Binary Classification Using (tensor) LDA

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Outline

Linear Discriminant Analysis

- **Task**: Implement a binary classifier for car detection.
- Using (conventional) Linear Discriminant Analysis.

Steps

- Calculate mean μ
  - For class 0, class 1, and for the overall dataset
- Calculate covariance matrix
  - S_B and S_W
- Calculate projector matrix w

Determine w

- w is a projection vector that maximally separates the data

$$\boldsymbol{w} = \arg\max_{w} \frac{w^T S_B w}{w^T S_w w} \quad (1)$$

Determine a projector w

$$y(X) = \begin{cases} +1, & \text{if } w^T x \geq \theta \\ -1, & \text{otherwise} \end{cases} \tag{2}$$

Plot from S_W

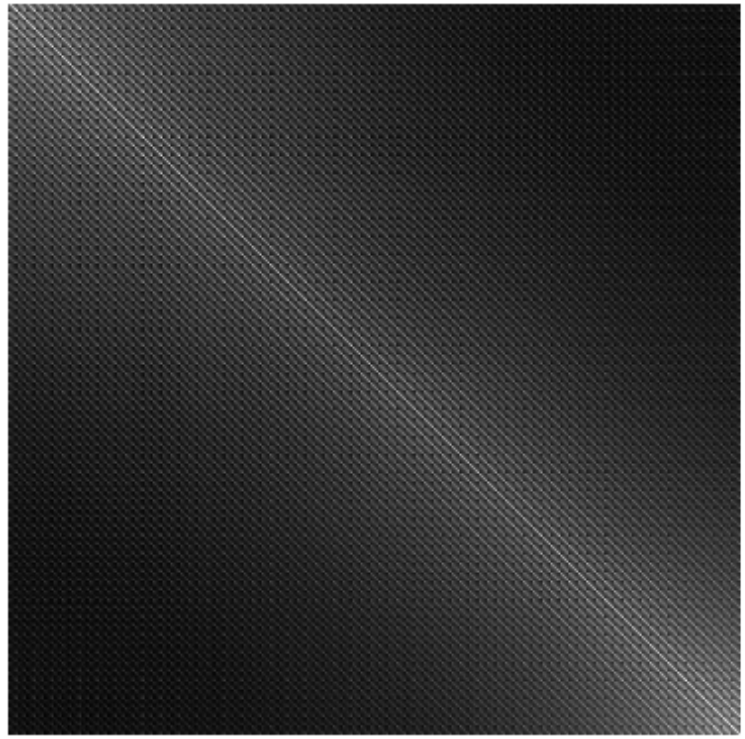

Figure 1: Plot from S_W

Plot from S_B

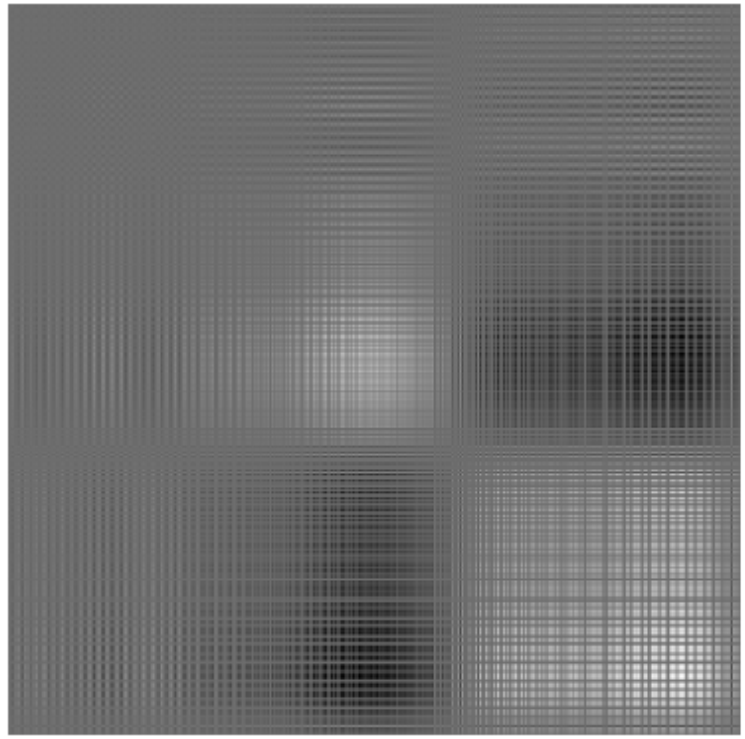

Figure 2: Plot from S_B

Plot from w

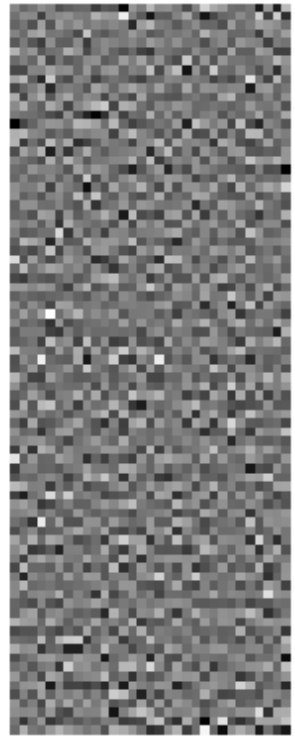

Figure 3: Plot from w

