AML

John Min - Victor Ferrand

Predict Heat Consumption with Deep Learning

Goals

- Implement our own deep learning library (get our hands dirty)
- Beat “classical” methods on this learning problem (miserable results: 300% error)
- Hope to actually get better results

Deep Learning Implementation

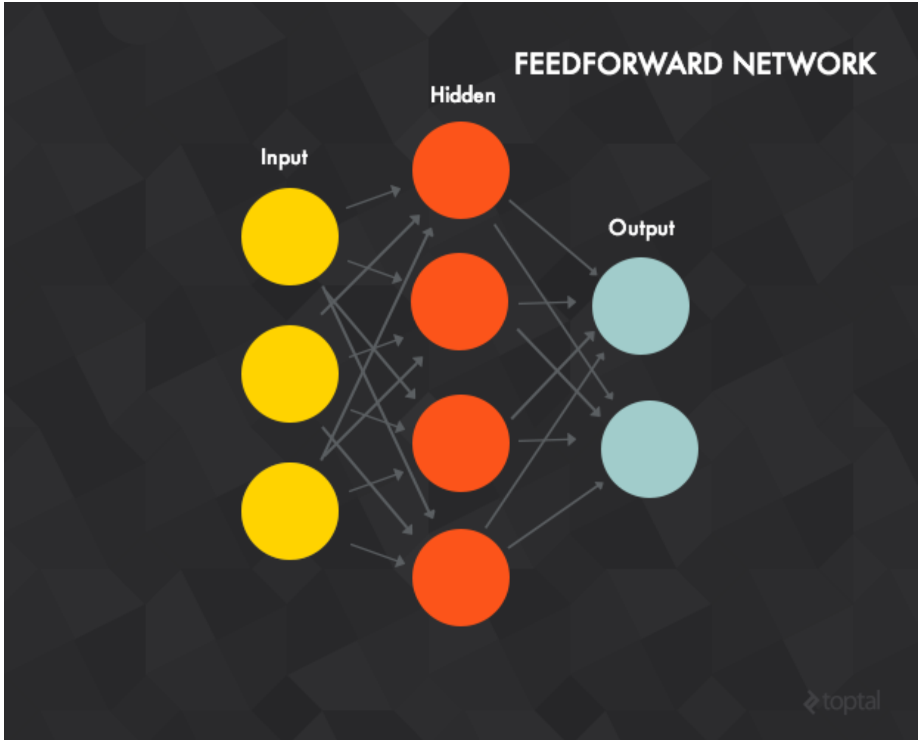
- Neural Network
- Restricted Boltzmann Machine
- Deep Belief Network

Neural Network

- Classic implementation:
  - Feed forward / Back propagation
  - L2 cost function
  - Activation/Output functions (sigm / tanh / linear)

- Weights Initialization inspired from /*some paper*/
  - Uniform distribution over $[-\frac{\sqrt(6)}{in+out}, \frac{\sqrt(6)}{in+out}]$

