
Pattern Recognition

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Agenda

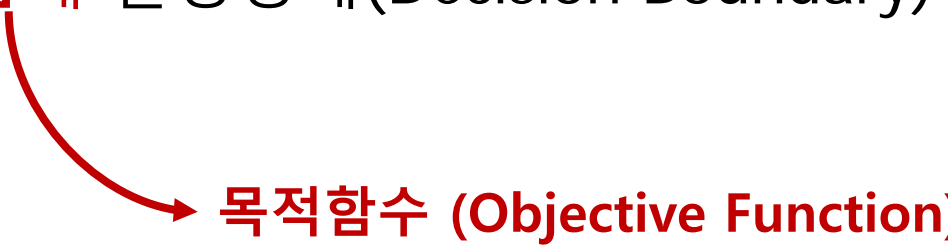
- Linear Discriminant Analysis (LDA)
- LDA Labs.
 - LDA vs PCA

***Topic Model인 Latent Dirichlet Allocation (LDA) 와 약자가 동일하니 주의

Discriminant Analysis

- DA Method
 - Linear Discriminant Analysis (LDA) – 선형판별분석법
 - Quadratic Discriminant Analysis (QDA) - 이차판별분석법

Discriminant Analysis

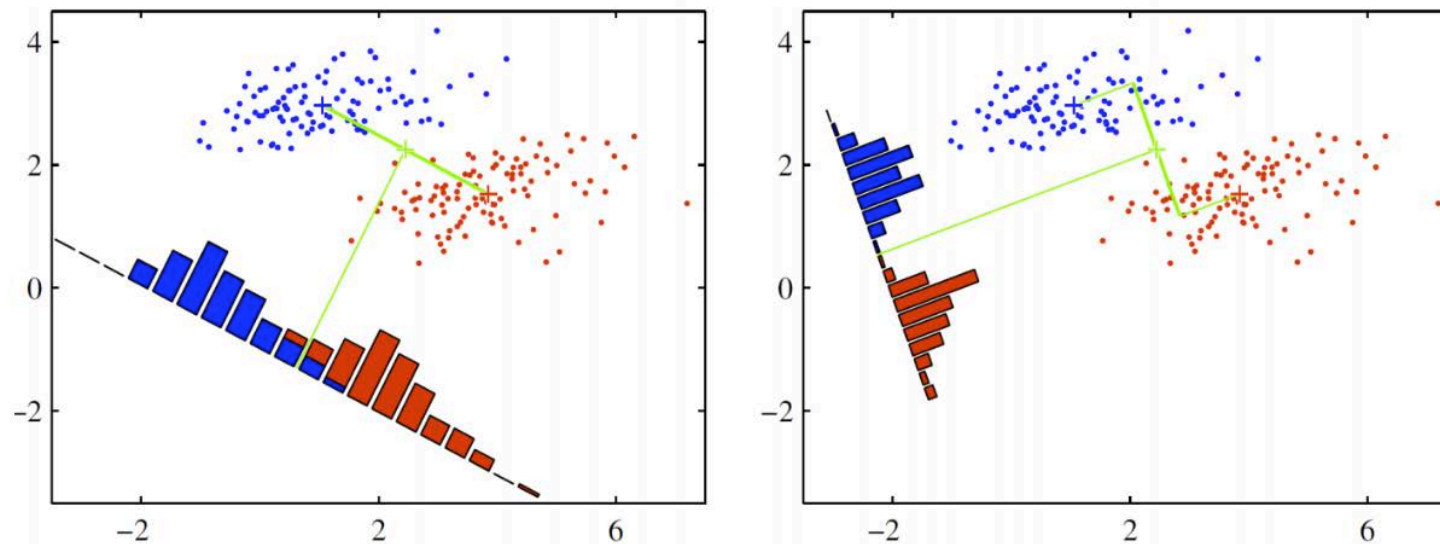
- Linear Discriminant Analysis (LDA)
 - 선형판별분석법
- Definition
 - LDA는 데이터 분포를 학습해 결정경계(Decision Boundary)를 만들어 데이터 분류(Classification) 하는 모델

목적함수 (Objective Function)
- LDA is most commonly used as dimensionality reduction technique.



