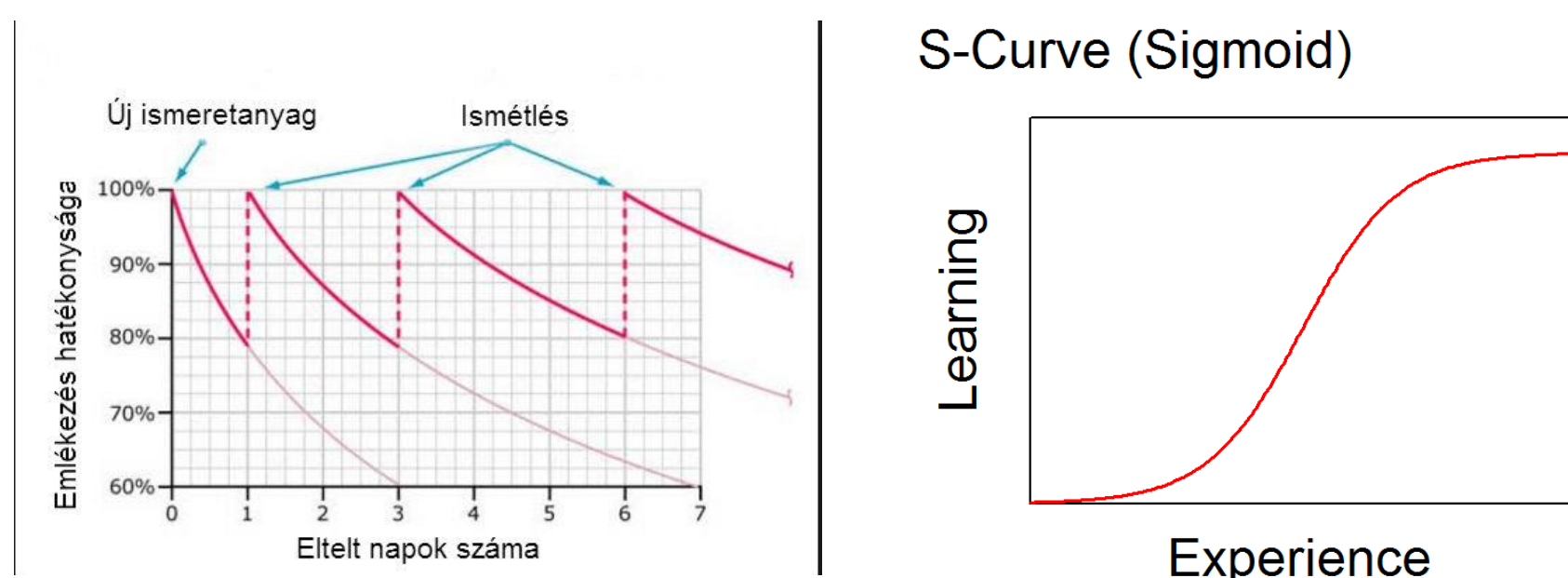# Modeling the Rehearsal Effect of Humans

Agarwal Mohit and Stevens Christopher

Introduction

- Why do humans forget?
  - Hermann Ebbinghaus
- Capacity of Neural Networks
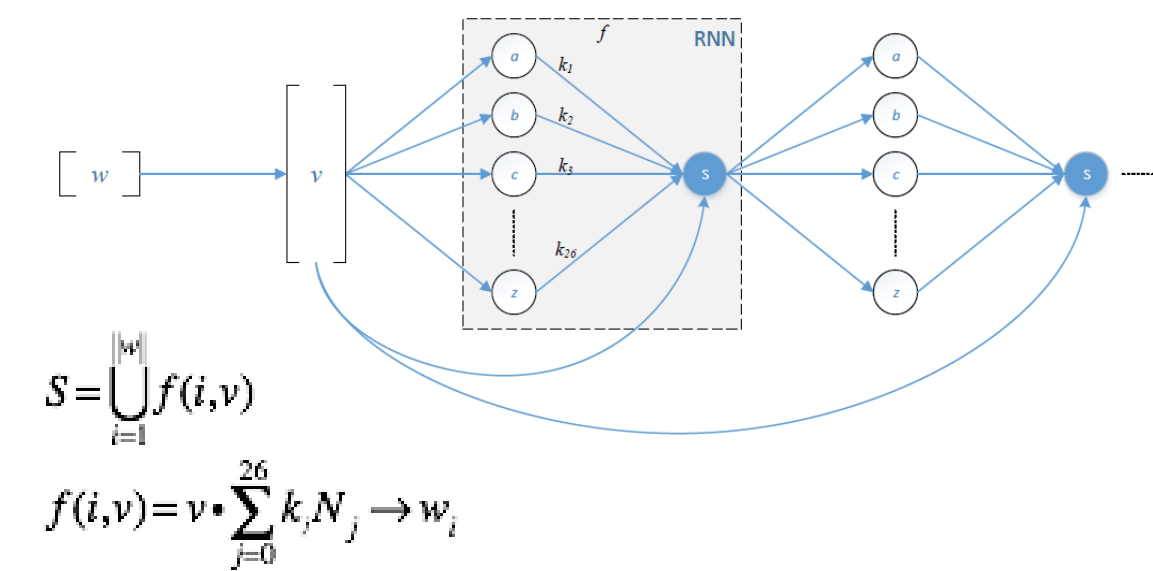 - Fixed or variable?
  - Kernel Density Functions

