Project 2: Feature Selection with Nearest Neighbor

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Solution:

Dataset	Best Feature Set	Accuracy
Small Number: 54	Forward Selection = {9, 1 ,7}	0.91
	Backward Elimination = {1, 7, 9}	0.95
	Custom Algorithm = Not implemented	NA
Large Number: 54	Forward Selection = {25, 33 ,39}	0.965
	Backward Elimination = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 21, 23, 24, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 40}	0.778
	Custom Algorithm = Not implemented	NA

----------<Begin Report>----------

In completing this project, I consulted following resources:

For graphing purposes: https://www.w3schools.com/python/matplotlib_markers.asp

Syntax help purposes

- Reading/Writing files:
  https://mkyong.com/python/python-difference-between-r-w-and-a-in-open/

  https://docs.python.org/3/library/csv.html
https://stackoverflow.com/questions/19143667/how-to-read-a-csv-without-the-first-column

- Setting up function variables:

  https://www.geeksforgeeks.org/python-infinity/

  https://www.geeksforgeeks.org/round-function-python/

  https://www.w3schools.com/python/ref_dictionary_keys.asp

  https://www.journaldev.com/45109/normalize-data-in-python

- General library help: https://docs.python.org/3/library/

I. Introduction

In the first phase, we are designing a greedy forward and backward selection feature search with a dummy evaluation function that returns a random number. Feature selection starts with the empty set and adds one feature at a time, whereas backward selection starts with the full set of features and removes one feature at a time. In this project, we are trying to find the subset of features that has the maximum score using the evaluation function. The evaluation function takes a node as input and calculates the accuracy percentage score for that node as the output.

In the second phase, we are replacing the stub evaluation function by creating the official Classifier and Validator class. The Classifier class serves as a helper class for the Validator class. It keeps the data points from the file and parses them to the respective variables, such as Euclidean distance and classifier variable. for future usage to return the nearest neighbor operations and set accuracy. The Validator class is using the evaluation function by referencing the Classifier function to perform a leave_one_out_validation operation for the feature and backward selection algorithms' current node. Another major component of the second phase is the operation of opening and reading data set files where it acts as our raw input, and the goal is to analyze its data by calculating the subset accuracies through our selection algorithms.

In the third and final phase, we are mainly cleaning up our code, and adding more features so that we can interpret and present the given data better. We are given our two additional personal datasets and will be using CS170_Spring_2022_Small_data__54.txt and CS170_Spring_2022_Large_data__54.txt datasets. During the process, we will be normalizing the data by using pandas and computing the default accuracy for each dataset. In order to plot our graphs, we will be using matplotlib functions to create our preferred visualization. After we collect the desired results from our 4 datasets, can conclude by finishing the project report.

II. Challenges

We will break down into two categories: Main Challenges and Minor Challenges

Main Challenges:

1. Designing the two feature selection algorithms
    a. Finding methods to convert Matlab pseudocode to python
    b. Backward selection takes more time since your only major clue is from the forward selection algorithm
    c. Using deep copy for python in a correct logic and syntax, performing for loops of features without overestimating/underestimating the bounds

2. Implementing Classifier Class
    a. I underestimate how important this class is going to be for this project since it contains the bulk of the inputs and outputs
    b. As a result, a huge chunk of time is spent on debugging reading the file, parsing it to respective variables, and processing it correctly.
        i. With many choices to pick from, there is a lot of time spent contemplating which library to use (NumPy, CSV, pandas) to read and parse our datasets and implementing a working code
    c. Creating the train() and test() function
        i. A lot of time was spent trying to use NumPy to read our file, but not able to find a way to convert it to a floating-point format from a list() format. Finally was able to find an alternative and cleaner way to read the data by using the CSV method

Minor Challenges:

1. Designing the Validator function
    a. Was stumped on why the output accuracy was 100% for the first two sets. Later realized that I made a careless mistake by forgetting that the array is being saved locally.
    b. I'm not sure if my implementation of the Warning if statements, or the accuracy calculation is correct or not since the result is short of the true solution
        i. example: set {3, 5} accuracy is higher than {3, 5, 7}
2. Implementing the visualization function using matplotlib
    a. Recall CS009P plotting lab work and other online resources that focus on using matplotlib to plot out the data
3. Creating the tracing function for selection algorithms and NN

III. Code Design

For this part, I will break down each numbered 'cell' (from JupyterLab) that contains the code for this project.

1st cell: The first cell contains my main() function, where the 'user' will only have to interact with selecting which algorithm to use, the two features to plot, and the file name will be used by calling the Helper Class, which we will discuss later.

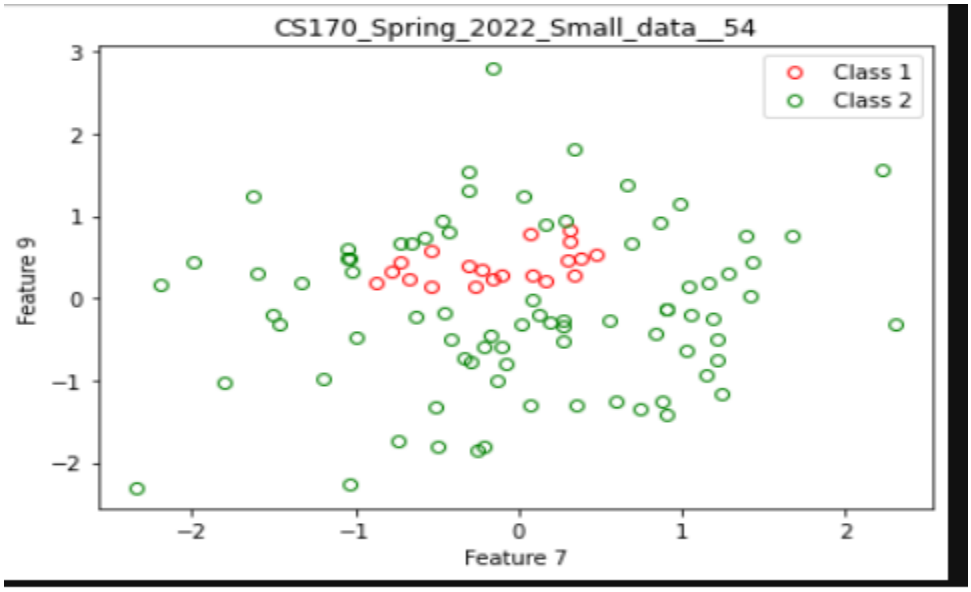
2nd cell: The second cell contains the Classifier class, which is the most important component of this project in my opinion. When the Helper Class initializes the filename and algorithm choice, it is the job of the Classifier class to deliver. First, the train() function is called to read the data from the respective file and filter out the data to essential variables such as self.kRows and self.numFeatures for later usage. Then, the test() function will be called to use the previously trained data for parsing to get the accuracy for each subset by using the nearest neighbor algorithm. Within this class, we create the plotFeatures function to plot our two feature data from our user inputs.

