Term Project I: Information Theory of Learning

2005 Fall
Instructor: Byoung-Tak Zhang
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Project I: Pattern Classification by the Probabilistic Library Model (PLM)
Due: Draft 10/4(Tu.), Final 10/20(Th.)

Given:
- A training set of labeled examples (64 bit digit patterns + labels)
- A test set of labeled examples
- Results by k-nearest neighbor classifiers as a reference

To do:
- Build PLMs to do digit classification using the algorithm described in Reference [ZJ-04; ZJ-05]

Evaluation criteria:
- Classification performance
- Innovative ideas to improve the performance or the algorithm
- Analysis of performance: why does the proposed method work or why does it not work well?
- (Encouraged) Try to use the information theoretic measures learned in the classes to analyze the data and the performance
- (Optional) Comparison with other existing methods (e.g., k-nearest neighbor, decision trees, perceptrons)
Term Project II: Information Theory of Learning

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Project II: Pattern Completion by the Correlational PLM
Due: Draft 11/3 (Th.), Final: 11/10 (Th.)

Given:
- A training set of labeled examples (64 bit digit patterns + labels)
- A test set of labeled examples
- Results by a Bayesian network as a reference

To do:
- Use the Correlational PLMs (explained in the class) to solve the pattern completion tasks
- Pattern completion task: Given an input pattern x with some part corrupted, recover its uncorrupted version or a similar one

Evaluation criteria:
- Completion performance: define your own measure(s) for success criteria, e.g. hamming distance to the target pattern or the mean pattern of the class, to evaluate the performance
- Innovative ideas to improve the performance or the algorithm
- Analysis of performance: why does the proposed method work or why does it not work well?
- Try to use the information theoretic measures learned in the classes to analyze the data and the performance
- Comparison with other existing methods (e.g., Hopfield networks, Bayesian networks)
Term Project III: Information Theory of Learning

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Project III: Pattern Prediction by the Latent PLM
Due: Draft 12/1(Th.), Final: 12/8(Th.)

Given:
- A training set of labeled examples (64 bit digit patterns + labels)
- A test set of labeled examples
- Results by a Bayesian network as a reference

To do:
- Use the Latent PLMs (explained in the class) to solve the pattern prediction tasks.
- Pattern prediction task: Given the values of an arbitrary set of variables (i.e. image and class variables), predict the values of another arbitrary set of variables.

Evaluation criteria:
- Prediction performance: correct computation of conditional probabilities of arbitrary subsets of the variables. This includes the three special cases: (1) predicting the correct class of a given digit pattern, (2) predicting the values of missing variables, (3) completing the correct pattern given a corrupted version.
- Innovative ideas to improve the performance or the algorithm
- Analysis of performance: why does the proposed method work or why does it not work well?
- Try to use the information theoretic measures learned in the classes to analyze the data and the performance
- Comparison with other existing methods (e.g., Boltzmann machines, Bayesian networks)