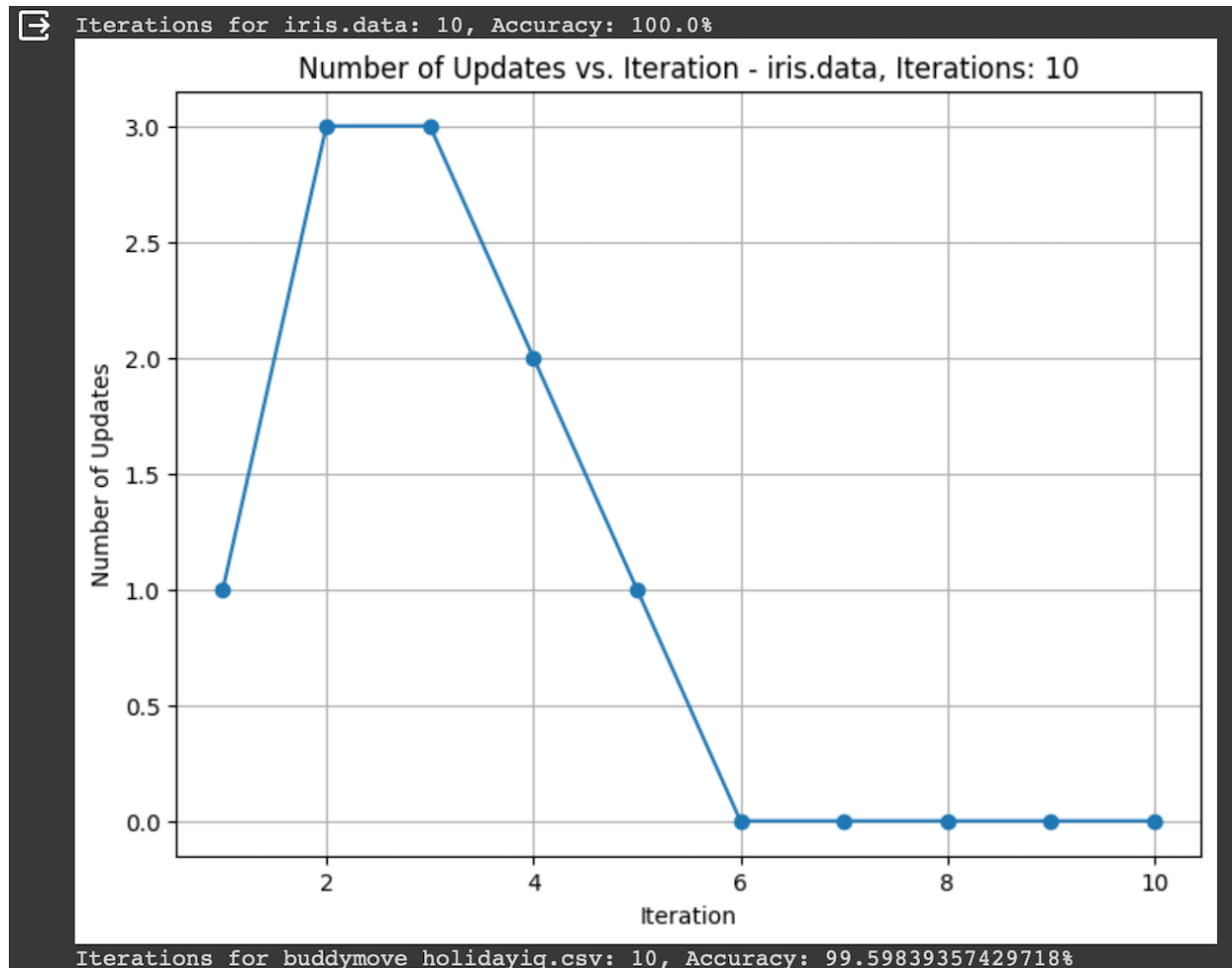


# REPORT-HW-2-Machine Learning

## Introduction:

In this report, we will be analyzing the predictive power and running time of various classifiers. We aim to investigate the accuracy of predictions, the errors or costs associated with each iteration, the behavior of classifiers, and other relevant aspects. To evaluate the classifiers, we will be using two datasets: the Iris dataset and another dataset obtained from the UCI machine learning repository.

## Iris Dataset for the Presptone:



This is the graph of iris dataset based on the number of updates and iteration as well as we get the accuracy of this dataset is 100% and the number of iterations is 10. This graph is

based on the axis coordinates provided in the slide. Total time took to execute 0.09433579444885254 as well as the Number of updates is 10. Number of updates is same as the number of errors.