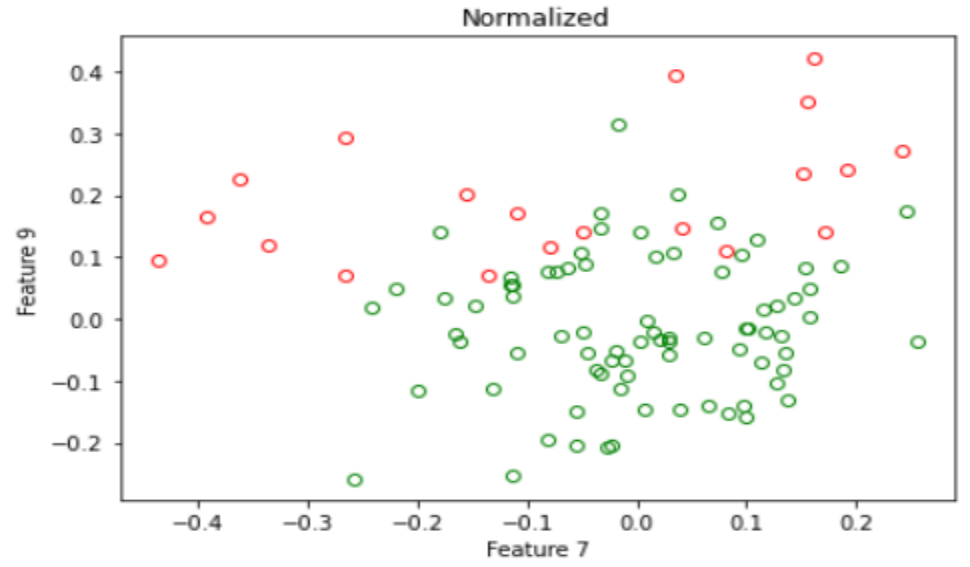
3rd cell: The third cell contains the Validator class. Although this is the smallest class for this project, I believe that it is still very important since our realEvaluation function will rely on it to pass in the current node/subset and return an accurate accuracy for each respective node/subset.

4th cell: The 4th cell contains the Helper class, which is the biggest chunk of our project and the second most important part of this project. This class is first used in the first cell main function() as a method to retrieve data variables from the Classifier and Validator class for our selection algorithms to use. First, our start() function will initiate and call the train() function from the Classifier class to initialize the dataset data, and take the user inputs for two features in plotting our graph before any algorithm runs. After start() is finished, the user can pick an algorithm of choice by using our Helper class function. Finally, before running either the forward or backward selection algorithm, we can compute the default accuracy by using the defaultAccuracy() function, which calculates the accuracy similar to the Classifier's test() method, but by using a local dictionary variable to initialize self.contents, and kRows() function to call self.kRows variable from Classifier class.

