Teaching Innovations

Teaching Deep Learning to MBAs using Tensorflow

Professor Avi Seidmann
Xerox Professor, IS/OM Area Chair
Simon Business School
University of Rochester
Rochester, New York
MBA Core Teaching

• An MBA Core class is typically about:
  • A basic skill set (acct, stat, communications...)
  • OR, a functional area (fin, mkt, econ...)
IS/IT Core Teaching Questions to Talk About

• What new cases, experiential learning, and topics have you added recently?

• What tools should we teach in the core (Excel, Access, SQL, Tableau, Plotly, Google Analytics, R, VBA)?
  • Are they to be done in class, or lab. or online tutorials, or in some other way?

• What is the role of “AI/Deep Learning” in the IS core class?
AI/Deep Learning Teaching I

• Students must understand how emerging technologies may shape businesses of the future

• The pioneers of the driverless car movement — such as Google and Tesla — are mapping the MBAs a future in which artificial intelligence and robotics will likely impact the entire job market and global economy.

• Such disruptive technologies are now an “essential” part of the b-school landscape

• Despite their Major Structural limitations, at times they are being (over) sold as “The Magic Power”
  • Hence we need a ‘Buyer Beware’
What I’m trying to teach students is:

“What can these technologies deliver? And what are the challenges and opportunities for a company that does AI?”

Beyond a ‘Black Box’:

My students must understand how these technologies work on a basic level but, more importantly, how they may shape businesses of the future.

The Challenge:

Most AI technologies have a ‘high barrier to entry’

Require Tech Set, Complex background, Programming Skills, Powerful M/C, Vast Data set ➔ Yet, at the Core, we are short in Time, and most of the above...
**Didactic Objectives:**

- Get a Hands-On Experience in Deep Learning (Classification)
  - (Develop Awareness, and Basic Intuition)
  - Understand: ➔ Neural Networks Constructs, Hidden Layers
  - Recognize the key tradeoffs involving:
    - Learning Rate
    - Regularization
    - Activation, Features
    - Impact of Data Noise
    - Accuracy (Loss) Measures
    - Computational Challenges
    - Ratio of training to Test Data
## Comparison of Deep Learning Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Languages</th>
<th>Tutorials and training materials</th>
<th>CNN modeling capability</th>
<th>RNN modeling capability</th>
<th>Architecture: easy-to-use and modular front end</th>
<th>Speed</th>
<th>Multiple GPU support</th>
<th>Keras compatible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theano</td>
<td>Python, C++</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tensor-Flow</td>
<td>Python</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Torch</td>
<td>Lua, Python (new)</td>
<td>+</td>
<td>+++</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Caffe</td>
<td>C++</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>MXNet</td>
<td>R, Python, Julia, Scala</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Neon</td>
<td>Python</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>CNTK</td>
<td>C++</td>
<td>+</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
Introduction to **tensorflow-playground**

• Web App developed as **Open Source** in d3.js
• Has web based examples to learn from interactively
• Helps students learn about NN:
  • No Math
  • No Programming
  • Built in data sets for experimentaion
  • Can create a NN on their Web Browser and run it
AI/Deep Learning Hands-On Teaching I

• Selected Google’s Tensorflow
  • Open Source, Popular
  • https://playground.tensorflow.org/

• Demo
  • Hwk #1 based on
    • playground.tensorflow.org
  • Hwk #2 based on
    • Classification of 50,000 handwritten digits data set
    • Install TensorFlow (Windows, Linux and Mac OS)
Hwk #2

Objective

You are given a dataset with 50,000 images of handwritten digits. The range of each digit is from 0-9. The task is to predict a label (which is the correct number) for each handwritten image. The next figure illustrates the input and output of the neural network we are about to build. This “classification” is a common task in machine learning. You choose your prediction from a limited number of options, which in this case, is 0-9.
Part of the Students’ Output:
“Modifying code by adding layers [30, 10, 10, 30]”
• Conclusions:
  • Students all mastered fast our Hwk #1
    • They went ‘above and beyond’; Very Engaging, Amazingly Easy
  • Students needed more help with our Hwk #2
    • Gave them a deeper empirical understanding of AI/Deep Learning
  • They have gained new insights concerning the Power & Limitations of AI/Deep Learning (Science, Art)

➔ It is feasible, enjoyable, and worth doing

➔ I do need to reflect on doing a bit more/better next time
Many Thanks

• Please contact me for:
  • Didactic Material, Tech Support, etc’
  
Avi

Future Managers will need different skills.... To handle and interpret all kinds of unstructured data and [for] managing teams of people and smart machines harmoniously.