Goal of LDA

- Goal
 - LDA는 아래 그림처럼 데이터를 특정 한 축에 사영(projection)한 후에 두 범주를 잘 구분할 수 있는 직선을 찾는 것



- Optimization
 - 사영 후 두 범주(class)의 중심(mean)이 서로 멀도록, 그 분산이 작도록

Goal of LDA

- Objective Function

$$J(w) = \frac{(m_1 - m_2)^2}{s_1^2 + s_2^2} = \frac{w^T S_B w}{w^T S_W w}$$

$$S_B = (m_1 - m_2)(m_1 - m_2)^T$$

평균 거리 클수록

$$S_W = \sum_{n \in C_1} (x_n - m_1)(x_n - m_1)^T + \sum_{n \in C_2} (x_n - m_2)(x_n - m_2)^T$$

분산 작을 수록

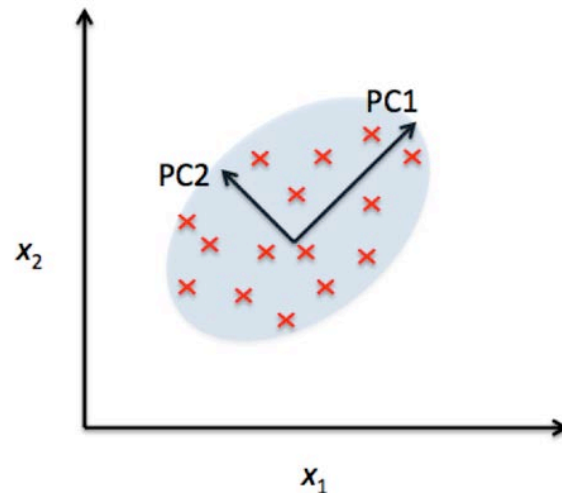
$J(w)$ 목적 함수가 최대가 되는 파라미터(w)를 찾으면 된다.

해결책은 w 로 미분해서 0이 되는 지점을 찾아 평균거리는 멀고 (분자), 각각의 분산은 작은 해를 얻는다.



PCA vs LDA

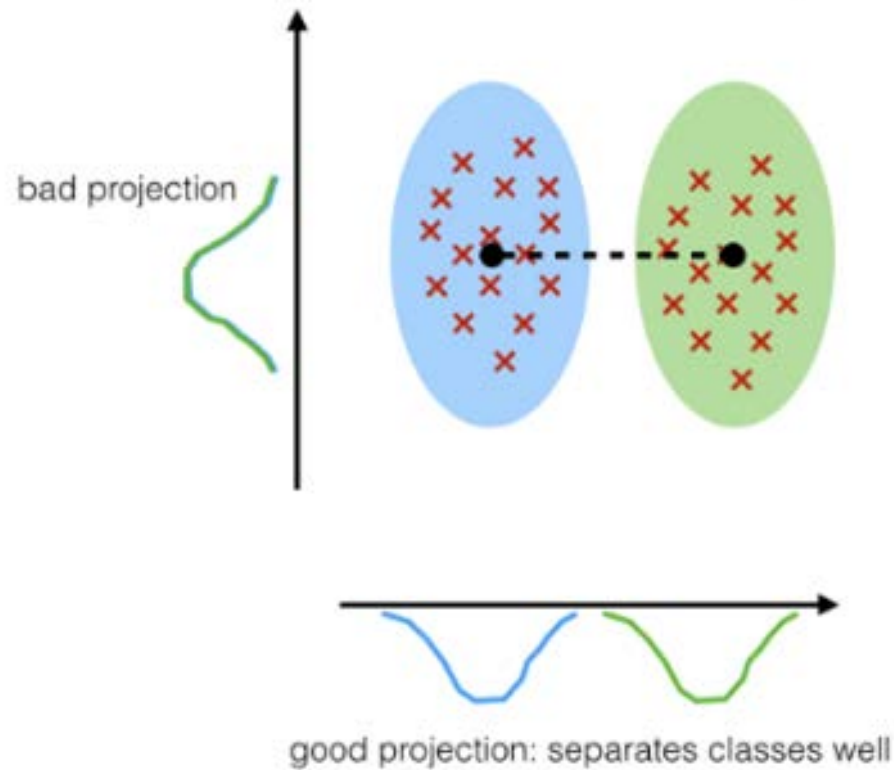
- Feature Elimination
 - Reducing the feature space by elimination feature
- Feature Extraction
 - Dropping the “least important” variables while still retaining the most valuable parts of all the variables





