

Machine Learning



Lab 11: k-means clustering / gradient descent

Task 1.

In this exercise you will implement a gradient descent procedure to find the minimum of a function.

- A. Create a function that calculates $f[x_1, x_2, x_3] = (x_1 - 1)^2 + (x_2 - 3)^2 + (x_3 + 2)^2$.
- B. Create a function that calculates the gradient of a function numerically.
- C. Create a gradient descent procedure to find the minimum of f .
- D. The minimum of f is clearly at $(1, 3, -2)$. Count the number of iterations until the gradient descent procedure reaches a point within $1e-6$ of this minimum
- E. Try out different step-size parameters η and observe how this affects the speed of convergence.

Task 2.

In this exercise you will implement the k-means clustering algorithm for unsupervised learning. It is based on the data generation implemented in Lab 03.

- A. Go back to Lab03 and generate 3 clusters with random cluster means and 100 random normal distributed points each.
- B. Run the k-means clustering algorithm from sklearn and compare the estimated cluster means with the cluster means you used for generating the data.
- C. Implement the k-means clustering algorithm yourself and compare the results.