Cluster Geometry (COMP4330)

The previous assignment has shown clusters of measurements at close angles. The angles where these clusters occur change with each data set. Design and implement an algorithm which characterizes these changes.

Hint: Isolate clusters $C_m$ of $m$ valid distance measurements in a data set. Find candidates $C_m', C_n'$ for corresponding clusters from successive data sets. In order to characterize the relation between the candidates, find an angle $\beta$ which applied as rotation to the second cluster produces the best correlation between these two clusters. As a measure for the correlation you may use the normalized sum over all differences $d_k$ between a measurement $n_k$ from the second cluster $C_n'$ and the linear interpolation between the neighboring measurements $m_i$ and $m_{i+1}$ from the first cluster $C_m$:

$$\frac{1}{k} \cdot \sum_k d_k = \frac{1}{k} \cdot \sum_k \left| m_i + (m_{i+1} - m_i) \cdot \frac{\beta - \alpha_i}{\alpha_{i+1} - \alpha_i} - n_k \right|$$

For the laser range finder $\alpha_{i+1} - \alpha_i = 0.5^\circ$ and $0 \leq (\beta - \alpha_i) \leq 0.5^\circ$. 

![Diagram of cluster geometry](image)