PCA vs **LDA**

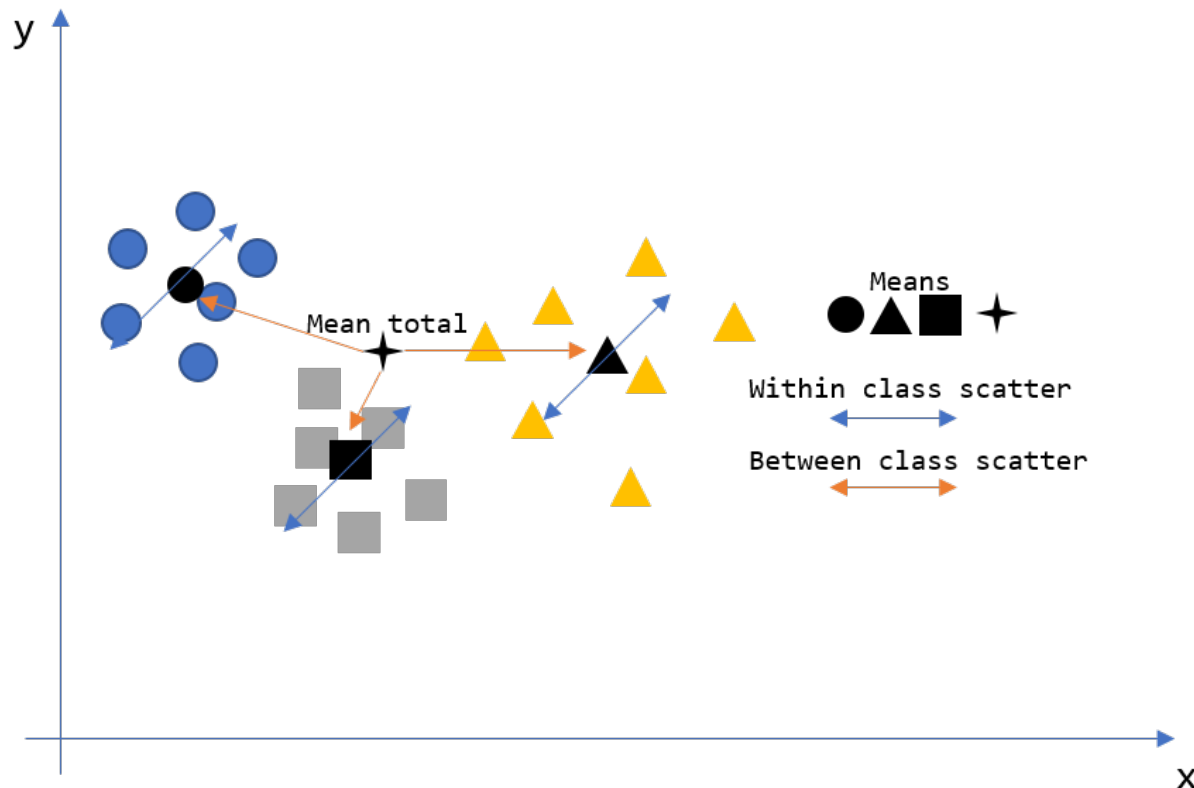
- Feature Transformation → Projection
 - Applying a function to that site to separately analyze multiple classes of objects