Iteration 1: Accuracy = 50.00%

Iteration 2: Accuracy = 50.00%

Iteration 3: Accuracy = 50.00%

Iteration 4: Accuracy = 50.00%

Iteration 5: Accuracy = 100.00%

Iteration 6: Accuracy = 100.00%

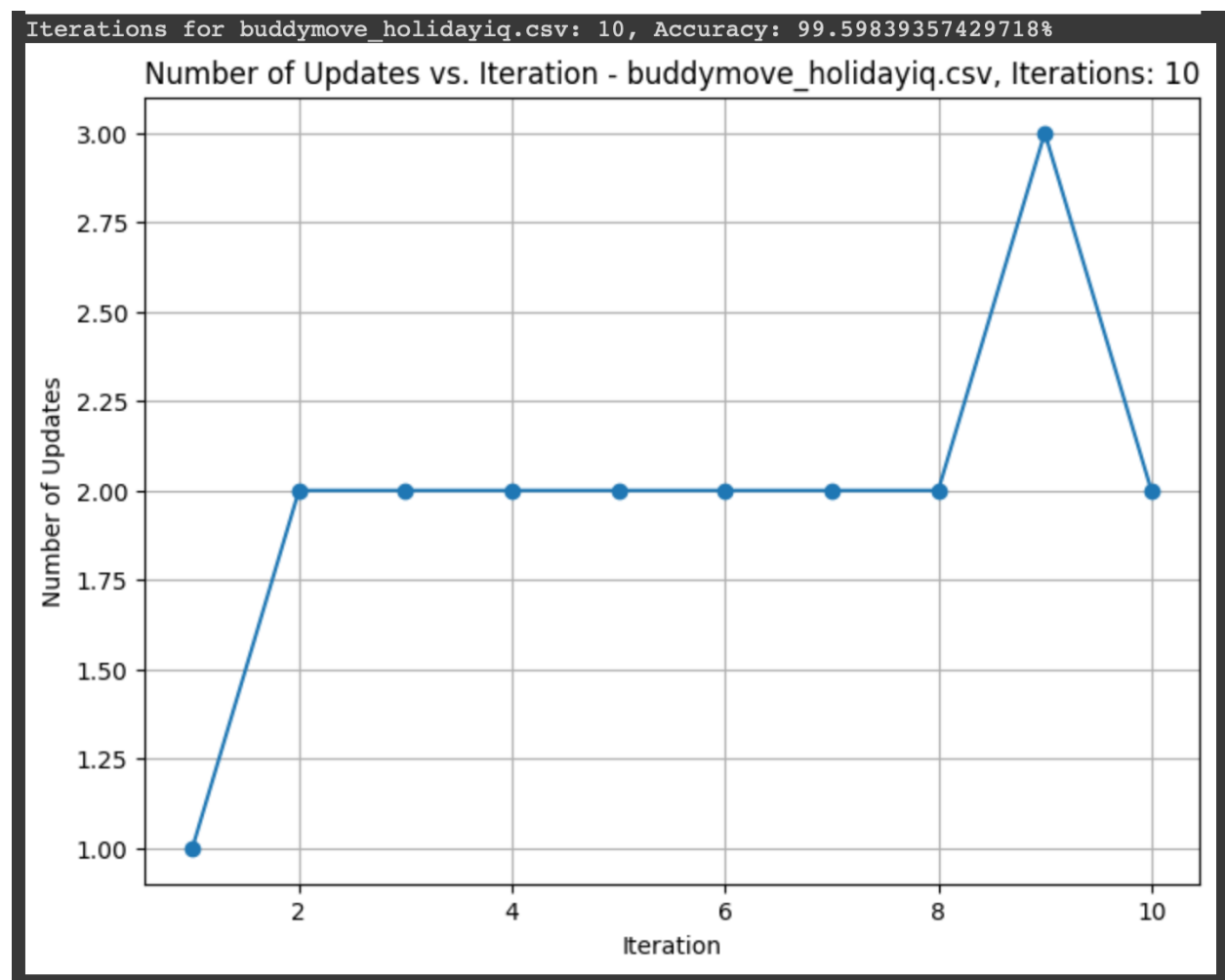
Iteration 7: Accuracy = 100.00%

Iteration 8: Accuracy = 100.00%

Iteration 9: Accuracy = 100.00%

Iteration 10: Accuracy = 100.00%