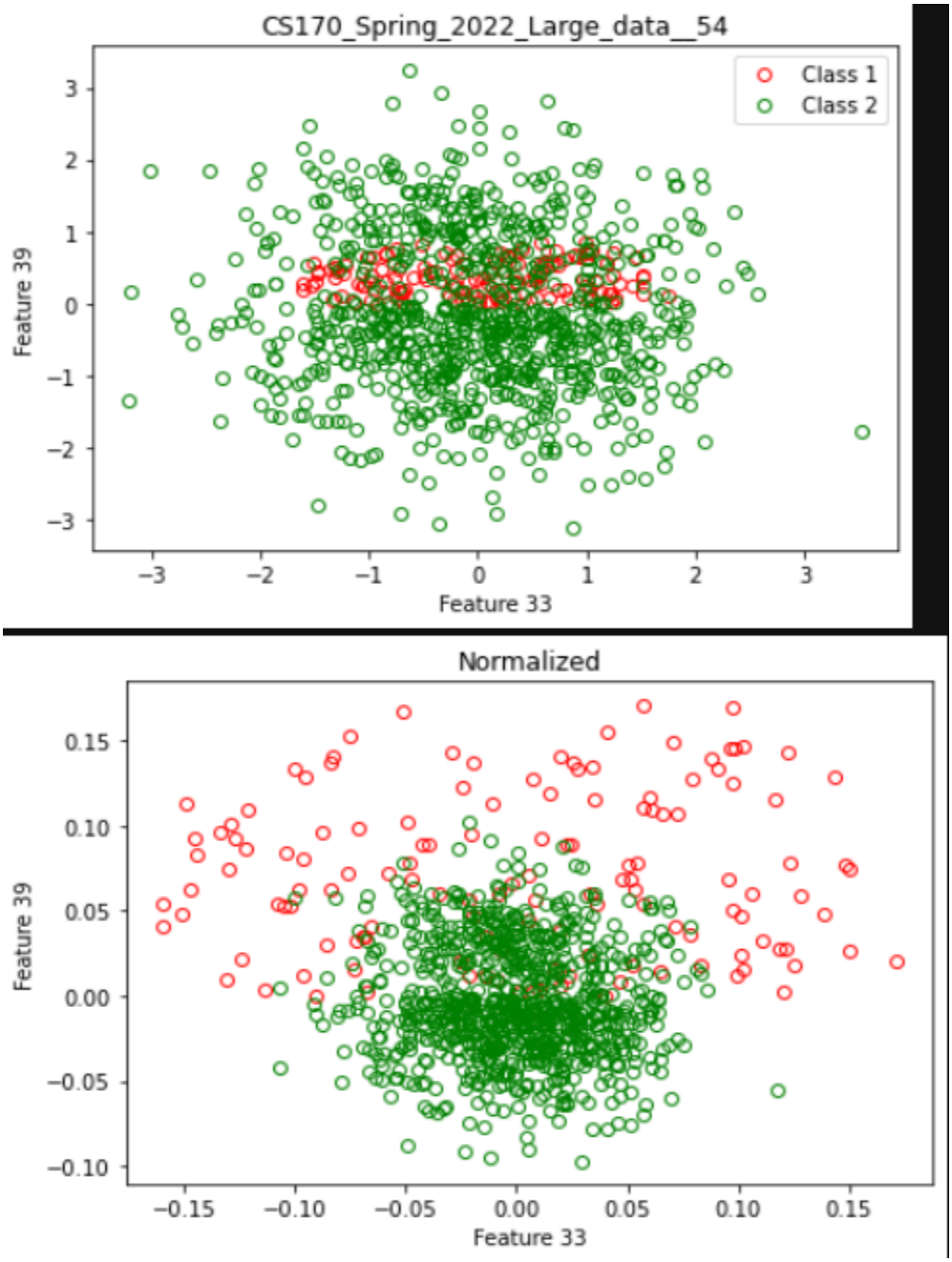
IV. Dataset details

Small Dataset 54: Number of features: 10, number of instances: 100

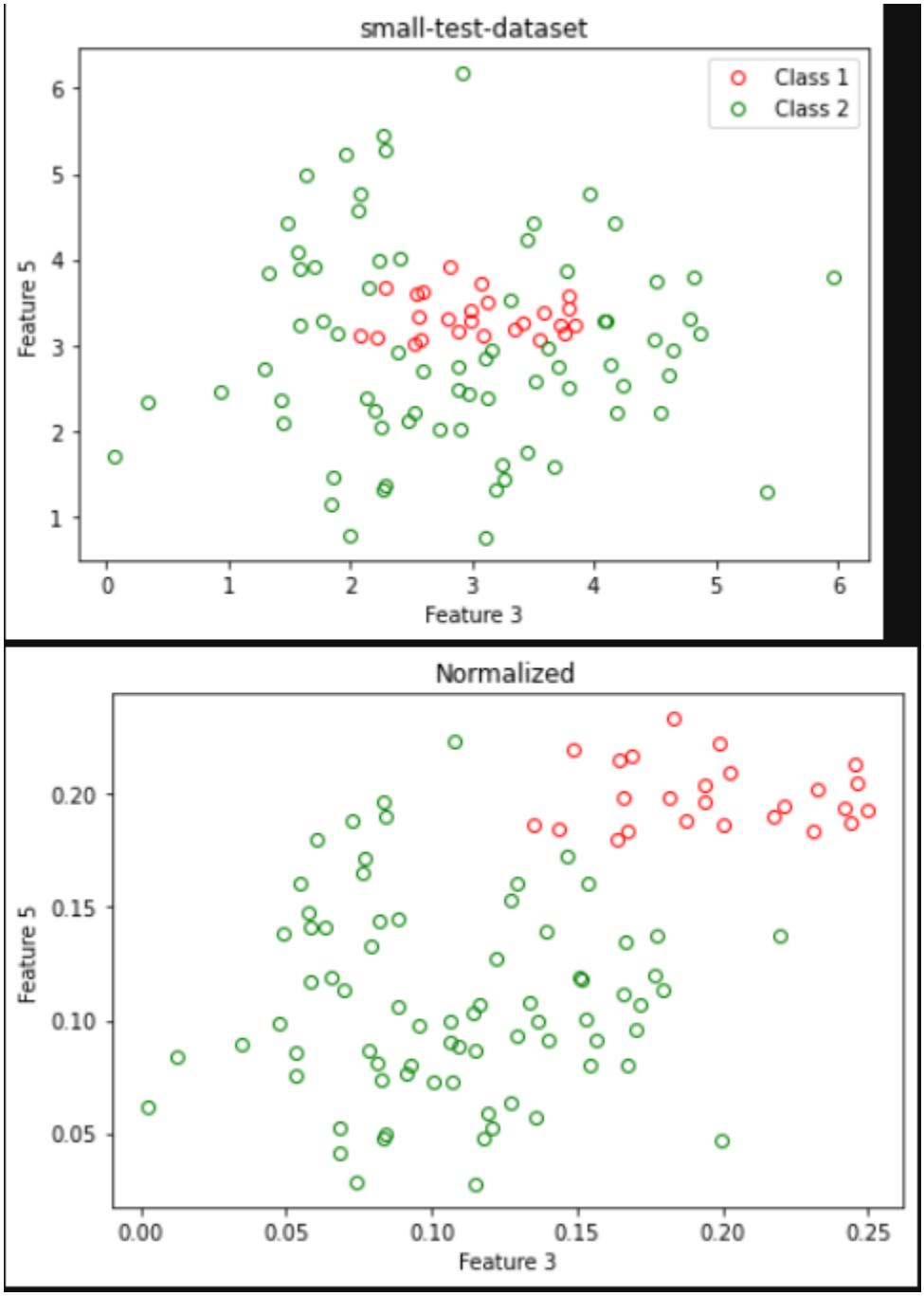




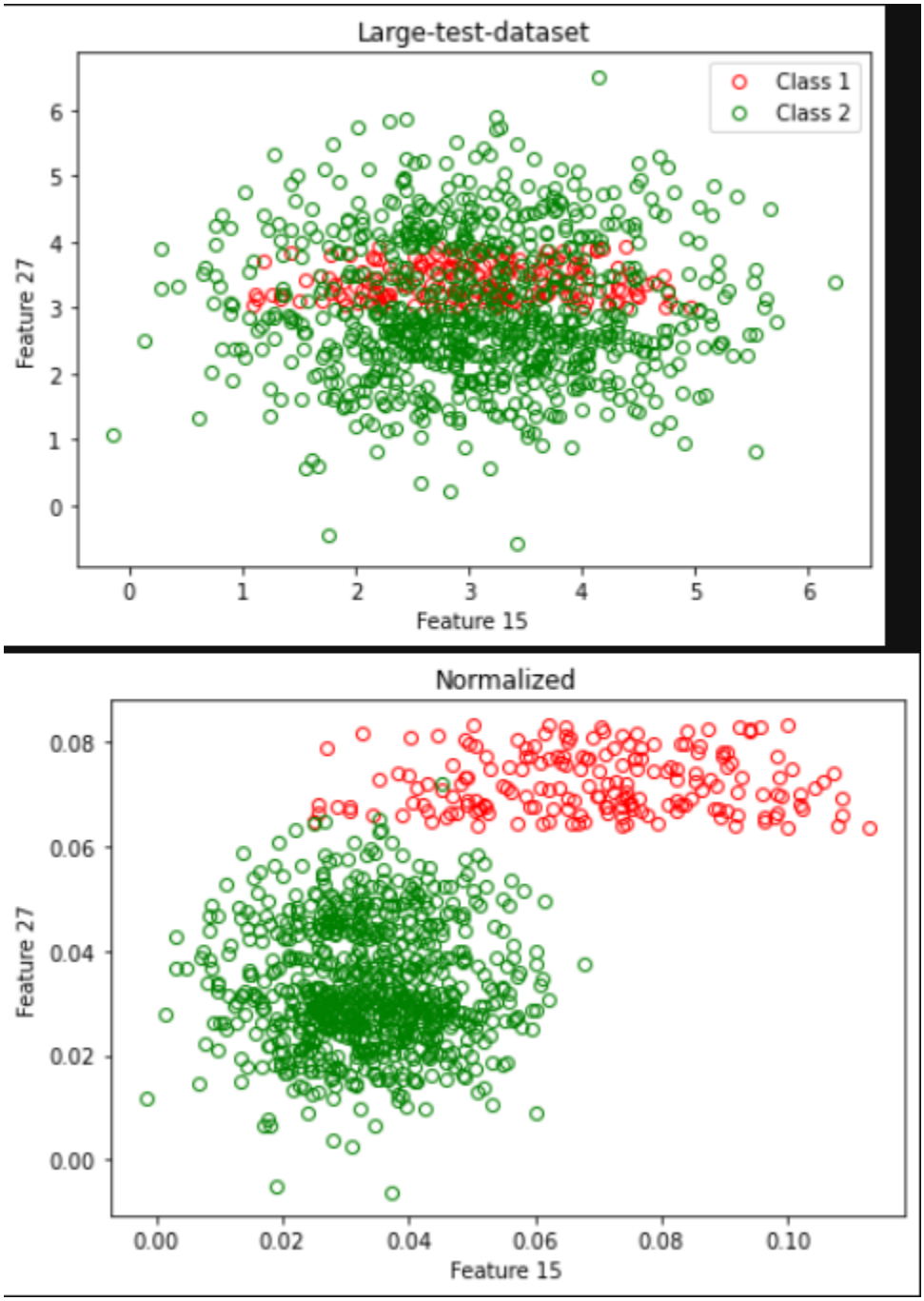
Large Dataset 54: Number of features: 40, number of instances: 1000