- Do artificial neural networks "forget" similar to humans?
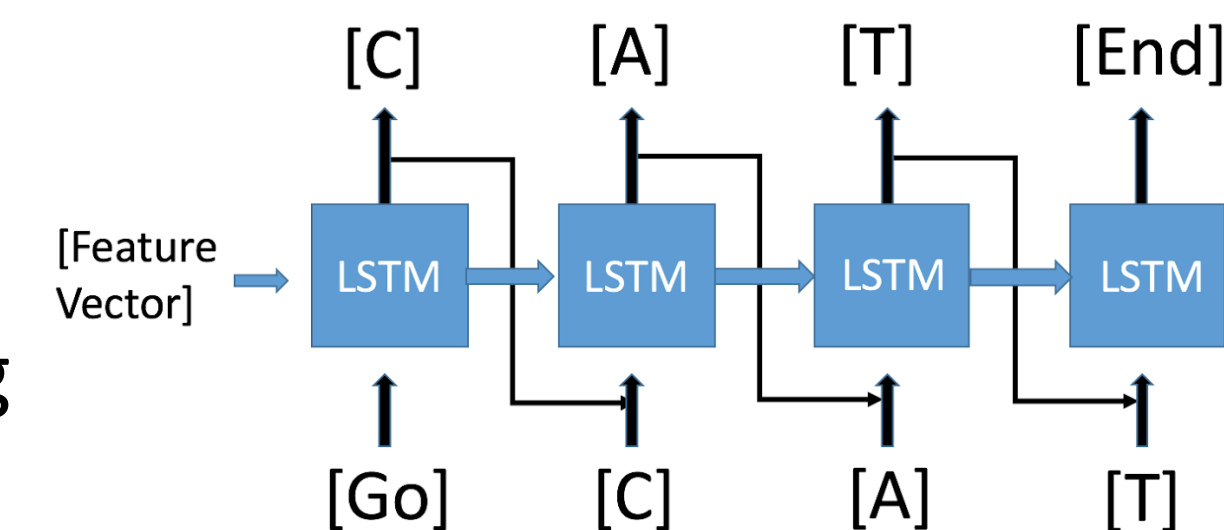 - Forgetting/Learning curve
  - Rehearsal effects

- Neural-Network based model
  - Goal: Learn the word associations with its feature vector
  - Recurrent model (based on LSTMs)
  - Implemented in Tensorflow

Model

$$S = \bigcup_{i=1}^{|w|} f(i,v)$$

$$f(i,v) = v \bullet \sum_{j=0}^{26} k_i N_j \to w_i$$

- 16 LSTM units
- Single layer
- Word embedding
- Gradient descent

Data

- Word2vec
- Training data: feature vector
- Training label: word spelling
- Fixed length words (8)
- Size: 7000 words

Experiments and Results

Experiment 1: Number of iterations required to learn words in a serial fashion

	Word1	Word2	Word3	Word5
Mean	790.28	251.81	192.54	156.27
Std	301.27	123.33	105.87	65.43

Experiment 2: Accuracy of i words after training of i-th word

	Word1	Word2	Word5	Word10	Word20	Word50	Word100
Accuracy	1	0.5980	0.3437	0.2462	0.1803	0.1389	0.1198

