



Making a Contextual Recommendation Engine using Python and Deep Learning

By

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'A technology company working on building state of the art artificial intelligence technology and giving easy access to anyone and everyone who needs it through our easy to use APIs'



Semantic Similarity

Analyze how close two sentences are with respect to each other



Text Classifier

Automatically classify the text according to your categories



Entity Extraction

Recognize the entities in the text to get the better picture of it



Sentiment Analysis

Determine the sentiment of the text that you are working on



Contextual Recommendation Engine

Need of a new recommendation engine



Pre-existing Solutions

- Related Posts” plugin in CMS like Wordpress
- TFIDF based search which fails frequently
- Article tags can result in garbage results

Aims of new solution

- Should be more accurate than TFIDF tag search.
- Should be able to generate related posts for all articles.
- Should be cheap to deploy. (Its still “related posts” at the end of it)



We have four different layers which are interconnected to throw most accurate results at very high traffic blogs.



Word
Embeddings



Neural
Networks/Heuristics



Efficient Space
Partitioning based
search



Go Lang channels
to serve web
requests

Word Embeddings



Word Embeddings are dense low dimensional representation for each word

Google Word2Vec

- Most Popular
- Neural Net which predicts next word
- Recently patented by Google

ParallelDots Tyrion

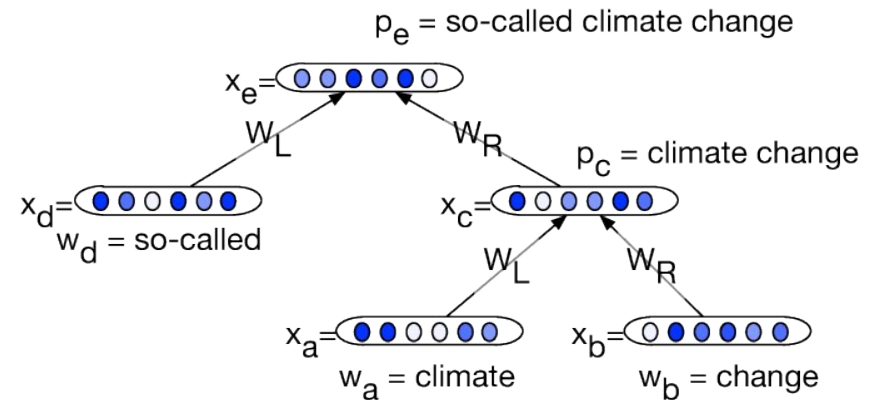
- Uses much lower RAM
- Can be trained in on normal CPU
- Autoencoder recreates co-occurrence matrix.
- Can be used on very large datasets with ease
- Open sourced

Deep Learning Models



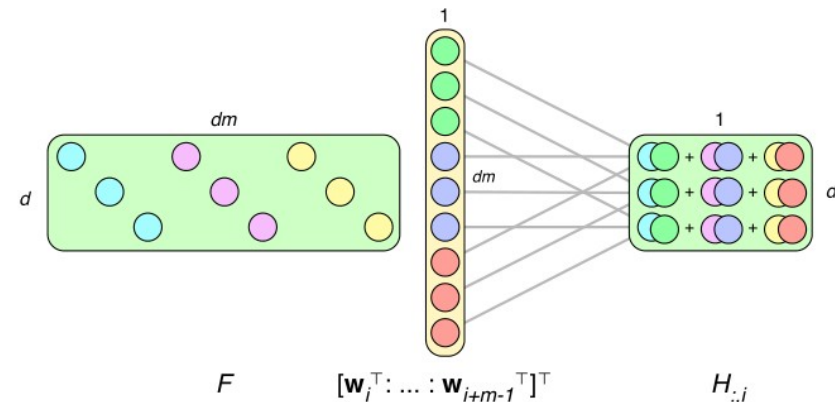
In Search Engine

- Recursive Neural Networks to combine Word Vectors into phrase Vectors for semantic closeness.
- Heuristically combining Word/Phrase Vectors for similar entity based near neighbors.



Others

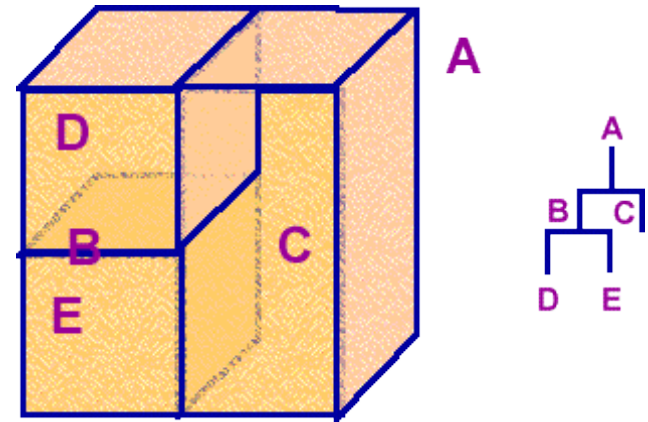
- Convolutional Neural Networks to capture Sentiments in text.
- Recursive Neural Net based entity extraction.