Neural Network

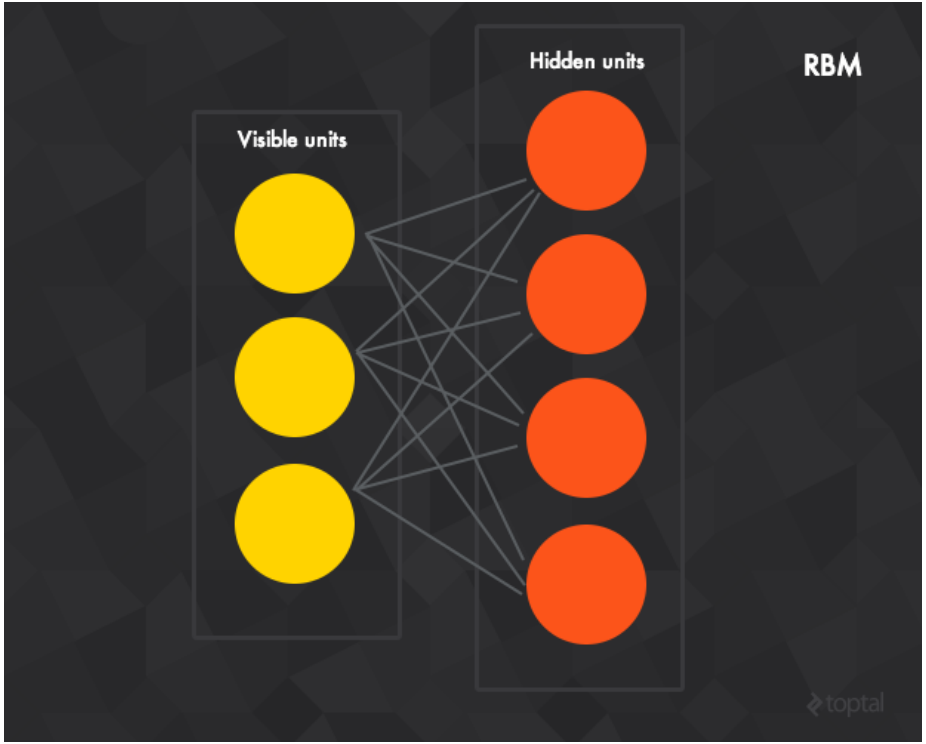


- Directed network
- Training algorithm

  - feed forward
  - error L2
  - backpropagation

$$\Delta w_i = \alpha(t - y)\varphi' x_i$$

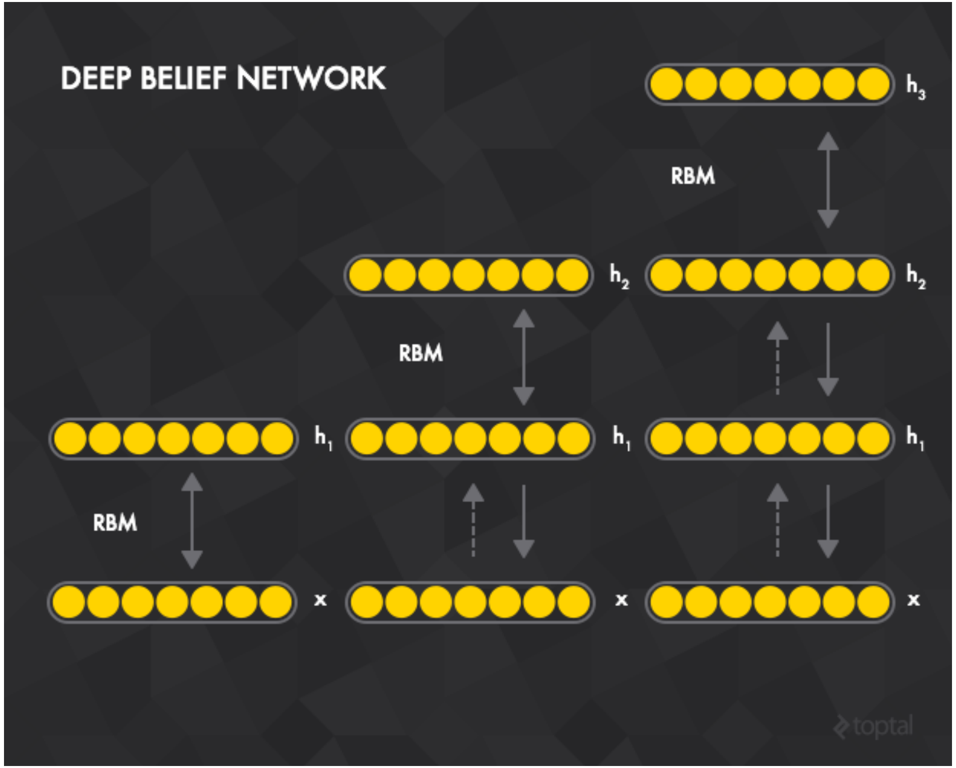
RBM



- Undirected network
- Fully connected network
- Contrastive divergence training algorithm (2 phases)

  - positive: ff+ (x) = h
  - negative: ff+(ff- (h)) = h’
  - update with error(h’-h)