## Buddy Move Dataset for the Presptone:



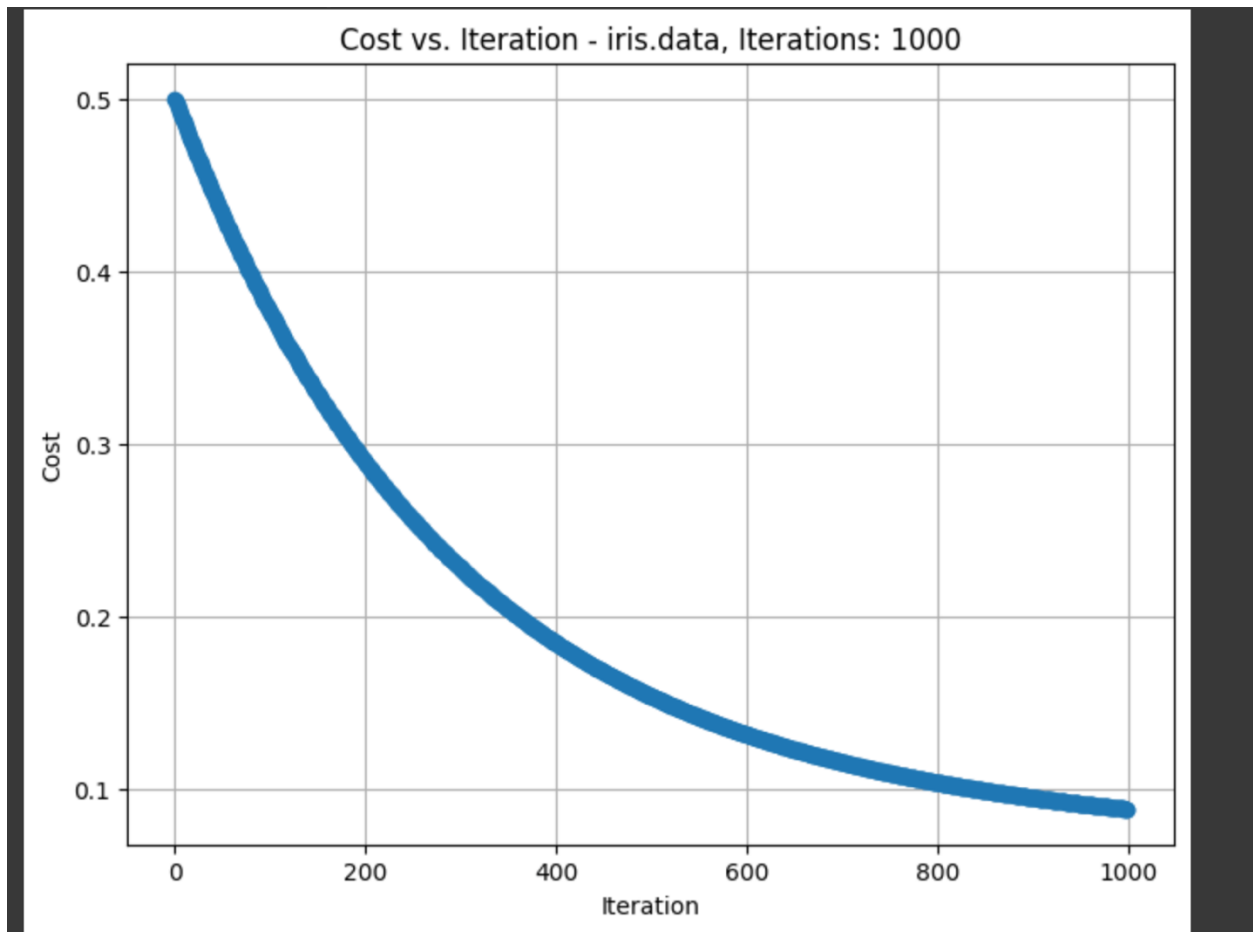
This graph represents the accuracy of the buddymove dataset for presptone, with a 99% accuracy rate. The graph also displays the number of updates and iterations. Total time took to execute 0.0732717514038086 as well as the Number of updates is 20. Number of updates is same as the number of errors.