Vantage Point Tree

About VP Tree

- Arrange Document Representation on a Space partitioning Tree
- Uses VP Tree because of minimal requirements
- Makes query $O(\log n) < \text{querytime} < O(N)$

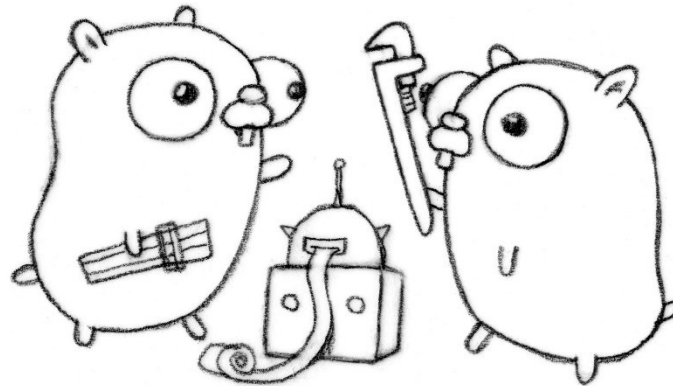


Our Implementation

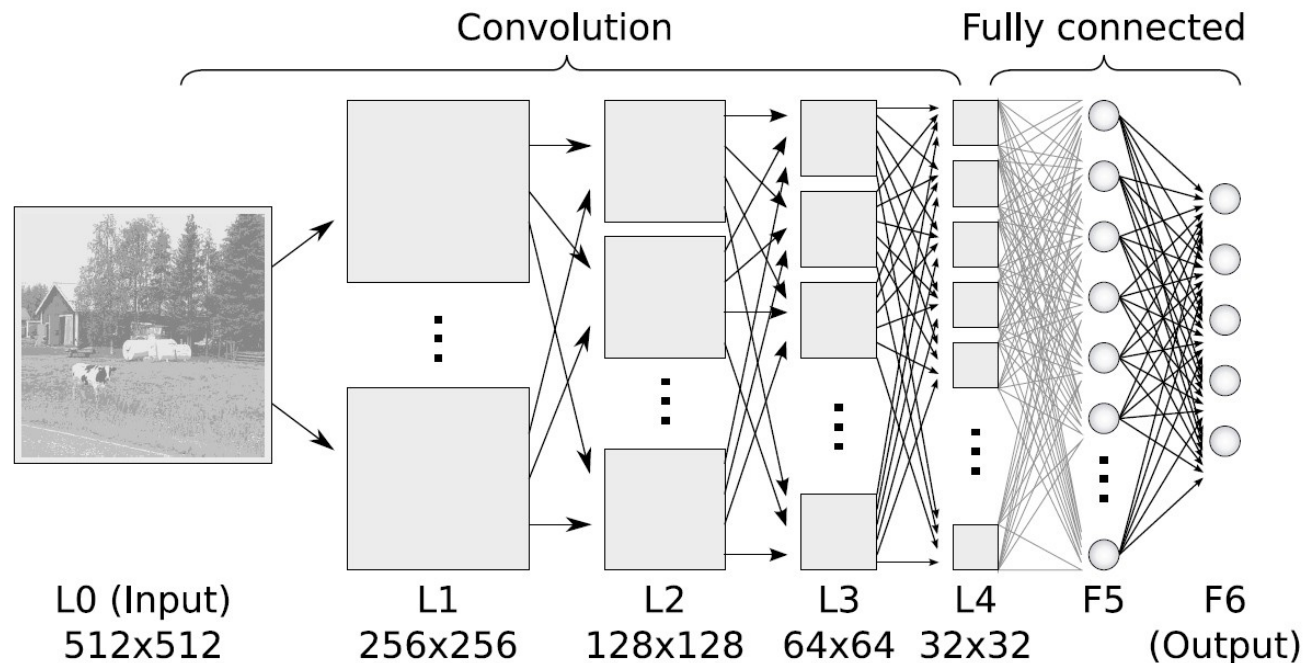
- Fast implementation in Numpy
- Right now documents divided into buckets and hosted one bucket/core using Python's multiprocessing
- Future Work: Shared memory model to make it work as true $O(\log(n))$

Handling Traffic

- Analysis of incoming traffic using Pareto Principle
- Generation recommendations for viral unique articles
- Development Go-Lang channels to concurrently handle requests
- Golang channels to group these requests and deduplicate hits on Machine Learning infrastructure
- Combined with a caching layer (Redis) we handle up to 5000 concurrent users on a single box.