Stacked RBMs = DBN



- Deep Belief Networks are a concatenation of RBMs

- Train with contrastive divergence algorithm 2 layers by 2 layers

  - train RBM1
  - train RBM2 with input (ff (inputs) in first layer)

DBN

- Modularity of the Network
  - one global training
  - train any added layer as an independant RBM with the previous output layer

- Big picture : Neural Network with different training

Data

- Weather data over 2 years (2012-2013)
  - temperature / humidity / pressure / wind speed / precipitation / global conditions
  - collected hourly

- Steam data from a NY building
  - evaluate heat consumption of the building (Mlbs/hr)
  - collected every 15 min

Data

Tidy up data:

- Linear interpolation on steam data
- Filter (where some data aren’t accurate)
- Separate in 3 datasets:
  - Seasons
  - Week days
  - Weekends

Results SVM / Random Tree

	Season data: Winter / Summer Spring / Fall	Week days	Weekends
SVM			
Random Tree			

Results Neural Net / DBN

	Season data: Winter / Summer Spring / Fall	Week days	Weekends
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Result Graphics

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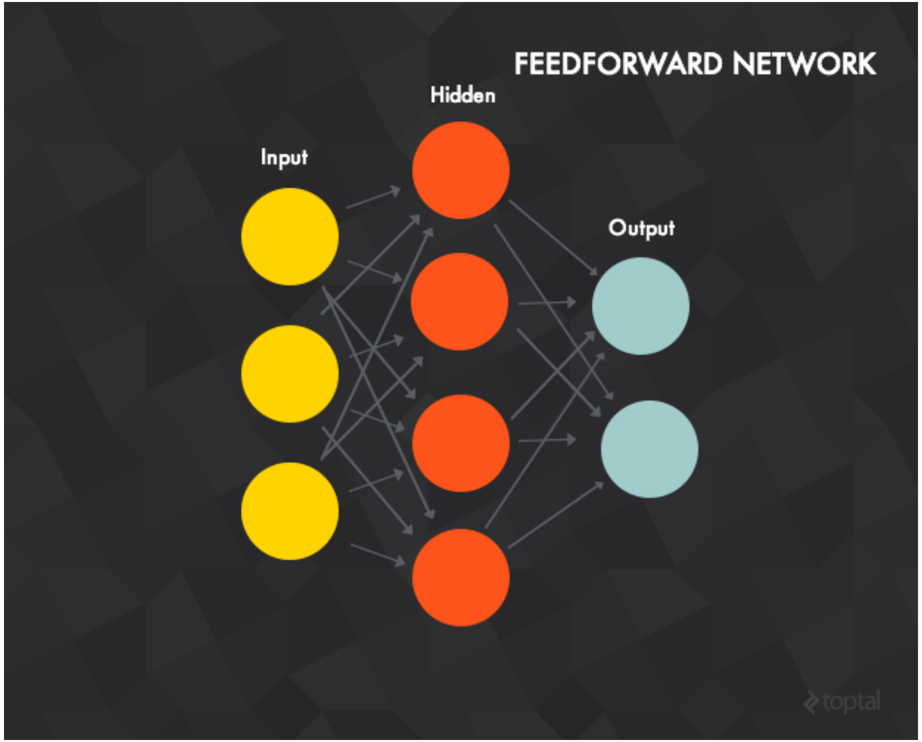

