Large Scale Log Analytics through ELK

Marcel den Reijer

University of Amsterdam
MSc System and Network Engineering

July 5, 2018

- Events
- Centralized location
- ELK-stack
  - Elastic Search
  - Logstash
  - Kibana
- Lambda Architecture
  - Batch layer (raw data sets and pre-compute Batch views)
  - Speed layer (Real-time views)
  - Serving Layer (ad-hoc queries)

According the introduction, the following research question is defined as:

- *Which way of applying Artificial Intelligence in the form of Machine Learning/Deep learning can be used to find relevant actionable information from event data suitable for use within the batch layer in a Lambda Architecture?*

This main research question are divided into the following sub questions:

- Which Deep Learning (DL) model fits for this type of data?
- How is the accuracy of the DL model calculated?
- How can the model be tuned during operations?

Introduction

Approach

- Keras Deep Learning API
  - High-level implementation of Artificial Neural Networks (ANN) written python
  - Run on top of Tenserflow, Theano or CNTK
- Define layers
  - Sequence layer
  - Function layer
- Compile model
  - How to learn - Optimizing Stochastic Gradient Decent algorithms?
    - SGD
    - RMSprop
    - Adagrad
    - Adadelta
    - Adam

Related work

- Scherer, R. Lstm recurrent neural networks for short text and sentiment classification. 2017
- Ruder, S. An overview of gradient descent optimization algorithms. 2018