Original Small Dataset: Number of features: 10, number of instances: 100



Original Large Dataset: Number of features: 40, number of instances: 1000



V. Algorithms

1. Forward Selection
    - Feature selection starts with the empty set and adds one feature at a time. In each level, it uses the leave_one_out_validation algorithm to determine all current subsets' accuracy levels if the temporary feature set adds that feature. Finally, it picks the highest accuracy subset and adds one feature at a time and we repeat.
2. Backward Elimination
    - Backward selection starts with the full set of features and removes one feature at a time. In each level, it uses the leave_one_out_validation algorithm to determine all current subsets' accuracy levels if the temporary feature set removes that feature. Finally, it picks the highest accuracy subset.
3. Huy's custom algorithm (optional)
    - N/A

VI. Analysis

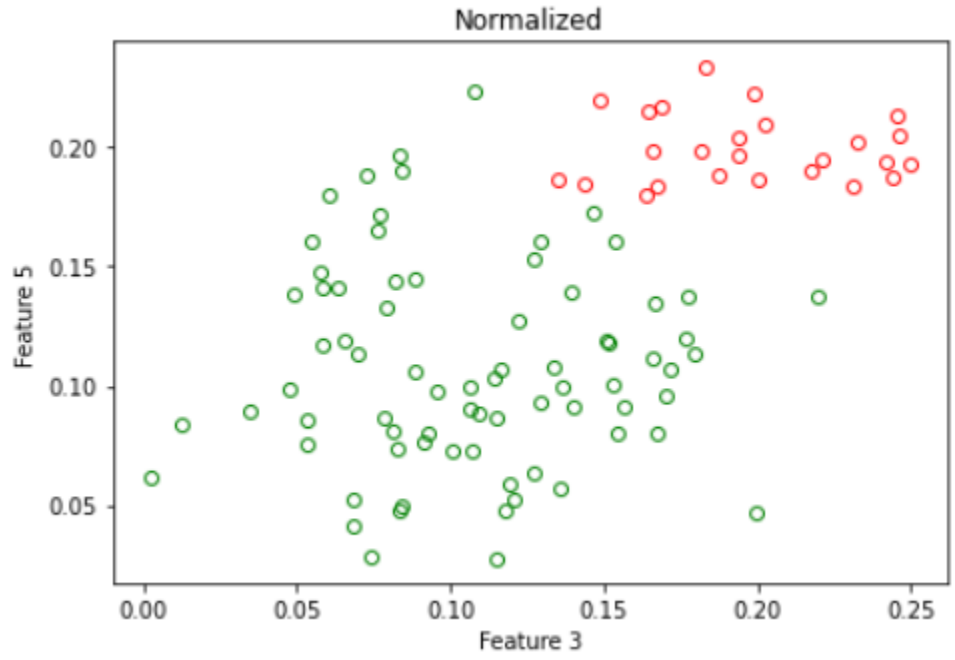
Experiment 1: Comparing Forward Selection vs Backward Elimination.

- Accuracy for Forward Selection is generally better than Backward Elimination varies in the given datasets. However, it might not be true for all cases since we see better accuracies for smaller datasets with Backward Elimination. It can also be a case where my program's termination logic is not tuned for Backward Elimination, which causes it to terminate too early leaving a large subset. In terms of runtime, Backward Elimination definitely takes longer since it starts out with a full set as opposed to starting with an empty set. For best practices, you use both forward and backward algorithms and pick the one with the higher accuracy.
    - small-test-dataset_forward_selection_tracing accuracy: 89%
    - small-test-dataset_backward_selection_tracing accuracy: 81%
    - Large-test-dataset_forward_selection_tracing accuracy: 94.9%
    - Large-test-dataset_backward_selection_tracing accuracy: 74.5%
    - CS170_Spring_2022_Small_data__54_forward_selection_tracing: 91%
    - CS170_Spring_2022_Small_data__54_backward_selection_tracing: 95%
    - CS170_Spring_2022_Large_data__54_forward_selection_tracing accuracy: 96.5%
    - CS170_Spring_2022_Large_data__54_backward_selection_tracing accuracy: 77.8%

Experiment 2: Effect of normalization

- With the introduction or normalization, when we compare the two graphs, you can see that there is a clearer distinction between class 1 and class 2 when using the two features.The first graph shows the clusters being more clumped up, which

makes it harder to differentiate between class 1 and 2 data points. When we normalize the data, you can see on the 2nd graph that there is a greater separation between class 1 and class 2 data points.



Experiment 3: Effect of number neighbors (k)

N/A

VII. Conclusion

Based on the findings in the Analysis section VII, we learn that in larger datasets, we noticed a huge drop in accuracy when using backward elimination instead of forwarding selection. This can be due to the fact that the algorithm's termination logic gives the Warning output too quickly, and prematurely determines the final accuracy. However, there is a marginal difference between the accuracy output of forwarding or backward selection when using smaller datasets. That is why it is important to use both algorithms and pick the one with a higher accuracy number. Another important thing to note is that using normalized data is the process of developing clean data, which will give you a better visualization when classifying and identifying the data points. This is because normalization adjusts the values of your numeric data to a common scale without changing the range.