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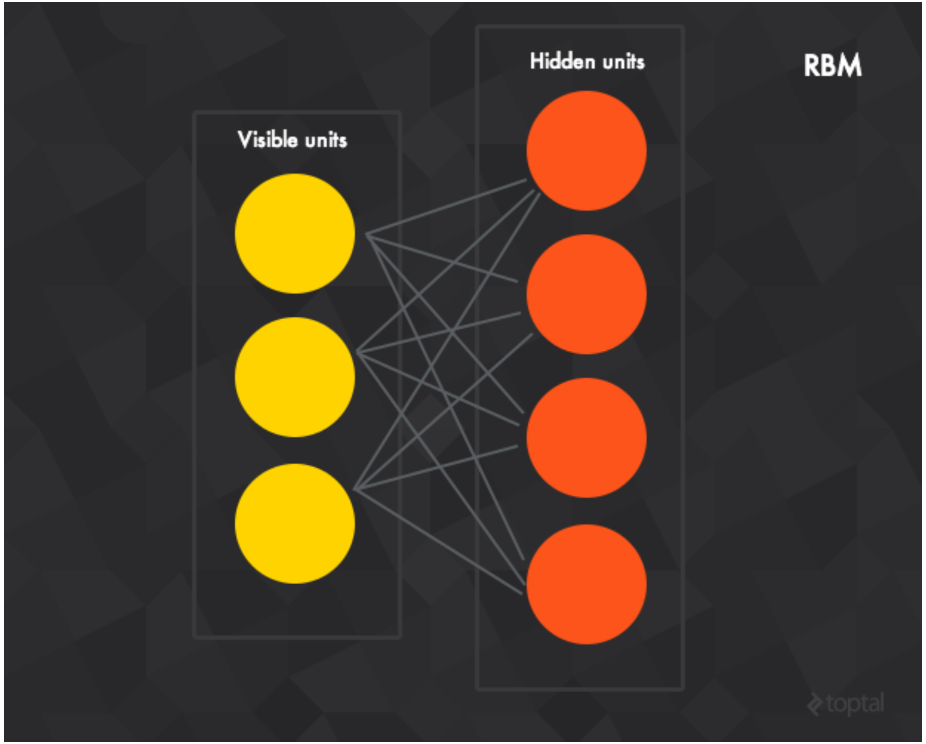

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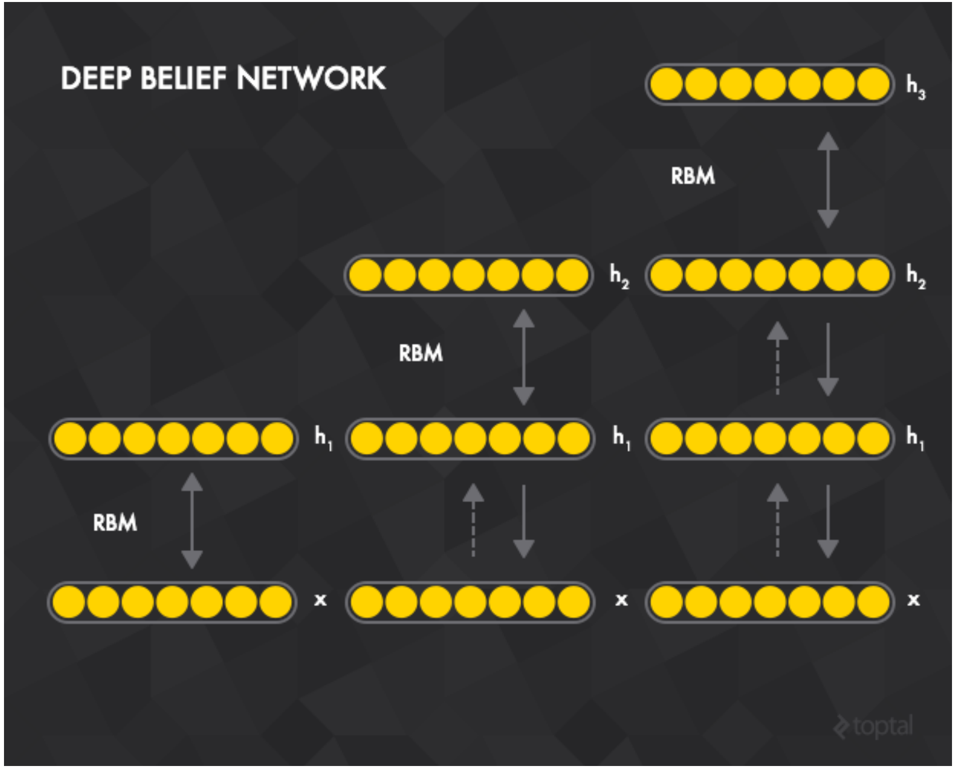

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References

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