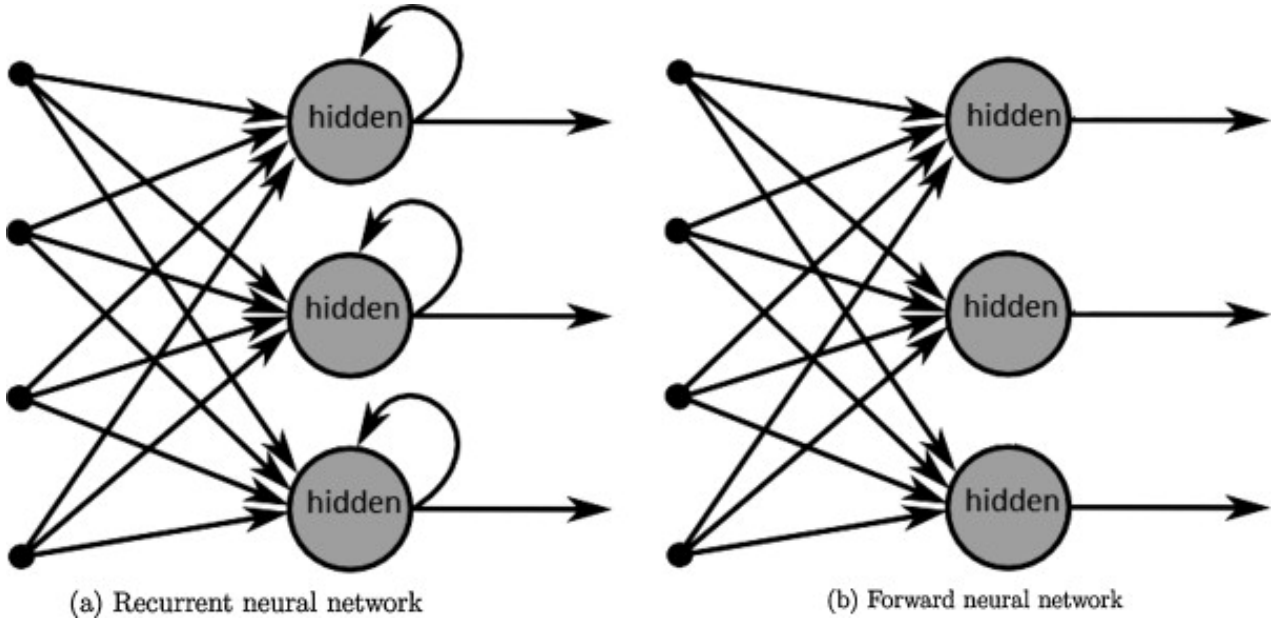


Figure: Recurrent vs Forward neural network; *Source: [1]*

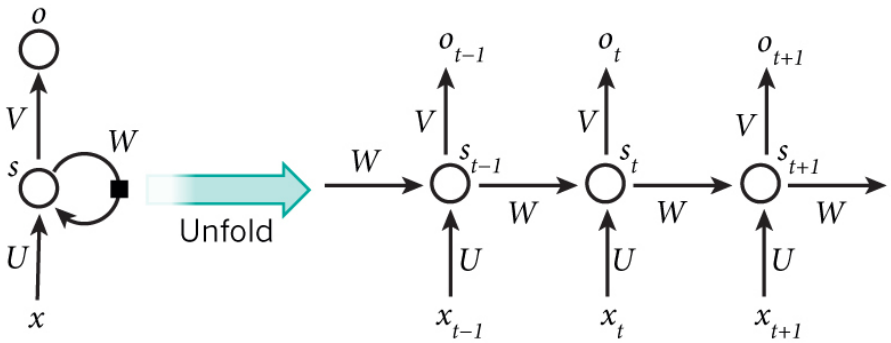


Figure: RNN sequence; *Source: [2]*

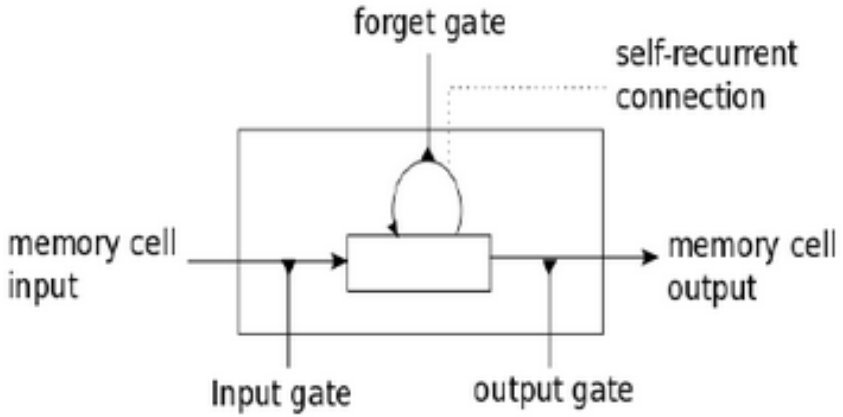


Figure: LSTM memory cell; *Source:[3]*

Technical background

Dense layer vs. Dropout layer

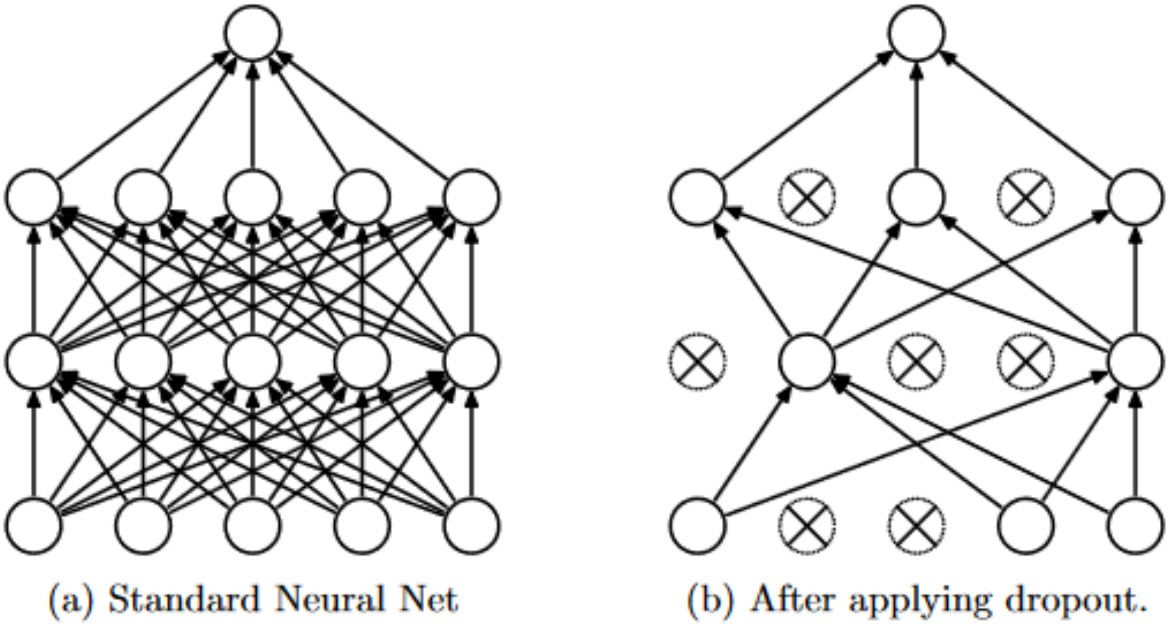


Figure: Dense vs Dropout layer; *Source: [4]*

Technical background

Cross-entropy, Epochs, Batch size and Softmax

- Categorical Cross-entropy
  - Loss Function
  - Indicates distance between what the model the output distribution should be and what the original distribution really is
- Epoch
  - Entire data set went through the algorithm in number of times
- Batch size
  - The amount of test/training examples in one forward or backward pass
  - RAM memory
- Softmax function
  - Calculate the probability distribution of each target class over n different/possible target classes for the given inputs