I. Trace of your small dataset

Original:

Forward Selection

Running nearest neighbor with no features (default rate), using leaving out validation, I get an accuracy of 75.0%

The dataset has 10 features (not including the class attribute), with 100 instances

On the 1 th level of the search tree

--Considering adding the 1 feature

Using feature(s) {1} accuracy is 57.0%

--Considering adding the 2 feature

Using feature(s) {2} accuracy is 54.0%

--Considering adding the 3 feature

Using feature(s) {3} accuracy is 68.0%

--Considering adding the 4 feature

Using feature(s) {4} accuracy is 65.0%

--Considering adding the 5 feature

Using feature(s) {5} accuracy is 75.0%

--Considering adding the 6 feature

Using feature(s) {6} accuracy is 61.0%

--Considering adding the 7 feature

Using feature(s) {7} accuracy is 62.0%

--Considering adding the 8 feature

Using feature(s) {8} accuracy is 60.0%

--Considering adding the 9 feature

Using feature(s) {9} accuracy is 66.0%

--Considering adding the 10 feature

Using feature(s) {10} accuracy is 64.0%

Feature set {5} was best, accuracy is 75.0%

On level 1 I added feature {5} to current set

On the 2 th level of the search tree

--Considering adding the 1 feature

Using feature(s) {1, 5} accuracy is 76.0%

--Considering adding the 2 feature

Using feature(s) {2, 5} accuracy is 80.0%

--Considering adding the 3 feature

Using feature(s) {3, 5} accuracy is 92.0%

--Considering adding the 4 feature

Using feature(s) {4, 5} accuracy is 75.0%

--Considering adding the 6 feature

Using feature(s) {5, 6} accuracy is 79.0%

--Considering adding the 7 feature

Using feature(s) {5, 7} accuracy is 80.0%

--Considering adding the 8 feature

Using feature(s) {8, 5} accuracy is 77.0%

--Considering adding the 9 feature

Using feature(s) {9, 5} accuracy is 73.0%

--Considering adding the 10 feature

Using feature(s) {10, 5} accuracy is 83.0%

Feature set {3, 5} was best, accuracy is 92.0%

On level 2 I added feature {3, 5} to current set

On the 3 th level of the search tree

--Considering adding the 1 feature

Using feature(s) {1, 3, 5} accuracy is 84.0%

--Considering adding the 2 feature

Using feature(s) {2, 3, 5} accuracy is 79.0%

--Considering adding the 4 feature

Using feature(s) {3, 4, 5} accuracy is 84.0%

--Considering adding the 6 feature

Using feature(s) {3, 5, 6} accuracy is 82.0%

--Considering adding the 7 feature

Using feature(s) {3, 5, 7} accuracy is 89.0%

--Considering adding the 8 feature

Using feature(s) {8, 3, 5} accuracy is 79.0%

--Considering adding the 9 feature

Using feature(s) {9, 3, 5} accuracy is 83.0%

--Considering adding the 10 feature

Using feature(s) {10, 3, 5} accuracy is 87.0%

Feature set {3, 5, 7} was best, accuracy is 89.0%

On level 3 I added feature {3, 5, 7} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {3, 5}, which is an accuracy of 92.0%

Backward Selection

The dataset has 10 features (not including the class attribute), with 100 instances

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 68%

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 62.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9, 10} accuracy is 70.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 3, 4, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 3, 4, 5, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 8, 9, 10} accuracy is 62.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 9, 10} accuracy is 72.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 10} accuracy is 67.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9} accuracy is 72.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 73.0%

On level 2 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 6, 7, 8, 9, 10} accuracy is 72.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 6, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 6, 8, 9, 10} accuracy is 68.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 9, 10} accuracy is 68.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9} accuracy is 67.0%

Feature set {1, 2, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 75.0%

On level 3 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 8, 9, 10} accuracy is 58.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 8, 9, 10} accuracy is 71.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 7, 9, 10} accuracy is 78.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 10} accuracy is 77.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9} accuracy is 71.0%

Feature set {1, 2, 4, 5, 7, 8, 9, 10} was best, accuracy is 78.0%

On level 4 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

--Considering removing the 1 feature
Using feature(s) {2, 4, 5, 7, 9, 10} accuracy is 76.0%
--Considering removing the 2 feature
Using feature(s) {1, 4, 5, 7, 9, 10} accuracy is 73.0%
--Considering removing the 4 feature
Using feature(s) {1, 2, 5, 7, 9, 10} accuracy is 67.0%
--Considering removing the 5 feature
Using feature(s) {1, 2, 4, 7, 9, 10} accuracy is 61.0%
--Considering removing the 7 feature
Using feature(s) {1, 2, 4, 5, 9, 10} accuracy is 75.0%
--Considering removing the 9 feature
Using feature(s) {1, 2, 4, 5, 7, 10} accuracy is 79.0%
--Considering removing the 10 feature
Using feature(s) {1, 2, 4, 5, 7, 9} accuracy is 76.0%
Feature set {1, 2, 4, 5, 7, 9, 10} was best, accuracy is 79.0%

On level 5 I added feature {1, 2, 4, 5, 7, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 10} to current set

--Considering removing the 1 feature
Using feature(s) {2, 4, 5, 7, 10} accuracy is 83.0%
--Considering removing the 2 feature
Using feature(s) {1, 4, 5, 7, 10} accuracy is 71.0%
--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 10} accuracy is 75.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 10} accuracy is 60.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 10} accuracy is 75.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7} accuracy is 77.0%

Feature set {1, 2, 4, 5, 7, 10} was best, accuracy is 83.0%

On level 6 I added feature {2, 4, 5, 7, 10} to current set

On level 1 I added feature {2, 4, 5, 7, 10} to current set

--Considering removing the 2 feature

Using feature(s) {4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 4 feature

Using feature(s) {2, 5, 7, 10} accuracy is 81.0%

--Considering removing the 5 feature

Using feature(s) {2, 4, 7, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {2, 4, 5, 10} accuracy is 76.0%

--Considering removing the 10 feature

Using feature(s) {2, 4, 5, 7} accuracy is 76.0%

Feature set {2, 4, 5, 7, 10} was best, accuracy is 81.0%

On level 7 I added feature {2, 5, 7, 10} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {2, 4, 5, 7, 10}, which is an accuracy of 83.0%

The dataset has 10 features (not including the class attribute), with 100 instances

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 0%

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 62.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9, 10} accuracy is 70.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 3, 4, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 3, 4, 5, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 8, 9, 10} accuracy is 62.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 9, 10} accuracy is 72.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 10} accuracy is 67.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9} accuracy is 72.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 73.0%

On level 2 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 6, 7, 8, 9, 10} accuracy is 72.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 6, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 6, 8, 9, 10} accuracy is 68.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 9, 10} accuracy is 68.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9} accuracy is 67.0%

Feature set {1, 2, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 75.0%

On level 3 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature
Using feature(s) {2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%
--Considering removing the 2 feature
Using feature(s) {1, 4, 5, 7, 8, 9, 10} accuracy is 73.0%
--Considering removing the 4 feature
Using feature(s) {1, 2, 5, 7, 8, 9, 10} accuracy is 64.0%
--Considering removing the 5 feature
Using feature(s) {1, 2, 4, 7, 8, 9, 10} accuracy is 58.0%
--Considering removing the 7 feature
Using feature(s) {1, 2, 4, 5, 8, 9, 10} accuracy is 71.0%
--Considering removing the 8 feature
Using feature(s) {1, 2, 4, 5, 7, 9, 10} accuracy is 78.0%
--Considering removing the 9 feature
Using feature(s) {1, 2, 4, 5, 7, 8, 10} accuracy is 77.0%
--Considering removing the 10 feature
Using feature(s) {1, 2, 4, 5, 7, 8, 9} accuracy is 71.0%
Feature set {1, 2, 4, 5, 7, 8, 9, 10} was best, accuracy is 78.0%