Basics of Deep Learning

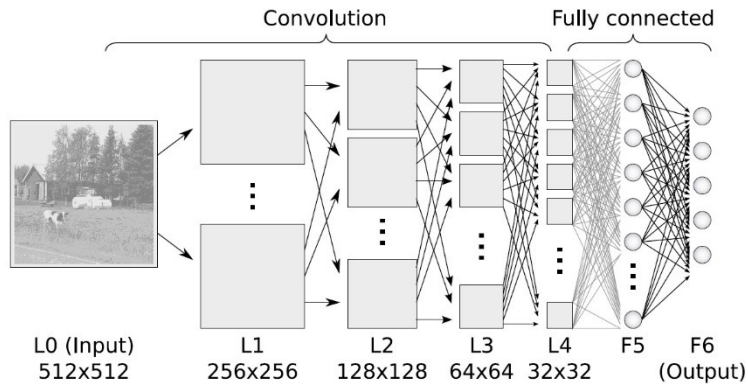


- Deep Learning is name given to multi layered Neural Networks.
- Layer(s) of weight are stacked on top of each other separated by layers of activation functions. Activation functions bring non-linearity into the learning, else multiple layers of weights would be same as one layer.
- They are trained by back propagation of errors generally by Gradient Descent.

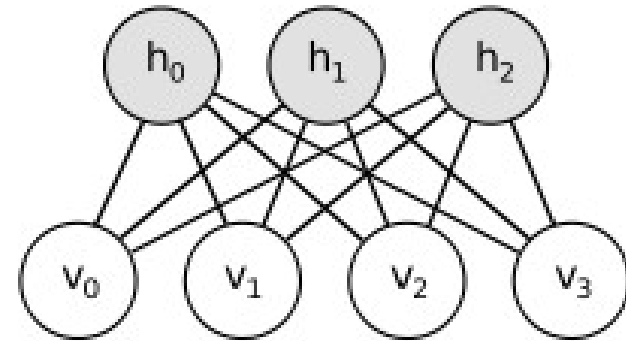
Deep Learning continued...



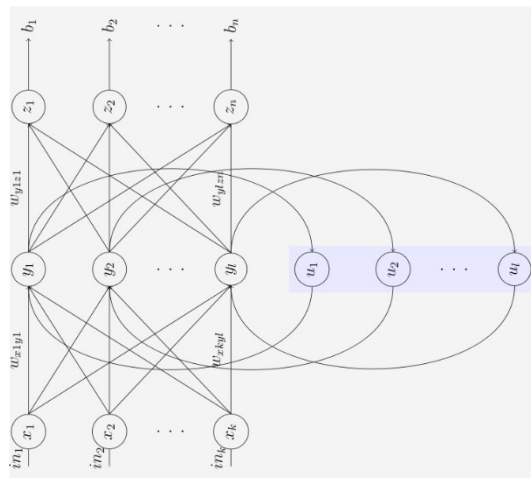
Types of Neural Networks



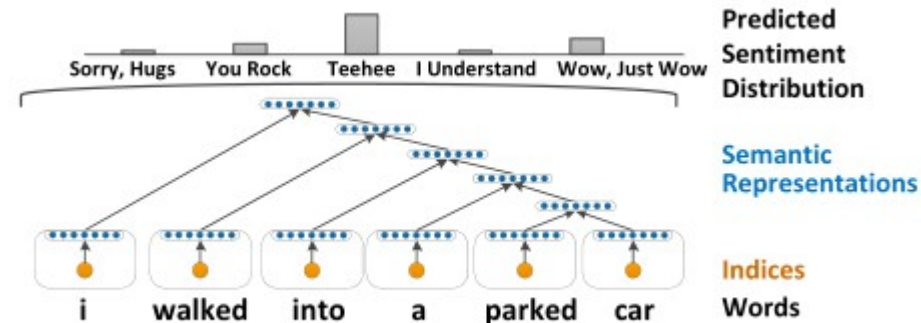
Convolutional



Boltzmann Machine(popular as RBMs)



Recurrent



Recursive

Deep Learning continued...



Some vocabulary

Architecture

Recurrent

Recursive

Convo NN

DBN

Neural Net Units

RBM

Sigmoid

Dropout

ReLU

LSTM

tanh

Optimization

Clipping

Hessian

MSGD

Simulated
Annealing

SGD

Momentum

Adadelta

Adagrad

RMSprop

theano

Production Workhorse @ ParallelDots

Light CPU tryouts

Kayak: Library for Deep Neural Networks


Pylearn2

Lasagne

Lasagne is a lightweight library to build and train neural networks in Theano.



Caffe

 **cuda-convnet2**
Fast convolutional neural networks in C++/CUDA



THANK
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