Proposed implementation

PoC

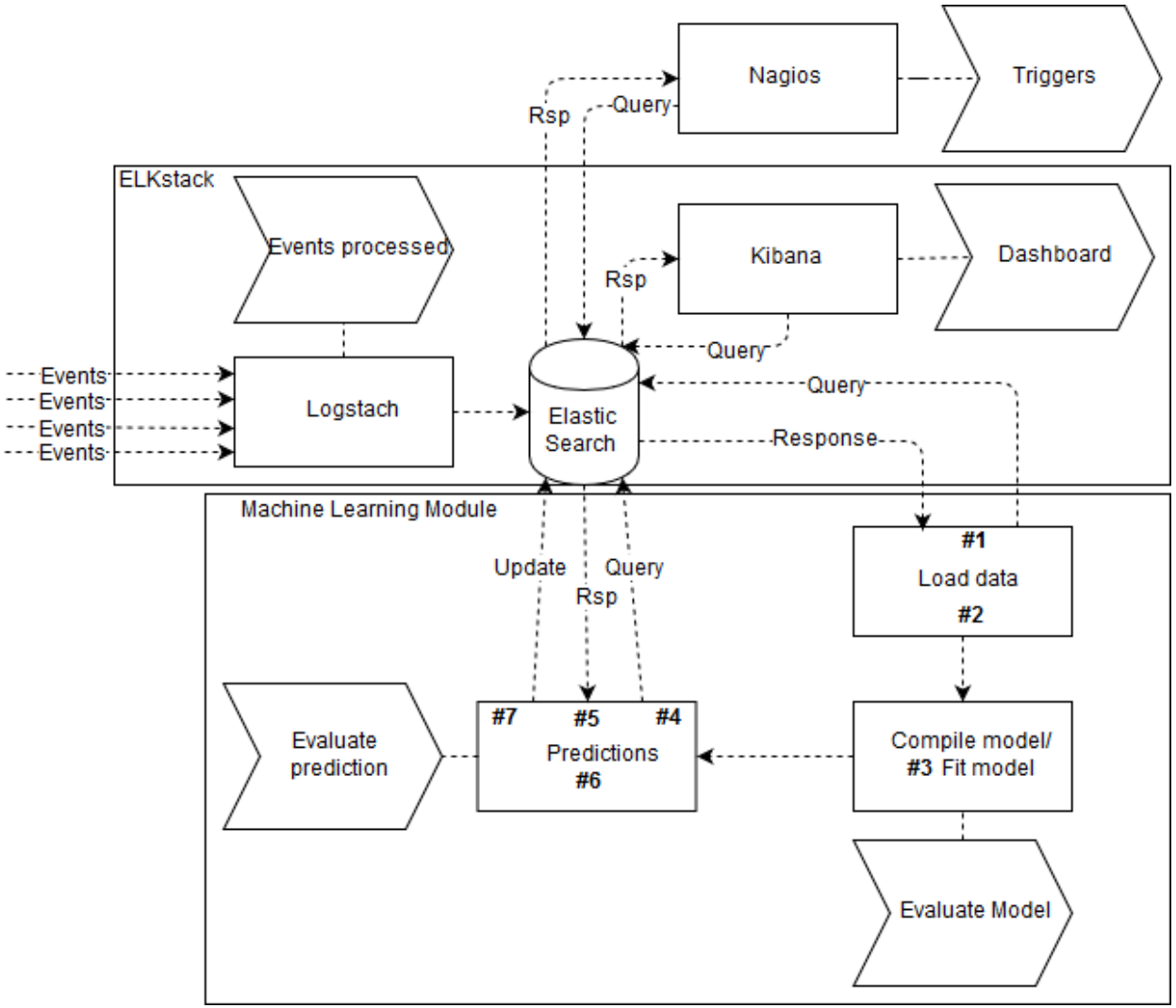


Figure: Architecture

Proposed implementation

PoC layers

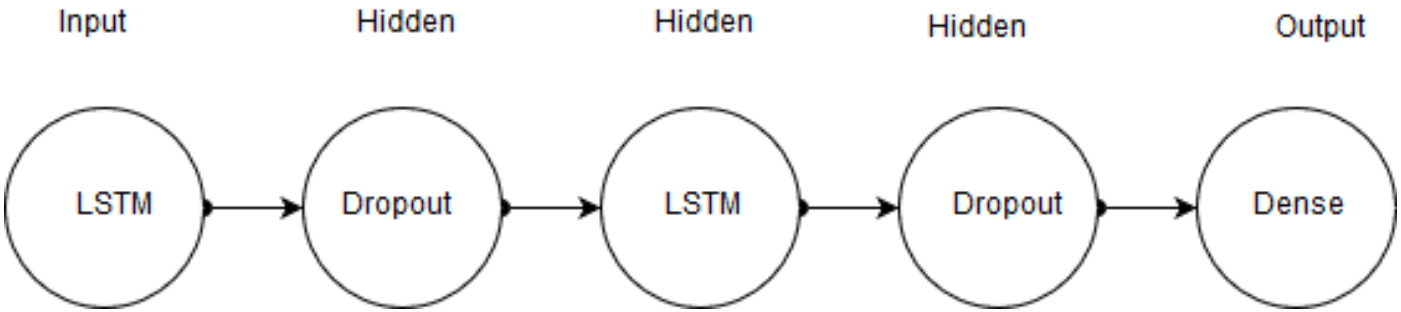
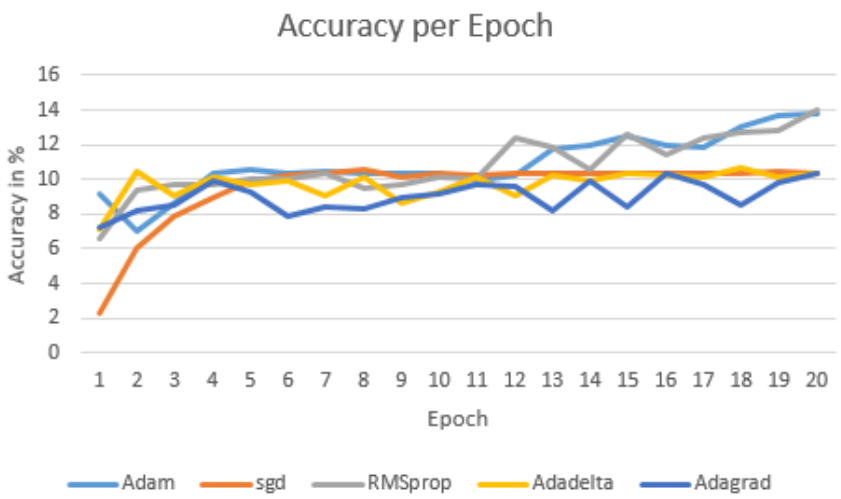