On level 4 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

--Considering removing the 1 feature
Using feature(s) {2, 4, 5, 7, 9, 10} accuracy is 76.0%
--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 9, 10} accuracy is 67.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 9, 10} accuracy is 61.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 9, 10} accuracy is 75.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 9} accuracy is 76.0%

Feature set {1, 2, 4, 5, 7, 9, 10} was best, accuracy is 79.0%

On level 5 I added feature {1, 2, 4, 5, 7, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 10} accuracy is 83.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 10} accuracy is 71.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 10} accuracy is 75.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 10} accuracy is 60.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 10} accuracy is 75.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7} accuracy is 77.0%

Feature set {1, 2, 4, 5, 7, 10} was best, accuracy is 83.0%

On level 6 I added feature {2, 4, 5, 7, 10} to current set

On level 1 I added feature {2, 4, 5, 7, 10} to current set

--Considering removing the 2 feature

Using feature(s) {4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 4 feature

Using feature(s) {2, 5, 7, 10} accuracy is 81.0%

--Considering removing the 5 feature

Using feature(s) {2, 4, 7, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {2, 4, 5, 10} accuracy is 76.0%

--Considering removing the 10 feature

Using feature(s) {2, 4, 5, 7} accuracy is 76.0%

Feature set {2, 4, 5, 7, 10} was best, accuracy is 81.0%

On level 7 I added feature {2, 5, 7, 10} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {2, 4, 5, 7, 10}, which is an accuracy of 83.0%

The dataset has 10 features (not including the class attribute), with 100 instances

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 0%

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature
Using feature(s) {2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 71.0%
--Considering removing the 2 feature
Using feature(s) {1, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 62.0%
--Considering removing the 3 feature
Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%
--Considering removing the 4 feature
Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9, 10} accuracy is 70.0%
--Considering removing the 5 feature
Using feature(s) {1, 2, 3, 4, 6, 7, 8, 9, 10} accuracy is 69.0%
--Considering removing the 6 feature
Using feature(s) {1, 2, 3, 4, 5, 7, 8, 9, 10} accuracy is 71.0%
--Considering removing the 7 feature
Using feature(s) {1, 2, 3, 4, 5, 6, 8, 9, 10} accuracy is 62.0%
--Considering removing the 8 feature
Using feature(s) {1, 2, 3, 4, 5, 6, 7, 9, 10} accuracy is 72.0%
--Considering removing the 9 feature
Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 10} accuracy is 67.0%
--Considering removing the 10 feature
Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9} accuracy is 72.0%
Feature set {1, 2, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 73.0%

On level 2 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 6, 7, 8, 9, 10} accuracy is 72.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 6, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 6, 8, 9, 10} accuracy is 68.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 9, 10} accuracy is 68.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9} accuracy is 67.0%

Feature set {1, 2, 4, 5, 7, 8, 9, 10} was best, accuracy is 75.0%

On level 3 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 8, 9, 10} accuracy is 58.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 8, 9, 10} accuracy is 71.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 7, 9, 10} accuracy is 78.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 10} accuracy is 77.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9} accuracy is 71.0%

Feature set {1, 2, 4, 5, 7, 9, 10} was best, accuracy is 78.0%

On level 4 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 9, 10} accuracy is 76.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 9, 10} accuracy is 67.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 9, 10} accuracy is 61.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 9, 10} accuracy is 75.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 9} accuracy is 76.0%

Feature set {1, 2, 4, 5, 7, 10} was best, accuracy is 79.0%

On level 5 I added feature {1, 2, 4, 5, 7, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 10} accuracy is 83.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 10} accuracy is 71.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 10} accuracy is 75.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 10} accuracy is 60.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 10} accuracy is 75.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7} accuracy is 77.0%

Feature set {2, 4, 5, 7, 10} was best, accuracy is 83.0%

On level 6 I added feature {2, 4, 5, 7, 10} to current set

On level 1 I added feature {2, 4, 5, 7, 10} to current set

--Considering removing the 2 feature

Using feature(s) {4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 4 feature

Using feature(s) {2, 5, 7, 10} accuracy is 81.0%

--Considering removing the 5 feature

Using feature(s) {2, 4, 7, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {2, 4, 5, 10} accuracy is 76.0%

--Considering removing the 10 feature

Using feature(s) {2, 4, 5, 7} accuracy is 76.0%

Feature set {2, 5, 7, 10} was best, accuracy is 81.0%

On level 7 I added feature {2, 5, 7, 10} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {2, 4, 5, 7, 10}, which is an accuracy of 83.0%

The dataset has 10 features (not including the class attribute), with 100 instances

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 0%

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 62.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9, 10} accuracy is 70.0%

--Considering removing the 5 feature

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--Considering removing the 6 feature

Using feature(s) {1, 2, 3, 4, 5, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 8, 9, 10} accuracy is 62.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 9, 10} accuracy is 72.0%

--Considering removing the 9 feature

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--Considering removing the 10 feature

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--Considering removing the 6 feature

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--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 6, 8, 9, 10} accuracy is 68.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 9, 10} accuracy is 68.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9} accuracy is 67.0%

Feature set {1, 2, 4, 5, 7, 8, 9, 10} was best, accuracy is 75.0%

On level 3 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 8, 9, 10} accuracy is 58.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 8, 9, 10} accuracy is 71.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 7, 9, 10} accuracy is 78.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 10} accuracy is 77.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9} accuracy is 71.0%

Feature set {1, 2, 4, 5, 7, 9, 10} was best, accuracy is 78.0%

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--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 9, 10} accuracy is 76.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 9, 10} accuracy is 67.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 9, 10} accuracy is 61.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 9, 10} accuracy is 75.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 9} accuracy is 76.0%

Feature set {1, 2, 4, 5, 7, 10} was best, accuracy is 79.0%

On level 5 I added feature {1, 2, 4, 5, 7, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 10} to current set

--Considering removing the 1 feature
Using feature(s) {2, 4, 5, 7, 10} accuracy is 83.0%
--Considering removing the 2 feature
Using feature(s) {1, 4, 5, 7, 10} accuracy is 71.0%
--Considering removing the 4 feature
Using feature(s) {1, 2, 5, 7, 10} accuracy is 75.0%
--Considering removing the 5 feature
Using feature(s) {1, 2, 4, 7, 10} accuracy is 60.0%
--Considering removing the 7 feature
Using feature(s) {1, 2, 4, 5, 10} accuracy is 75.0%
--Considering removing the 10 feature
Using feature(s) {1, 2, 4, 5, 7} accuracy is 77.0%
Feature set {2, 4, 5, 7, 10} was best, accuracy is 83.0%