Result

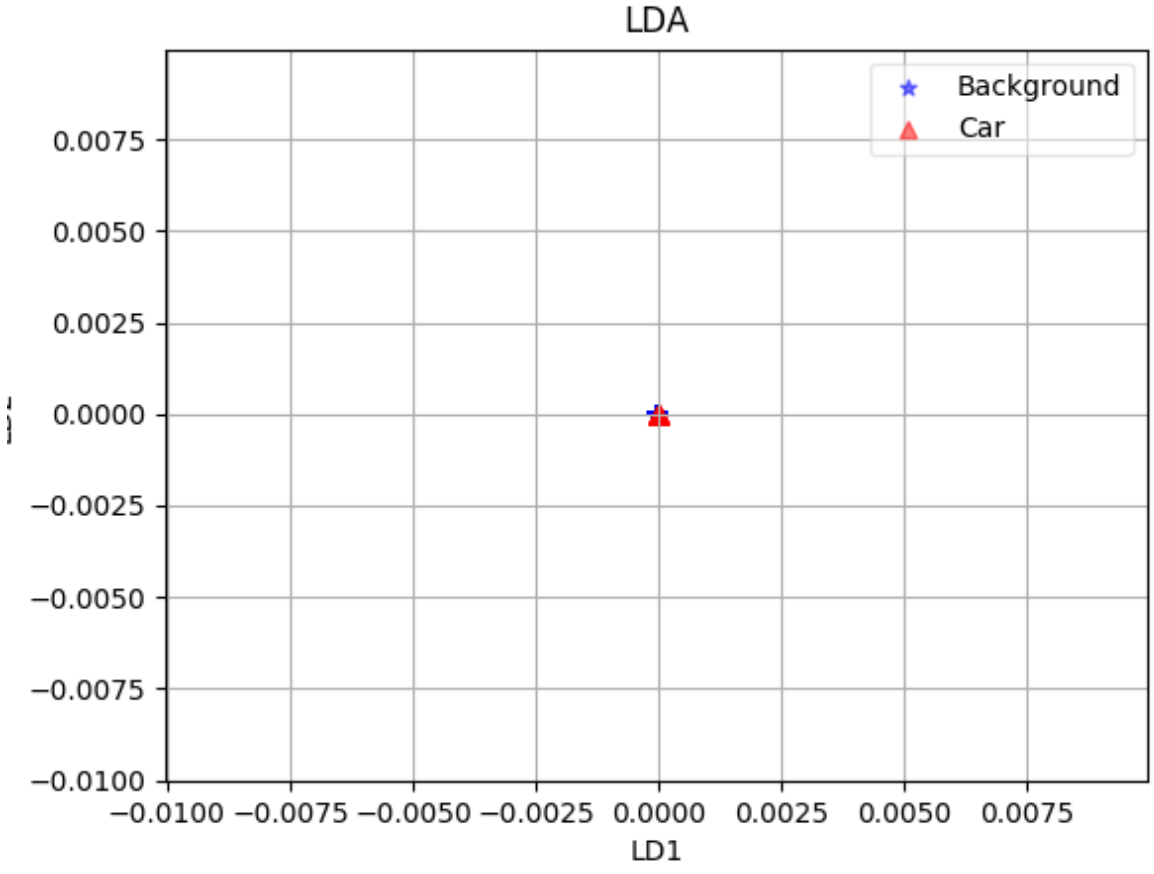

Figure 4: Result from LDA

Precision and recall

$$Precision = \frac{tp}{tp + fp} \tag{3}$$

$$Recall = \frac{tp}{tp + fn} \tag{4}$$

Precision and recall

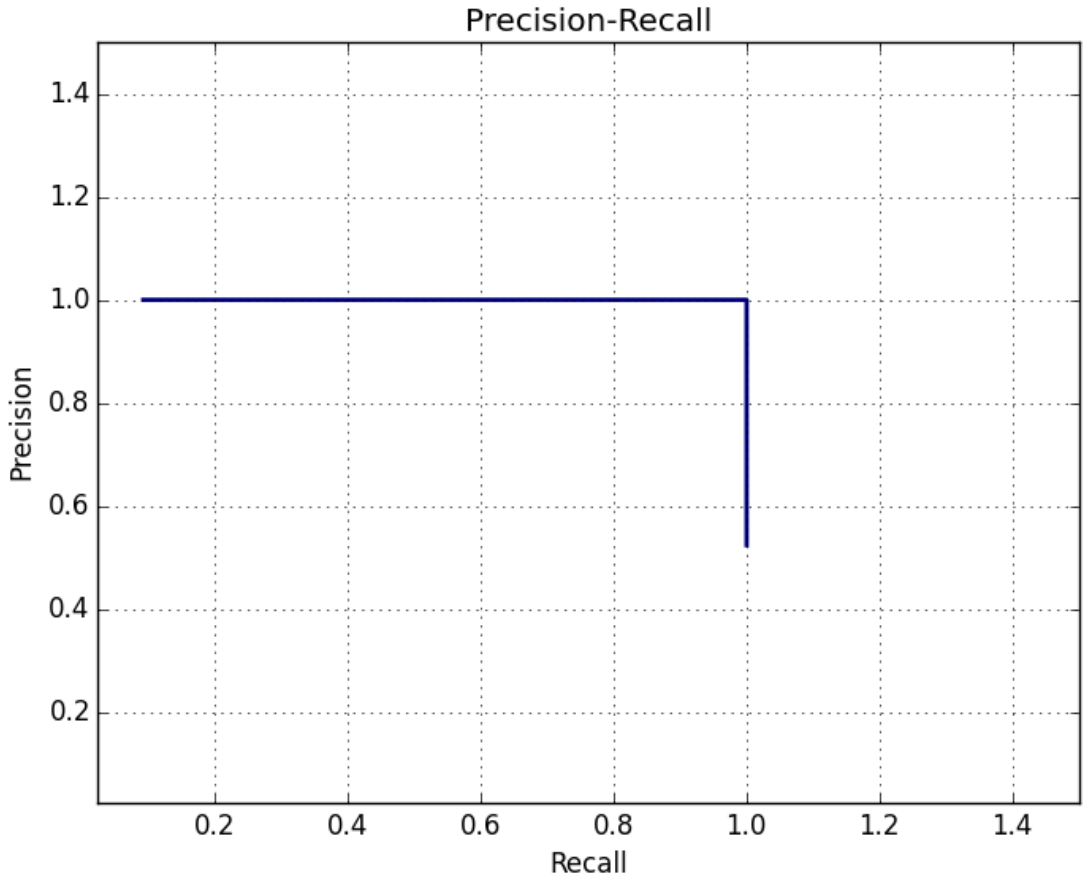

Figure 5: Precision and recall

Tensor Linear Discriminant Analysis

- **Task**: Implement a binary classifier for car detection.
- Using Tensor Linear Discriminant Analysis.

Tensor W output

Figure 6: