

ECE M146 Introduction to Machine Learning

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Today's Lecture

Recap:

- Gaussian Discriminant Analysis – scalar case

New topic:

- Gaussian Discriminant Analysis – vector case
- Multivariate Gaussian RVs

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Recap:

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Recap: GDA in the scalar case

- Instance of generative modeling.
- Class marginals:
- Class conditionals:
- Estimate the parameters by taking the derivatives of the log of the joint.

Parameter estimation

At test time

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Recap:

- Gaussian Discriminant Analysis – scalar case

New topic:

- Gaussian Discriminant Analysis – vector case
- Multivariate Gaussian RVs

Now, we generalize to vector input data

- Notation:

Conditional pdf is modeled as jointly Gaussian.

More on Jointly Gaussian RVs

- For the vector case, mean and covariance matrix represent:

More on Jointly Gaussian RVs

- Properties of the covariance matrix

More on Jointly Gaussian RVs

- Properties of the covariance matrix

More on Jointly Gaussian RVs

- Properties of the covariance matrix

More on the Jointly Gaussian RVS

- Special case of covariance matrix being diagonal.

Covariance matrix -- examples

Parameter estimation

- Same idea as in the scalar case: take derivative of the log likelihood, except that we are after vectors and matrices (need to use matrix calculus)

Parameter estimation

Parameter estimation

At test time

GDA for multiclass classification

Unequal class covariance matrices

At test time

GDA as Naïve Bayes classifier

- Recall that last time we studied Naïve Bayes classifier that adopts conditional independence:
- When this assumption is used in the current setting:

Connections with logistic regression

Connections with logistic regression