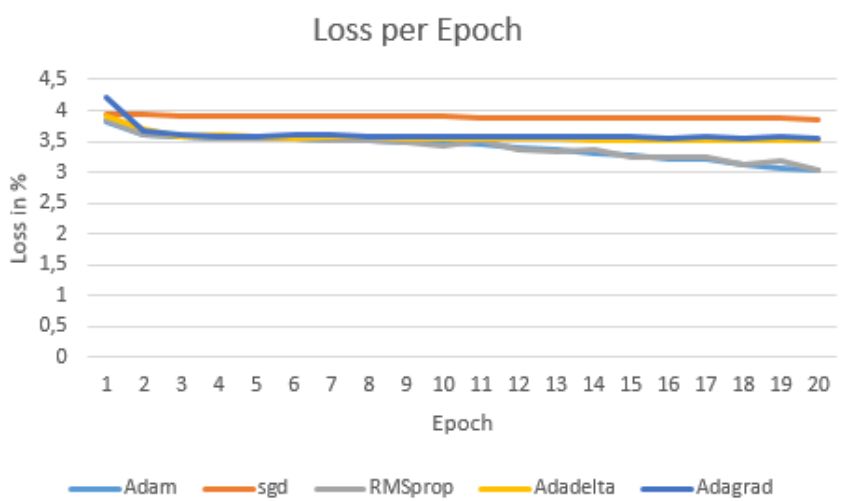
Figure: AI layers

- Advantages of this model
  - Interfaces may be changed easily
  - Change AI model easily
  - Change Algorithms easily