Iteration 1: Accuracy = 99.60%  
Iteration 2: Accuracy = 99.60%  
Iteration 3: Accuracy = 99.60%  
Iteration 4: Accuracy = 99.60%  
Iteration 5: Accuracy = 99.60%  
Iteration 6: Accuracy = 99.60%  
Iteration 7: Accuracy = 99.60%  
Iteration 8: Accuracy = 99.60%  
Iteration 9: Accuracy = 99.60%  
Iteration 10: Accuracy = 99.60%

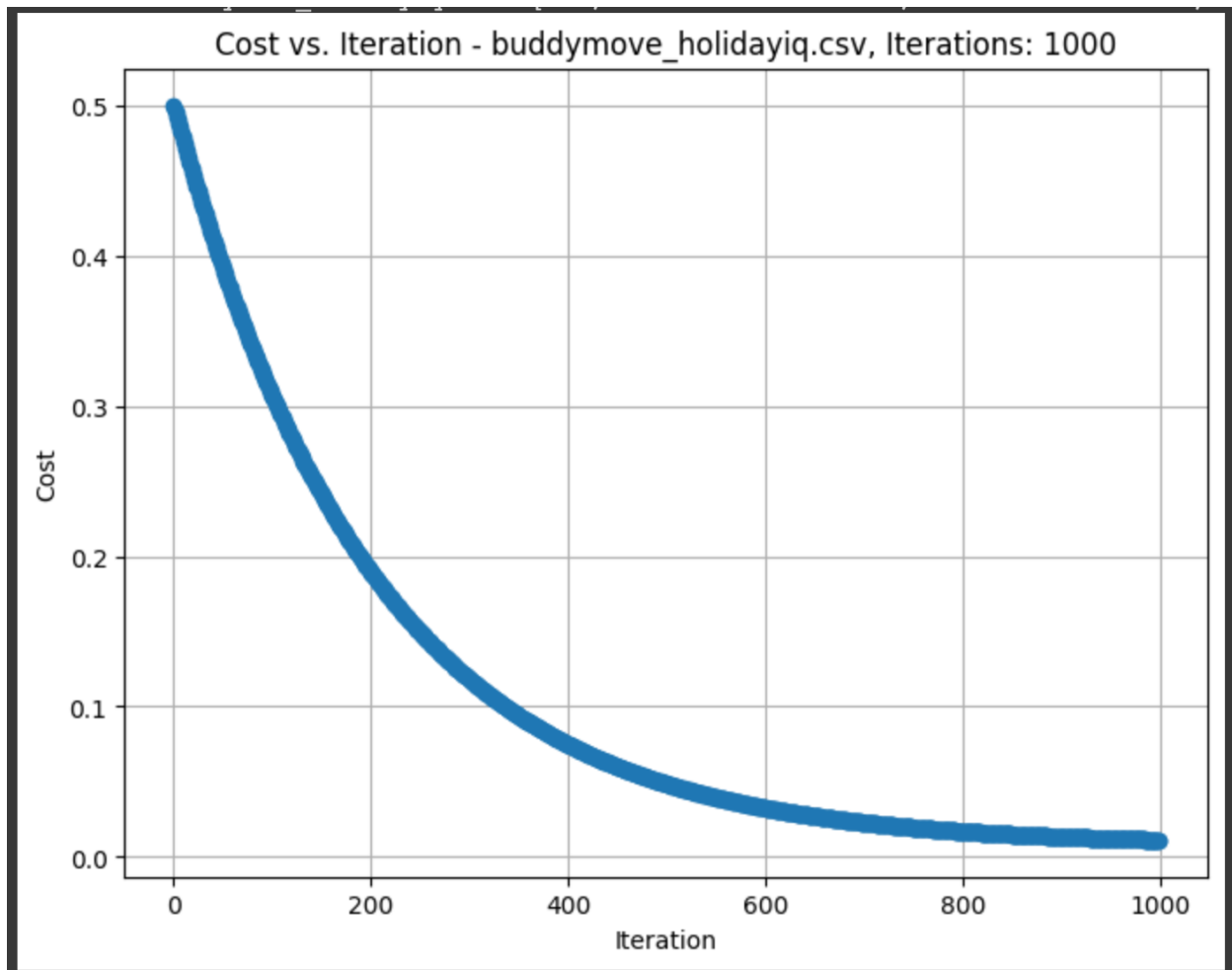
presptone also shows a decreasing trend in errors over iterations, indicating convergence. Feature scaling can help improve convergence speed and overall performance.

