Exercise 1: Grid search vs random search

(implementation exercise)
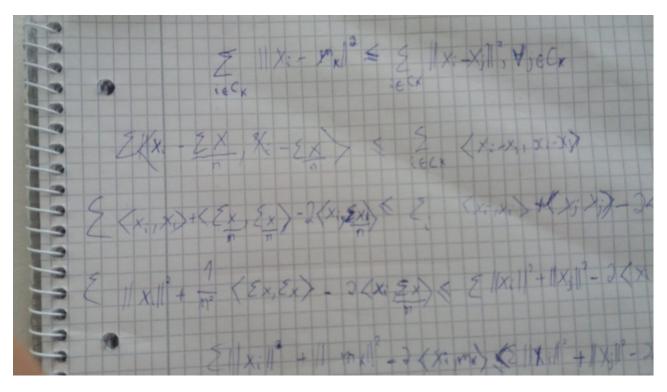
Exercise 2: Implement Multi-dimensional scaling MDS

(implementation exercise)

Exercise 3: Implement Isomap

(implementation exercise)

Exercise 4: k-means and kernel k-means

(a)

$$\sum \|X_i\|^2 + \sum_i^n \|m_K\|^2 - 2\sum \langle x_i, m_K \rangle \leq \sum \|X_i\|^2 + \sum \|X_j\|^2 - 2\sum \langle x_i, x_j \rangle$$

$$\sum \|m_K\|^2 - 2\sum \langle x_i, m_K \rangle \leq \sum \|X_j\|^2 - 2\sum \langle x_i, x_j \rangle$$

$$n\|m_K\|^2 - 2\left(\langle x_1, m_K \rangle + \langle x_2, m_K \rangle + \dots \right) K$$

$$x_1 \cdot n \cdot m_{K1} + x_{12} \cdot m_{K2} + \dots \quad 2 x_{21} \cdot m_{K1} + \dots$$

$$\underline{m \overset{\sim}{\Longrightarrow} K}$$

$$n\|m_K\|^2 - 2\langle \sum x_i, n m_K \rangle \leq \sum \|X_j\|^2 -$$

$$n\|m_K\|^2 - 2\langle n m_K, n m_K \rangle$$

$$n\|m_K\|^2 - 2n^2\|m_K\|^2 \leq \langle n m_K, n m_K \rangle - 2\sum \langle x_i, x_j \rangle$$

$$n\|m_K\|^2 - 2\langle \sum x_i, n m_K \rangle \leq \sum \|X_j\|^2 -$$

$$n\|m_K\|^2 - 2\langle n m_K, n m_K \rangle$$

$$n\|m_K\|^2 - 2n^2\|m_K\|^2 \leq \langle n m_K, n m_K \rangle - 2\sum \langle x_i, x_j \rangle$$

$$n\|m_K\|^2 - 2n^2\|m_K\|^2 \leq n^2\|m_K\|^2 - 2\sum \langle x_i, x_j \rangle$$

$$n^2\|m_K\|^2 - 2\langle n m_K, n m_K \rangle$$

$$n^2\|m_K\|^2 - 2n^2\|m_K\|^2$$

$$n\|m_K\|^2 - 2n^2\|m_K\|^2 \leq -n^2\|m_K\|^2 \rightarrow n\|m_K\|^2 \leq n^2\|m_K\|^2$$