On level 6 I added feature {2, 4, 5, 7, 10} to current set

On level 1 I added feature {2, 4, 5, 7, 10} to current set

--Considering removing the 2 feature
Using feature(s) {4, 5, 7, 10} accuracy is 79.0%
--Considering removing the 4 feature
Using feature(s) {2, 5, 7, 10} accuracy is 81.0%
--Considering removing the 5 feature

Using feature(s) {2, 4, 7, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {2, 4, 5, 10} accuracy is 76.0%

--Considering removing the 10 feature

Using feature(s) {2, 4, 5, 7} accuracy is 76.0%

Feature set {2, 5, 7, 10} was best, accuracy is 81.0%

On level 7 I added feature {2, 5, 7, 10} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {2, 4, 5, 7, 10}, which is an accuracy of 83.0%

The dataset has 10 features (not including the class attribute), with 100 instances

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 0%

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 62.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9, 10} accuracy is 70.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 3, 4, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 3, 4, 5, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 8, 9, 10} accuracy is 62.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 9, 10} accuracy is 72.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 10} accuracy is 67.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9} accuracy is 72.0%

Feature set {1, 2, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 73.0%

On level 2 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 6, 7, 8, 9, 10} accuracy is 72.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 6, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 6, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 6, 8, 9, 10} accuracy is 68.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 9, 10} accuracy is 68.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9} accuracy is 67.0%

Feature set {1, 2, 4, 5, 7, 8, 9, 10} was best, accuracy is 75.0%

On level 3 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 8, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 8, 9, 10} accuracy is 58.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 8, 9, 10} accuracy is 71.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 4, 5, 7, 9, 10} accuracy is 78.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 10} accuracy is 77.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 8, 9} accuracy is 71.0%

Feature set {1, 2, 4, 5, 7, 9, 10} was best, accuracy is 78.0%

On level 4 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 9, 10} accuracy is 76.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 9, 10} accuracy is 73.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 9, 10} accuracy is 67.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 9, 10} accuracy is 61.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 9, 10} accuracy is 75.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7, 9} accuracy is 76.0%

Feature set {1, 2, 4, 5, 7, 10} was best, accuracy is 79.0%

On level 5 I added feature {1, 2, 4, 5, 7, 10} to current set

On level 1 I added feature {1, 2, 4, 5, 7, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 4, 5, 7, 10} accuracy is 83.0%

--Considering removing the 2 feature

Using feature(s) {1, 4, 5, 7, 10} accuracy is 71.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 5, 7, 10} accuracy is 75.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 4, 7, 10} accuracy is 60.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 4, 5, 10} accuracy is 75.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 4, 5, 7} accuracy is 77.0%

Feature set {2, 4, 5, 7, 10} was best, accuracy is 83.0%

On level 6 I added feature {2, 4, 5, 7, 10} to current set

On level 1 I added feature {2, 4, 5, 7, 10} to current set

--Considering removing the 2 feature

Using feature(s) {4, 5, 7, 10} accuracy is 79.0%

--Considering removing the 4 feature

Using feature(s) {2, 5, 7, 10} accuracy is 81.0%

--Considering removing the 5 feature

Using feature(s) {2, 4, 7, 10} accuracy is 71.0%

--Considering removing the 7 feature

Using feature(s) {2, 4, 5, 10} accuracy is 76.0%

--Considering removing the 10 feature

Using feature(s) {2, 4, 5, 7} accuracy is 76.0%

Feature set {2, 5, 7, 10} was best, accuracy is 81.0%

On level 7 I added feature {2, 5, 7, 10} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {2, 4, 5, 7, 10}, which is an accuracy of 83.0%

Data 54:

Forward Selection

Running nearest neighbor with no features (default rate), using leaving out validation, I get an accuracy of 75.0%

The dataset has 10 features (not including the class attribute), with 100 instances

On the 1 th level of the search tree

--Considering adding the 1 feature

Using feature(s) {1} accuracy is 66.0%

--Considering adding the 2 feature

Using feature(s) {2} accuracy is 67.0%

--Considering adding the 3 feature

Using feature(s) {3} accuracy is 67.0%

--Considering adding the 4 feature

Using feature(s) {4} accuracy is 65.0%

--Considering adding the 5 feature

Using feature(s) {5} accuracy is 72.0%

--Considering adding the 6 feature

Using feature(s) {6} accuracy is 72.0%

--Considering adding the 7 feature

Using feature(s) {7} accuracy is 69.0%

--Considering adding the 8 feature

Using feature(s) {8} accuracy is 65.0%

--Considering adding the 9 feature

Using feature(s) {9} accuracy is 82.0%

--Considering adding the 10 feature

Using feature(s) {10} accuracy is 68.0%

Feature set {9} was best, accuracy is 82.0%

On level 1 I added feature {9} to current set

On the 2 th level of the search tree

--Considering adding the 1 feature

Using feature(s) {9, 1} accuracy is 76.0%

--Considering adding the 2 feature

Using feature(s) {9, 2} accuracy is 75.0%

--Considering adding the 3 feature

Using feature(s) {9, 3} accuracy is 79.0%

--Considering adding the 4 feature

Using feature(s) {9, 4} accuracy is 84.0%

--Considering adding the 5 feature

Using feature(s) {9, 5} accuracy is 73.0%

--Considering adding the 6 feature

Using feature(s) {9, 6} accuracy is 83.0%

--Considering adding the 7 feature

Using feature(s) {9, 7} accuracy is 95.0%

--Considering adding the 8 feature

Using feature(s) {8, 9} accuracy is 79.0%

--Considering adding the 10 feature

Using feature(s) {9, 10} accuracy is 83.0%

Feature set {9, 7} was best, accuracy is 95.0%

On level 2 I added feature {9, 7} to current set

On the 3 th level of the search tree

--Considering adding the 1 feature

Using feature(s) {9, 1, 7} accuracy is 91.0%

--Considering adding the 2 feature

Using feature(s) {9, 2, 7} accuracy is 87.0%

--Considering adding the 3 feature

Using feature(s) {9, 3, 7} accuracy is 85.0%

--Considering adding the 4 feature

Using feature(s) {9, 4, 7} accuracy is 84.0%

--Considering adding the 5 feature

Using feature(s) {9, 5, 7} accuracy is 87.0%

--Considering adding the 6 feature

Using feature(s) {9, 6, 7} accuracy is 85.0%

--Considering adding the 8 feature

Using feature(s) {8, 9, 7} accuracy is 81.0%

--Considering adding the 10 feature

Using feature(s) {9, 10, 7} accuracy is 88.0%

Feature set {9, 1, 7} was best, accuracy is 91.0%

On level 3 I added feature {9, 1, 7} to current set

"(Warning, Accuracy has decreased!)"

