CPSC Project 2 MPI KNN

a. Project 2 submission
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b.

474-Project2

Project 2: Implement a distributed algorithm using MPI

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c. Algorithm Pseudocode
   i. Data is read into program, function parser(), will separate the data into the training data and queries for the KNN algorithm and return it back as a dataset.

```
parser(int queries, int instances, int cols, string filename){
  file = file.open(filename)
  buffer = string
  dataset = dataset()

  while(not end of file){
    for x amount of instances
      for y amount of cols
        dataset.trainingData[x][y] = buffer

    for x amount of queries
      for y amount of cols
        dataset.query[x][y] = buffer

    return dataset
  }
}
```

   ii. Rank 0 finds the number of queries per process, done in function knn()

```
knn(dataset, query, k) {
    // MPI_scatter from rank 0 process
    if rank == 0:
        get num_processes from argv
        split_size = dataset.size()/num_processes
        send dataset splits and query to processes
    else:
        Each process should
            distances = []
            for each datapoint in split
                distances.push(distance(query, datapoint))
            send distances to rank 0

    r = recombine(dataset_splits) // MPI_gather
    sort(r) //sorted in ascending ordre

    classes = map<class, int>
    for class in r[i] = r[:k]
        classes[class]++;
    sort(classes.begin(), classes.end(), cmp_fn)
    // cmp_fn to compare the counts of the elements in classes

    return classes.begin().element
}
```

iii. Rank zero sends each process the set of queries to be process and each process performs KNN and sends the classification values back to be store in a vector

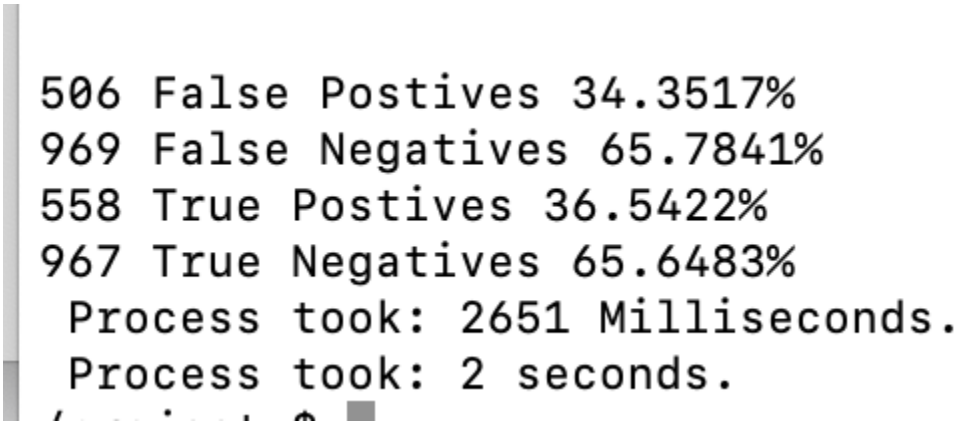
```
if (rank == 0){
    predicted_total[] //Keeps track of recieved splits when condition is met
    receive_split[] // Splits recived from process
    for x in size of processes:
        MPI_Recv(start_from_other_process)
        MPI_Recv(end_from_other_process)

        MPI_Recv(recive_split)

        for y = start_from_other_process, if y <= end_from_other_process, increment y:
            predicted_total[j] = receive_split[x]
}else{
    MPI_Send(start)
    MPI_Send(end)
    MPI_Send(predicted split)
}
```

iv. Rank Zero collects all the data and creates a scoring matrix and displays the time taken,this is done in main()

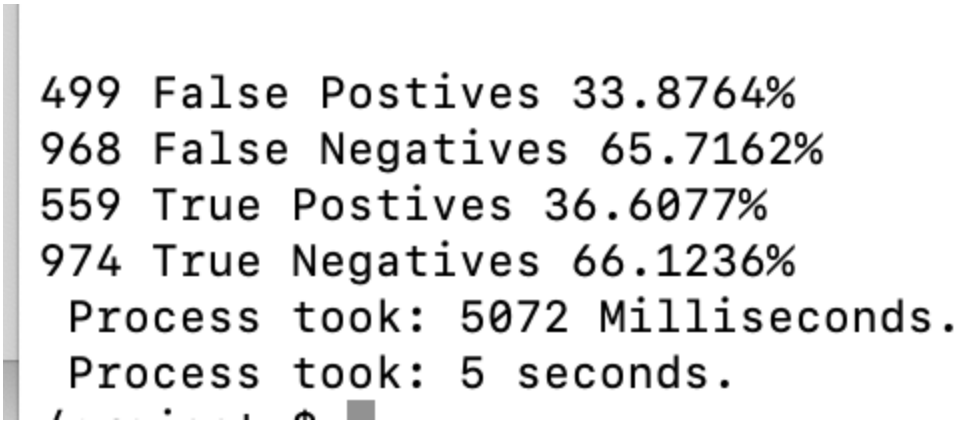
```
MPI_Finalize()

if (rank == 0){
    double true_positive
    double false_positive
    double true_negative
    double false_negative
    int classification = argv

    for x in the number of quieries
        if(query == true_positive):
            true_positive++
        else if (query == false_positive):
            false_positive++
        else if (query == true_negative):
            true_negative++
        else if (query == false_negative):
            false_negative++
}
//Display all results
```

d. In order to run the code type sh r.sh
   i. Alternatively you can change the arguments or run it as follows
   ii. mpic++ -std=c++11 knn.cc -o knn
   iii. mpirun -n 5 ./knn 3000 7000 5 30 testdata.txt
   iv. argv[1] = number of queries, argv[2] = number of training instances argv[3] = number of columns in training instance, argv[4] = how many neighbors argv[5] = name of textfile for training data

e. Snapshot of code executed 3 distinct screenshots
   i. 5 Processes



   ii. 2 Processes



iii. 1 Process