Results

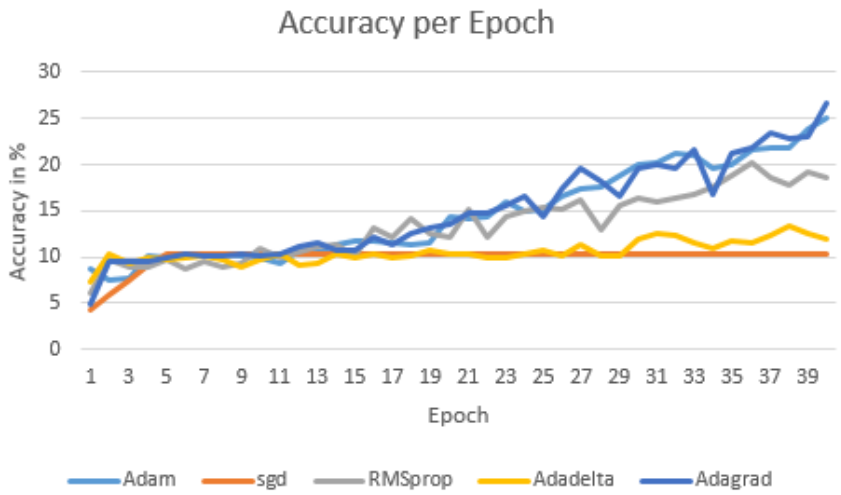
20 Epochs

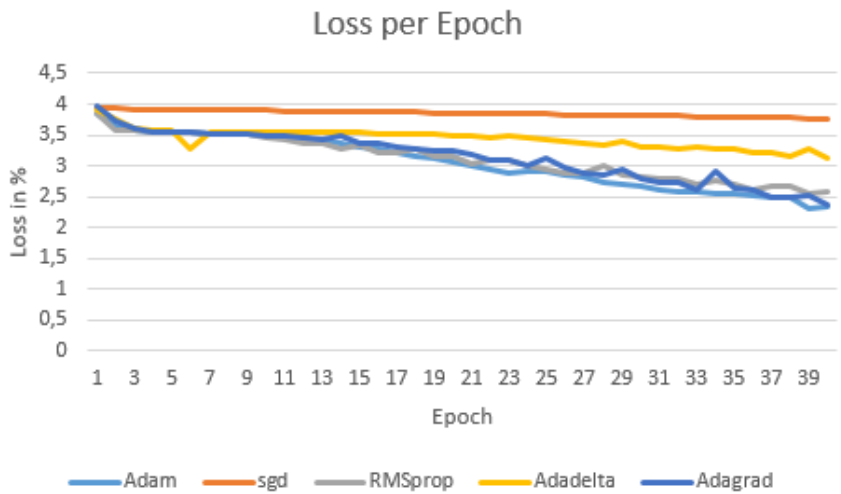




Results

40 Epochs





Results

	20 Epochs		40 Epochs	
	Loss	Accuracy	Loss	Accuracy
Adam	2.96977%	16.36363%	2.21985%	29.81818%
SGD	3.85677%	10.39999%	3.75910%	10.39999%
RMSprop	3.00070%	5.127276%	2.73776%	19.41818%
Adadelta	3.44532%	10.54545%	3.11788%	13.81818%
Adagrad	3.52502%	10.39999%	2.28705%	27.27272%

Table: Total accuracy and loss per model as a whole

Discussion & Conclusion

- Discussion
  - Adam is the best choice according the results
  - Does not guarantee the correctness.
  - Model needs a lot of data and time in order to get a better accuracy and learning rate
- Conclusion
  - Apply LTSM with Adam as optimizer
  - Softmax
  - Inject false or true events, in such a way the accuracy will change

Future work

- Apply AI on Speed layer
- Optimize AI module
- investigate better approach for accuracy and predictions.
- What should be the time-period to analyze to optimize relevant context but also trying to be as near-realtime as possible?

Questions

Questions?

References


De Mulder, W., Bethard, S. & Moens, M.F.
Deep learning applications and challenges in big data analytics.
https://stevenmiller888.github.io/mind-how-to-build-a-neural-network/, 2015.


C. Godbout.
Recurrent Neural Networks for Beginners.
https://medium.com/@camrongodbout/recurrent-neural-networks-for-beginners-7aca4e933b82#.q5otnbm2i, year = 2016.


A. Hassan, A. & Mahmood.
Deep learning for sentence classification.
https://www.researchgate.net/publication/318975052_Deep_learning_for_sentence_classification, year = 2017.


Srivastava, N., Hinton, G., Krizhevsky, A., Sutskever, I. & Salakhutdinov, R. .