INFO 7390
Advances in Data Sciences and Architecture
Exam 2

Student Name: _____
Professor: Nik Bear Brown

Due: August 16 Thursday, 2018

All the questions REQUIRE an explanation of the question. Yes or no responses get no credit. Any text or answers from the Internet MUST be cited. You MUST work alone on this; answers too similar to other students' answers will receive no credit.

Q1 (5 Points) What is "Deep Learning?" How does it different from traditional machine learning techniques such as SVMs, Naive Bayes, Decision Trees, etc? Why has it become so popular in the last decade?

Q2 (5 Points) What are activation functions? What is their purpose? Must they be non-linear? Must they be continuously differentiable? Must they be monotonic? How does the derivative of the activation function effect the gradient?

Q3 (5 Points) What is backpropagation? Name three backpropagation algorithms and explain how they work. List the pros and cons of your three backpropagation algorithms.

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Q4 (5 Points) Name two forms of regularization used in neural networks. Explain how they work. Why does one use regularization with neural networks?

Q5 (5 Points) What is a convolution? Give an example of a convolution on image data with and without padding.

Q6 (5 Points) What is max-pooling? Why is it used? How does it compare to mean-pooling and min-pooling? Which would you use between max-pooling, mean-pooling and min-pooling?

Q7 (5 Points) What is the feature learning pipeline in a CNN? How does it relate to the classification in a CNN? Can the feature learning pipeline be used with techniques like SVMs, Naive Bayes, Decision Trees, or GBMs?

Q8 (5 Points) What are loss functions? When would one choose cross-entropy vs mean-square error?

Q9 (5 Points) What is an RNN? What kind of data is an RNN used for? How does a Vanilla RNN differ from an LSTM?

Q10 (5 Points) What is a Markov model? What kind of data is a Markov model used for?

Q11 (5 Points) What is network initialization? How can it effect a neural network? Name three common approaches for network initialization and why one would choose one over another.

Q12 (5 Points) What is transfer learning? When would one use it? Give an example of transfer learning using neural networks.

Q13 (5 Points) What is an autoencoder? What are they used for? Explain how an autoencoder works.

Q14 (5 Points) What is a variational autoencoder? What are they used for? How do they differ from autoencoders?

Q15 (5 Points) What are deep generative models? What are they used for?

Q16 (5 Points) What are multilayer perceptron? What are they used for?

Q17 (5 Points) In deep generative models what is meant by density estimation? What is meant by latent variable models?

Q18 (5 Points) What are soft-max functions? What are they used for?

Q19 (5 Points) What is a session in TensorFlow? Why aren't sessions required for scikit-learn?

Q20 (5 Points) TensorFlow uses a dataflow graph. What is it? Why is it used?