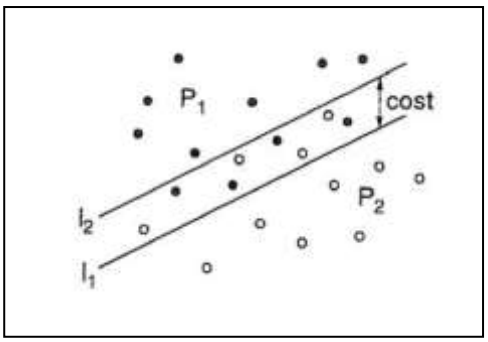
CG Homework Assignment Set – 05

Total points: 30; Credit: 10%

1 (10 points). You are given two sets of points in the plane, P_1 and P_2, where $|P_1 \cup P_2| = n$. A partial classifier is a pair of lines l_1 and l_2, such that all the points of P_1 lie on or above l_1 and all the points of P_2 lie on or below l_2. The cost of the partial classifier is the vertical distance between these lines (see the figure below). Give a geometric interpretation of a partial classifier in the dual plane. What is the cost in the dual setting?



2 (10 points). Given a set of n data-points in the 2D-plane and an axis-parallel rectangular box R, the problem is to report all data points included in box R. Show that this problem can be solved using *kd*-tree in $O(\sqrt{n} + k)$ time, where k is the number of data points included in the rectangular query-box. Write the recurrence relation and justify the proof.

3 (10 points). In a town, all streets are axis-parallel (i.e., the network resembles a rectangular grid), and two consecutive parallel streets are 0.5 *km* apart. There are n houses scattered around the town. A pizza company wants to set up delivery stations in different locations. Assume that all houses and delivery stations are located just on grid intersections. The time for delivery in minute from a station $s(x, y)$ to a house $h(w, z)$ is equal to the taxi-cab distance between s and h , i.e., $|x - w| + |y - z|$, in *km*. Sketch an algorithm that minimizes the number of pizza-delivery stations so that any order can be honoured in at most 15 minutes. Discuss its complexity.

Issued on 25 March 2022, **Due:** 4 April 2022, 11:55 pm; Please submit on Moodle by the due date.