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**PROJECT REPORT**

On

PROGRAM IMPLEMENTATION OF KNN ALGORITHM FOR DETECTION OF PROSTATE CANCER USING A GIVEN DATASET

*Submitted in partial fulfilment of the requirement for the award of Degree of**Bachelor of Engineering for the course Data Mining*

*in*

*Computer Science and Engineering*

*Submitted by:*

|  |  |
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Department of Computer Science and Engineering

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2021-2022

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**CERTIFICATE**

This is to certify that the **PROGRAM IMPLEMENTATION OF KNN ALGORITHM FOR DETECTION OF PROSTATE CANCER USING A GIVEN DATASET** is an authentic work carried out by **Rishabh S(1NT19CS157)**, **Bhargav D Bhat (1NT19CS053),Rohan Thomas(1NT19CS162) and Ravi Kiran Reddy B H(1NT19CS154)**  bonafide students of **Nitte Meenakshi Institute of Technology**, Bangalore in partial fulfilment for the award of the degree of ***Bachelor of Engineering*** in COMPUTER SCIENCE AND ENGINEERING of Visvesvaraya Technological University, Belagavi during the academic year ***2021-2022.*** It is certified that all corrections and suggestions indicated during the internal assessment has been incorporated in the report. This project has been approved as it satisfies the academic requirement in respect of project work presented for the said degree.

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|  | |  | |
|  | | 2. | |

**DECLARATION**

We hereby declare that

(i) The project work is our original work

(ii) This Project work has not been submitted for the award of any degree or examination at any other university/College/Institute.

(iii) This Project Work does not contain other persons’ data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

(iv) This Project Work does not contain other persons’ writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:

a) their words have been re-written, but the general information attributed to them has been referenced.

b) where their exact words have been used, their writing has been placed inside quotation marks, and referenced.

(v) This Project Work does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the References sections.

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Date: 19/01/2022

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**1.Introduction**

**1.1 Motivation**

Significant advances in information technology results in excessive growth of data in health care informatics [1]. Health care informatics data includes hospital details, patient’s details, disease details and treatment cost. These huge data are generated from different sources and format. It can have irrelevant attributes and missing data. Applying data mining techniques is a key approach to extract

knowledge from large disease data. Data mining has various methods to extract knowledge from huge disease data set. Data mining techniques like classification, clustering and rule mining can be used to analyze data and extract meaningful information. Some of the important

current applications of data mining in health care includes predicting the future outcomes of diseases based on previous data collected from similar diseases, diagnosis of disease based on patient data, analysing treatment costs and demand of resources, pre-processing of noisy, missing

data and minimizing the time to wait for the disease diagnosis. Data mining tools like Weka, Rapid miner, and Orange [2, 3, 4] are used to analyze and predict better result for health care data. New and current data mining tools and technologies are used in disease diagnosis and health care

informatics to improve the health care services in cost effective manner and minimizing the time for disease diagnosis.

**1.2 Problem Domain**

**Data Mining**

It is concerned with the process of computationally extracting unknown knowledge from huge

sets of data. Extraction of useful knowledge from the enormous data sets and providing decision-making results for the diagnosis and treatment of diseases is very important. Data mining can be used to extract knowledge by analysing and predicting various diseases. Health care

data mining has great potential to discover the hidden patterns in the data sets of the medical domain. Various data mining techniques are available with their suitability dependent on the health care data. Data mining applications in health care can have a wonderful potential and effectiveness. It automates the process of finding predictive information in huge databases. Disease prediction plays an important role in data mining. Finding of a disease requires the performance of a number

of tests on the patient. However, use of data mining techniques, can reduce the number of tests. This reduced test set plays significant role in performance and time. Health care data mining is an important task because it allows doctors to see which attributes are more important for diagnosis such as age, weight, symptoms etc. This will help the doctors diagnose the disease more efficiently.

Knowledge discovery in databases is the process of finding useful information and patterns in data. Knowledge discovery in databases can be done using data mining. It uses algorithms to extract the information and patterns derived by the knowledge discovery in databases process.

**1.3 Aim and Objectives**

Our aim or objective would be to use the K-Nearest Neighbour Regression algorithm to predict and classify information taken from an unsorted dataset into majorly two type of tumours. Namely Benign and Malignant types of tumours.

**2. Data Source and Data Quality**

**2.1 Dataset Used**

The dataset we selected to implement for KNN classification is the Prostate Cancer dataset.

It consists of 100 records which we further split into Train split that is 95 records and for test and validation we select 5 records.