PCA vs LDA

- Feature Transformation → Projection
 - Applying a function to that site to separately analyze multiple classes of objects

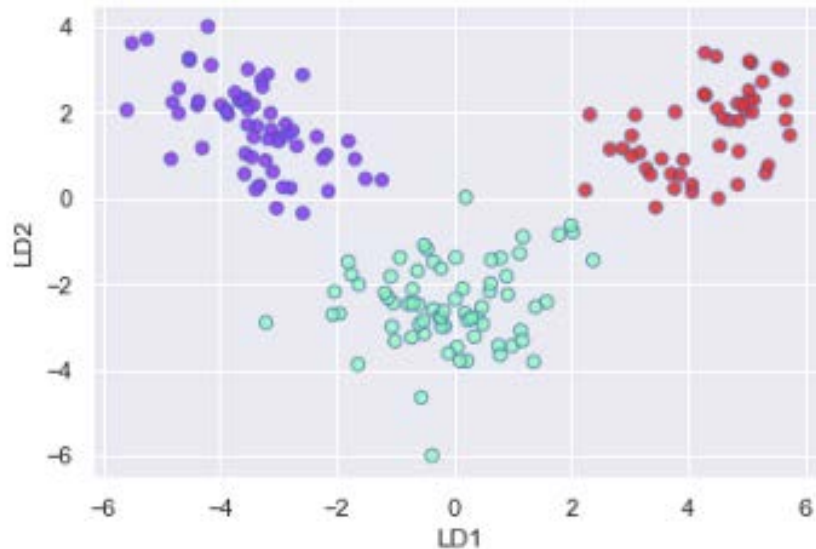


Inter-Class: within Class Scatter
Intra-Class: Between Class Scatter

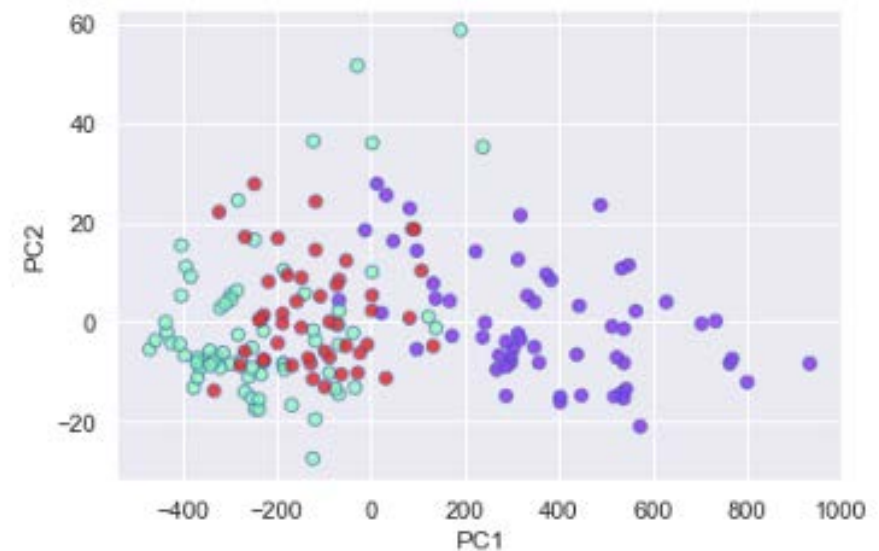
Labs. (PCA vs LDA)

- LDA is separable, PCA is not separable.
- https://colab.research.google.com/drive/1Wer0UjnnReGgp_np4vo3hW_FXzfCtTlx

LDA



PCA



Labs: Application

- DIGITS dataset
 - PCA vs LDA
 - https://colab.research.google.com/drive/1WXqdYcMmJ0AZeAnqTiFuqU_SssgXpOCt