Exercise 1
Machine Learning in Graphics & Vision

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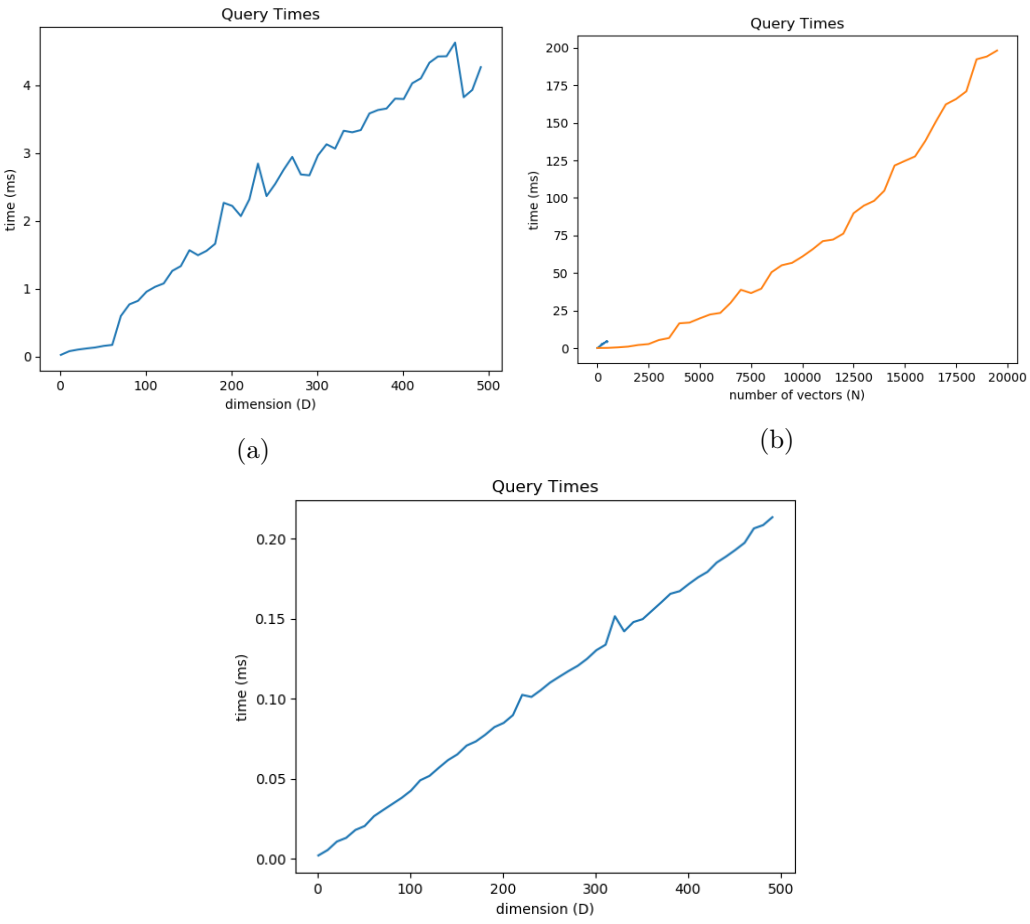
1 Task 1

(a) The complexity of the method in subtask (a) is $O(d * n^2)$ where d is the dimension of feature vector and n is the number of examples.

(b) A single vector has to be compared with
30 FPS $*120$ s $= 3,600$ frames $= 3,600 * N$ vectors $= 7.2 * 10^7$ vectors
in one video, and each one of these has to be compared with all of the vectors from another video (i.e. $7.2 * 10^7$ vectors as well).
There are therefore $128 * 7.2^2 * 10^{14}$ comparisons. Assuming that the machine can compute $3 * 10^9$ comparisons in a second, it would take $221,184,000$ s ≈ 7.0137 years to find all matchings of the vectors between two different 2 minute long videos (30 FPS) using `exhaustive_search`.



(a) (b)

(c)

Figure 1: Plot of results from task 1

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(c) Query times in both, exhaustive and KDTree search grow linearly as the number of dimensions increases. However, KDTree is us for datasets with more dimensional vectors up more than 20 times faster. This implies that another variable, the number of vectors in the dataset, is the source of this difference.