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The dataset contains an ID that is the index number and Diagnosis result in the form of ‘M’ and ‘B’ for malignant and benign respectively.

It also contains 8 features used for prediction namely:

1. Radius
2. Texture
3. Perimeter
4. Area
5. Smoothness
6. Compactness
7. Symmetry
8. Fractal Dimension

**2.2 Data Pre-processing**

**The predict function:**

**Text

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Initially Data is read from the CSV file and stored in a python list. We first skip the initial line which contains the heading of the attributes and later as Diagnosis result is in the form of Alphabets, we assign binary numbers to them and store it in its place ( 1 for M and 0 for B) . As data is in the form of string, we convert each attribute into float and store it in process\_data python list.

**3. Methods & Models**

**3.1 Data Mining Questions**

**What is KNN?**

KNN: K Nearest Neighbor is one of the fundamental algorithms in machine learning. Machine learning models use a set of input values to predict output values. It is mostly used for classification. It classifies the data point on how its neighbor is classified. It classifies the new data points based on the similarity measure of the earlier stored data points. For example, if we have a dataset of tomatoes and bananas. It will store similar measures like shape and colour. When a new object comes it will check its similarity with the colour (red or yellow) and shape. K in KNN represents the number of the nearest neighbors we used to classify new data points.

**When and where do we use KNN?**

We use KNN

* When we have properly labelled data. For example, if we are predicting someone is having diabetes or not the final label can be 1 or 0. It cannot be NaN or -1.
* When data is noise-free. For the diabetes data set we cannot have a Glucose level as 0 or 10000. It’s practically impossible.
* Dataset is small.

**What are the Pros and Cons of KNN?**

**Pros:**

* No assumptions about data — useful, for example, for nonlinear data
* Simple algorithm — to explain and understand/interpret
* High accuracy (relatively) — it is pretty high but not competitive in comparison to better supervised learning models
* Versatile — useful for classification or regression

**Cons:**

* Computationally expensive — because the algorithm stores all the training data
* High memory requirement Stores all (or almost all) of the training data
* Prediction stage might be slow (with big K)
* Sensitive to irrelevant features and the scale of the data

**What are the Applications and Examples of KNN?**

* KNN can be used for Recommendation Systems. Although in the real world, more sophisticated algorithms are used for the recommendation system. KNN is not suitable for high dimensional data, but KNN is an excellent baseline approach for the systems. Many companies make a personalized recommendation for its consumers, such as Netflix, Amazon, YouTube, and many more.
* KNN can search for semantically similar documents. Each document is considered as a vector. If documents are close to each other, that means the documents contain identical topics.
* KNN can be effectively used in detecting outliers. One such example is Credit Card fraud detection.

**3.2 Data Mining Algorithm**

**Working of KNN Algorithm:**

* K-nearest neighbors (KNN) algorithm uses ‘feature similarity’ to predict the values of new datapoints which further means that the new data point will be assigned a value based on how closely it matches the points in the training set. We can understand its working with the help of following steps
* Step 1 − For implementing any algorithm, we need dataset. So, during the first step of KNN, we must load the training as well as test data.
* Step 2 − Next, we need to choose the value of K i.e., the nearest data points. K can be any integer.
* Step 3 − For each point in the test data do the following −
* 3.1 − Calculate the distance between test data and each row of training data with the help of any of the method namely: Euclidean, Manhattan or Hamming distance. The most commonly used method to calculate distance is Euclidean.
* 3.2 − Now, based on the distance value, sort them in ascending order.
* 3.3 − Next, it will choose the top K rows from the sorted array.
* 3.4 − Now, it will assign a class to the test point based on most frequent class of these rows.
* Step 4 – End

**Algorithm implementation:**

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Above image shows how the function is called. It takes 5 parameters namely the final processed data and the query list which contains the test set, knum or the k nearest neighbours number , distance function to ctypesct distance between the train set and test condition , choice function to calculate the majority voting condition.

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Here we have defined the knn algorithm. Initially we declare the neighbors empty list. Then for each of the data in the process\_data we calculate the distance from the test condition and store it in the distance list and then with their respective index we store it in the neighbors list.

We then sort them according to their distance in ascending order. then we select the first k neighbours and retrieve their labels and store them in k\_nearest\_labels list. When returning we return the k nearest distances with their index and majority voting result using the choice function that is the mean function.

Distance function (Euclidean distance):

The Euclidean distance between the 2 points is calculated using the formula shown below

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**3.3 Data Mining Models**

**KNN: Regression and Classification:**

A simple implementation of KNN regression is to calculate the average of the numerical target of the K nearest neighbors. Another approach uses an inverse distance weighted average of the K nearest neighbors. KNN regression uses the same distance functions as KNN classification.