Experiment 3: Learning behavior
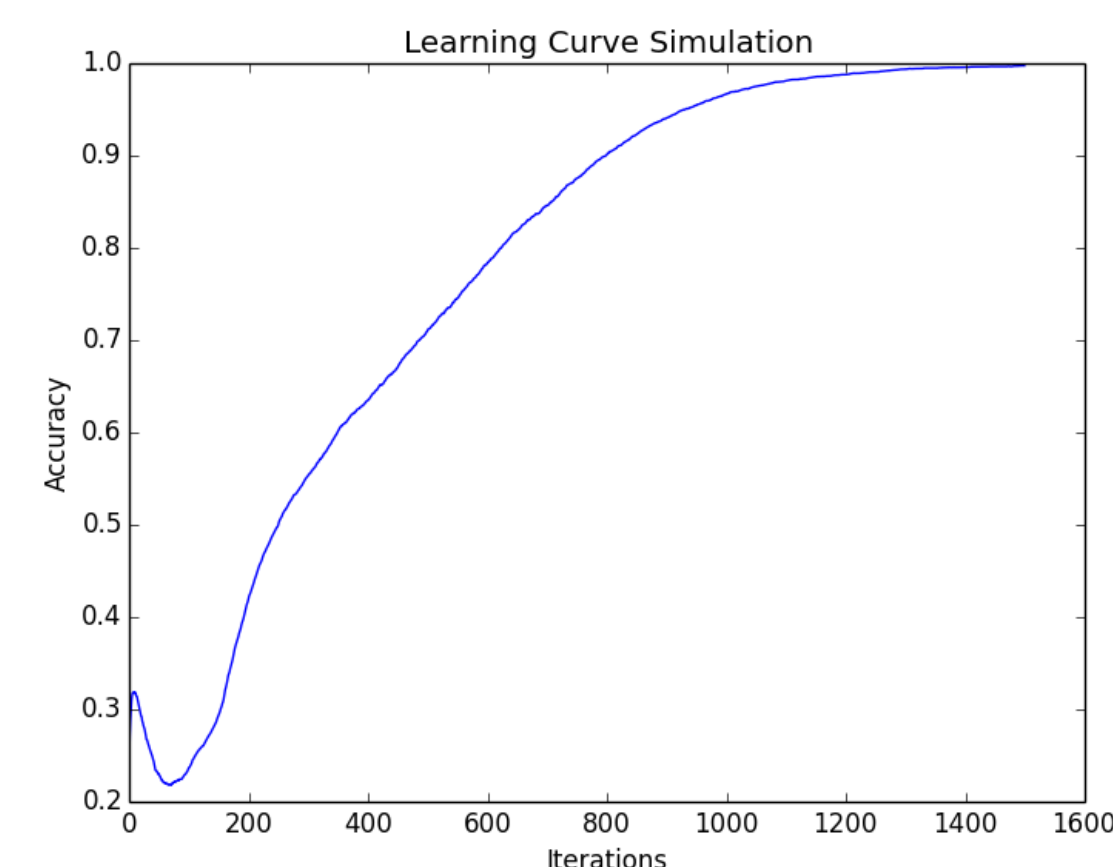
Experiment 4: Forgetting behavior
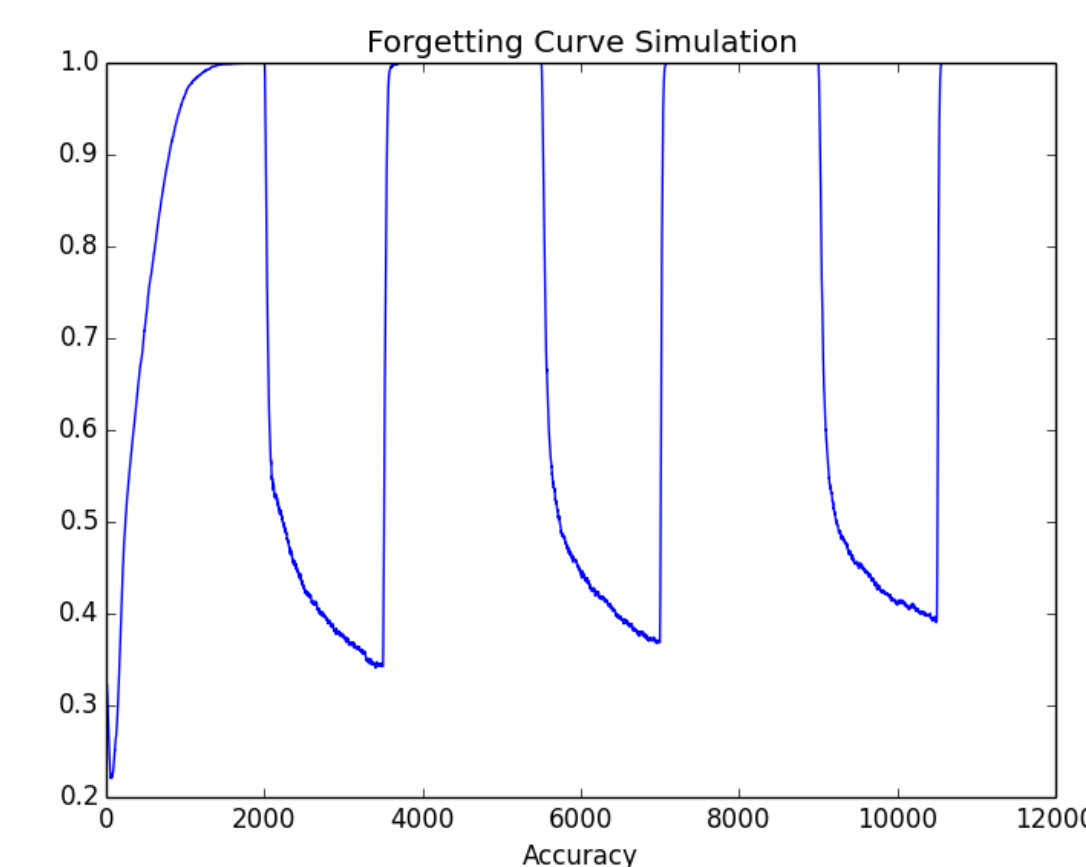
Discussion

- Alike humans
  - Learning with association (Exp1)
  - S-curve in learning (Exp3)
  - Forgetting and Rehearsal (Exp2,4)

- What is forgetting?
  - Fidelity loss, not loss of information
  - Shifting weights and thresholds

- Artificial Neural Networks
  - Very quick forgetting behavior
  - Fast retraining through rehearsal

- Future Directions:
  - Short-Term Memory Models
    - Plasticity?
  - Sequential vs Intermixed training
    - Perfect recall training