Pattern Classification and Machine Learning FEN3202

Discussion Agenda and Exercises for Lecture 6

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I. DISCUSSION AGENDA

1) Linear Models for Classification Chapter 4 of the text book.

   Discussion Points: Fisher' linear discriminant (section 4.1.4), equation 4.20-4.30, a discussion: actually it is not a linear discriminat, but allows effcieint linear model for classification.

   Fisher's discriminant for multiple classes (section 4.1.6), equation 4.39-4.51.

   Probabilistic Generative Models (Section 4.2), some terms: class-conditional density, class prior, posterior probability, equation 4.57-4.63, sigmoid function;

   Continuous inputs (section 4.2.1), equation 4.64-4.70, linear discriminant (linear model), quadratic discriminant, Figure 4.11,

   Maximum Likelihood solution (section 4.2.2), equation 4.71-4.80.

   Probabilistic discriminative models (section 4.3): what is this? Fixed basis functions (section 4.3.1), role of basis function to have non-linear classification boundary, Figure 4.12

   Logistic regression (section 4.3.2), equation 4.87-4.91

   Iteratively reweighted least-squares (section 4.3.3), equation 4.92-4.100

   The Laplace approximation (section 4.4), equation 4.125-4.134, Note the role of linearization

   Bayesian Logistic Regression (section 4.5), comment: the full Bayesian solution is intractable, equation 4.140-4.155

II. EXERCISES

1) Exercise 4.12 (To verify the relation in equation 4.88).

2) Exercise 4.13 (To verify the relation in equation 4.91).

3) Implement Iteratively reweighted least-squares Algorithm (section 4.3.3). Choose the model parameters by your own. Generate synthetic data and test the algorithm.

4) Exercise 4.24 (Alternative approach to derive the relation in equation 4.151; need to use Gaussian marginalization)

5) Exercise 4.25 (Helps to identify close relation between logistic sigmoid and probit functions)