Text

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The Euclidian distance measure is only valid for continuous variables. In the case of categorical variables, you must use the Hamming distance, which is a measure of the number of instances in which corresponding symbols are different in two strings of equal length.

Text, table

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Choosing the optimal value for K is best done by first inspecting the data. In general, a large K value is more precise as it reduces the overall noise; however, the compromise is that the distinct boundaries within the feature space are blurred. Cross-validation is another way to retrospectively determine a good K value by using an independent data set to validate your K value. The optimal K for most datasets is 10 or more. That produces much better results than 1-NN.

**4. Model Evaluation & Discussion**

Data representation using Graph:

Chart, scatter chart

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We consider 2 lists here i.e., ypoints and xpoints. ypoints contains the distance of each point from the test condition (considering the test condition to be at 0 distance from itself) and xpoints consists of its index. then using matplotlib.pyplot we annotate each point with its distance and plot the graph

With index of the point in the dataset on X-axis and its distance from the test set i.e. (X-axis) on the Y-axis.

**5. Conclusion & Future Direction**

Data mining techniques helps in finding the hidden knowledge in a group of disease data that can be used to analyze and predict the future behavior of diseases. Classification is one the data mining techniques which assigned a class label to a set of unclassified cases. The main objective of this project was to show that data mining algorithms such as KNN could certainly be used to efficiently predict and classify information. Future direction in this field is not limited to but can include creation of much faster and more efficient algorithms that perform similar functions.

**References**

1.) towardsdatascience

**Appendices**

**a**. **Dataset Link:**

<https://www.kaggle.com/alihantabak/prostate-cancer-predictions-with-ml-and-dl-methods/data>

**b. Python Code:**

**knn\_.py file**

*from* knn\_func *import* knn,euclidean\_distance,mean

def predict(*query*,*knum*):

    raw\_data = []

*with* open('Prostate\_Cancer.csv','r') *as* md:

        next(md)

*for* line *in* md.readlines():

            data\_row = line.strip().split(',')

            raw\_data.append(data\_row)

*#print(raw\_data)*

    process\_data = []

*for* row *in* raw\_data:

*if*(row[1]=='M'):

            row[1]=1

*else*:

            row[1]=0

        data\_row = list(map(float,row[1:]))

        process\_data.append(data\_row)

*#print(process\_data)*

    res, \_ = knn(

        process\_data, *query* , *knum*,

*distance\_fn*=euclidean\_distance, *choice\_fn*=mean

    )

*#print(round(\_))*

    res1 = round(\_)

*if*(res1==1):

        print("M")

*else*:

        print("B")

    print(res)

query1 = [21,24,74,413,0.09,0.075,0.162,0.066]

predict(query1,5)

**knn\_func.py file**

*import* math

*import* matplotlib.pyplot *as* plt

*#import numpy as np*

def knn(*data*, *query*, *k*, *distance\_fn*, *choice\_fn*):

    neighbor\_distances\_and\_indices = []

*for* index, data1 *in* enumerate(*data*):

*#print(index,data1)*

        distance = *distance\_fn*(data1[1:], *query*)

        neighbor\_distances\_and\_indices.append((distance, index))

    sorted\_neighbor\_distances\_and\_indices = sorted(neighbor\_distances\_and\_indices)

    ypoints = []

    xpoints = []

*for* dist,index *in* sorted\_neighbor\_distances\_and\_indices:

        ypoints.append(dist)

        xpoints.append(index)

        label = "{:.2f}".format(dist)

        plt.annotate(label,(index,dist),*ha*='left')

    plt.plot(xpoints,ypoints,'o')

    plt.show()

*#print(sorted\_neighbor\_distances\_and\_indices)*

    k\_nearest\_distances\_and\_indices = sorted\_neighbor\_distances\_and\_indices[:*k*]

    k\_nearest\_labels = [*data*[i][0] *for* distance, i *in* k\_nearest\_distances\_and\_indices]

*return* k\_nearest\_distances\_and\_indices , *choice\_fn*(k\_nearest\_labels)

def mean(*nums*):

*#print(sum(nums))*

*return* sum(*nums*) / len(*nums*)

def euclidean\_distance(*point1*, *point2*):

    sum1 = 0

*for* i *in* range(len(*point1*)):

        sum1 += math.pow(*point1*[i] - *point2*[i], 2)

*return* math.sqrt(sum1)

**c. Setup to execute the code:**

1.Installation of python

2.Any text editor