Finished search!! The best feature subset is {9, 7}, which is an accuracy of 95.0%

Backward Selection

The dataset has 10 features (not including the class attribute), with 100 instances

Running nearest neighbor with no features (default rate), using leaving out validation, I get an accuracy of 80.0%

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 66.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 66%

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 4, 5, 6, 7, 8, 9, 10} accuracy is 62.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 4, 5, 6, 7, 8, 9, 10} accuracy is 65.0%

--Considering removing the 4 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 3, 4, 6, 7, 8, 9, 10} accuracy is 65.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 3, 4, 5, 7, 8, 9, 10} accuracy is 66.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 8, 9, 10} accuracy is 69.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 9, 10} accuracy is 56.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 10} accuracy is 68.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 3, 4, 5, 6, 7, 8, 9} accuracy is 66.0%

Feature set {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} was best, accuracy is 69.0%

On level 2 I added feature {1, 2, 3, 5, 6, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 5, 6, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 5, 6, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 5, 6, 7, 8, 9, 10} accuracy is 70.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 5, 6, 7, 8, 9, 10} accuracy is 68.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 3, 6, 7, 8, 9, 10} accuracy is 64.0%

--Considering removing the 6 feature

Using feature(s) {1, 2, 3, 5, 7, 8, 9, 10} accuracy is 72.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 5, 6, 8, 9, 10} accuracy is 70.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 9, 10} accuracy is 62.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 10} accuracy is 70.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 3, 5, 6, 7, 8, 9} accuracy is 65.0%

Feature set {1, 2, 3, 5, 6, 7, 8, 9, 10} was best, accuracy is 72.0%

On level 3 I added feature {1, 2, 3, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 2, 3, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature

Using feature(s) {2, 3, 5, 7, 8, 9, 10} accuracy is 72.0%

--Considering removing the 2 feature

Using feature(s) {1, 3, 5, 7, 8, 9, 10} accuracy is 75.0%

--Considering removing the 3 feature

Using feature(s) {1, 2, 5, 7, 8, 9, 10} accuracy is 71.0%

--Considering removing the 5 feature

Using feature(s) {1, 2, 3, 7, 8, 9, 10} accuracy is 69.0%

--Considering removing the 7 feature

Using feature(s) {1, 2, 3, 5, 8, 9, 10} accuracy is 70.0%

--Considering removing the 8 feature

Using feature(s) {1, 2, 3, 5, 7, 9, 10} accuracy is 69.0%

--Considering removing the 9 feature

Using feature(s) {1, 2, 3, 5, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 2, 3, 5, 7, 8, 9} accuracy is 70.0%

Feature set {1, 2, 3, 5, 7, 8, 9, 10} was best, accuracy is 75.0%

On level 4 I added feature {1, 3, 5, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 3, 5, 7, 8, 9, 10} to current set

--Considering removing the 1 feature
Using feature(s) {3, 5, 7, 8, 9, 10} accuracy is 73.0%
--Considering removing the 3 feature
Using feature(s) {1, 5, 7, 8, 9, 10} accuracy is 75.0%
--Considering removing the 5 feature
Using feature(s) {1, 3, 7, 8, 9, 10} accuracy is 78.0%
--Considering removing the 7 feature
Using feature(s) {1, 3, 5, 8, 9, 10} accuracy is 73.0%
--Considering removing the 8 feature
Using feature(s) {1, 3, 5, 7, 9, 10} accuracy is 76.0%
--Considering removing the 9 feature
Using feature(s) {1, 3, 5, 7, 8, 10} accuracy is 71.0%
--Considering removing the 10 feature
Using feature(s) {1, 3, 5, 7, 8, 9} accuracy is 74.0%
Feature set {1, 3, 5, 7, 8, 9, 10} was best, accuracy is 78.0%

On level 5 I added feature {1, 3, 7, 8, 9, 10} to current set

On level 1 I added feature {1, 3, 7, 8, 9, 10} to current set

--Considering removing the 1 feature
Using feature(s) {3, 7, 8, 9, 10} accuracy is 78.0%
--Considering removing the 3 feature
Using feature(s) {1, 7, 8, 9, 10} accuracy is 80.0%

--Considering removing the 7 feature

Using feature(s) {1, 3, 8, 9, 10} accuracy is 79.0%

--Considering removing the 8 feature

Using feature(s) {1, 3, 7, 9, 10} accuracy is 80.0%

--Considering removing the 9 feature

Using feature(s) {1, 3, 7, 8, 10} accuracy is 73.0%

--Considering removing the 10 feature

Using feature(s) {1, 3, 7, 8, 9} accuracy is 82.0%

Feature set {1, 3, 7, 8, 9, 10} was best, accuracy is 82.0%

On level 6 I added feature {1, 3, 7, 8, 9} to current set

On level 1 I added feature {1, 3, 7, 8, 9} to current set

--Considering removing the 1 feature

Using feature(s) {3, 7, 8, 9} accuracy is 75.0%

--Considering removing the 3 feature

Using feature(s) {1, 7, 8, 9} accuracy is 84.0%

--Considering removing the 7 feature

Using feature(s) {1, 3, 8, 9} accuracy is 79.0%

--Considering removing the 8 feature

Using feature(s) {1, 3, 7, 9} accuracy is 83.0%

--Considering removing the 9 feature

Using feature(s) {1, 3, 7, 8} accuracy is 73.0%

Feature set {1, 3, 7, 8, 9} was best, accuracy is 84.0%

On level 7 I added feature {1, 7, 8, 9} to current set

On level 1 I added feature {1, 7, 8, 9} to current set

--Considering removing the 1 feature

Using feature(s) {8, 9, 7} accuracy is 81.0%

--Considering removing the 7 feature

Using feature(s) {8, 1, 9} accuracy is 85.0%

--Considering removing the 8 feature

Using feature(s) {1, 9, 7} accuracy is 91.0%

--Considering removing the 9 feature

Using feature(s) {8, 1, 7} accuracy is 70.0%

Feature set {1, 7, 8, 9} was best, accuracy is 91.0%

On level 8 I added feature {1, 7, 9} to current set

On level 1 I added feature {1, 7, 9} to current set

--Considering removing the 1 feature

Using feature(s) {9, 7} accuracy is 95.0%

--Considering removing the 7 feature

Using feature(s) {1, 9} accuracy is 76.0%

--Considering removing the 9 feature

Using feature(s) {1, 7} accuracy is 66.0%

Feature set {1, 7, 9} was best, accuracy is 95.0%

On level 9 I added feature {7, 9} to current set

Finished search!! The best feature subset is {9, 7}, which is an accuracy of 95.0%