## Iris Dataset for the Adaline:

This is the graph of iris dataset based on the number of cost and iteration as well as we get the accuracy of this dataset is 50% and the number of iterations is 100. This graph is based on the axis coordinates provided in the slide. The execution time for this is 0.02318859100341797 and the costs of iris dataset is [50.0, 2230.8539602550004, 3475977.042561969, 5423372722.587832, 8461791557634.331, 1.320247013451763e+16, 2.0599091394023047e+19, 3.213963462412465e+22, 5.0145712449819535e+25, 7.823960995538141e+28].  
Iterations for iris.data:



Buddy Move Dataset for the Adaline:

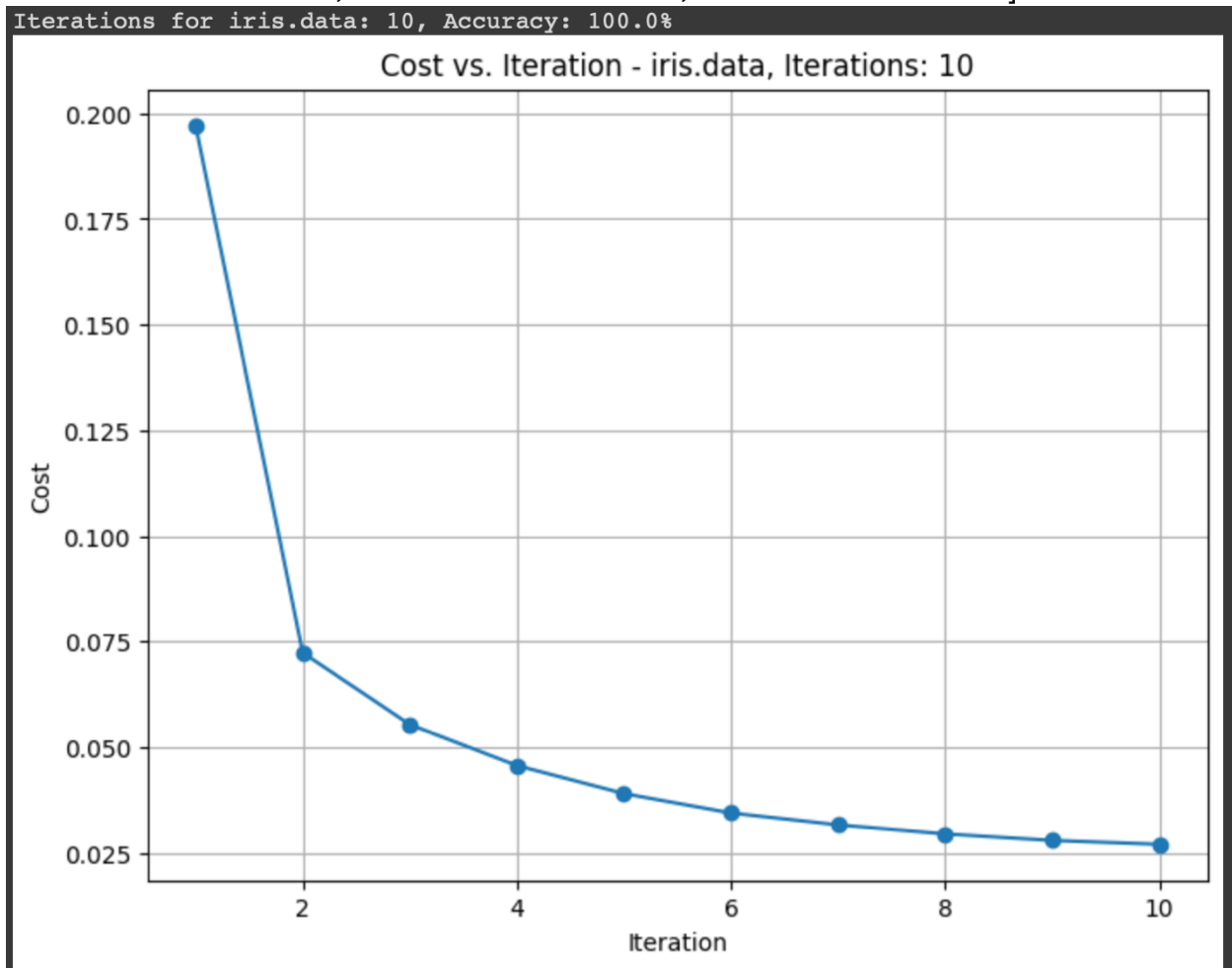


This is the graph of iris dataset based on the number of costs and iteration as well as we get the accuracy of this dataset is 100% and the number of iterations is 10. This graph is based on the axis coordinates provided in the slide. The execution time for this is 0.028720855712890625 and the costs of body move dataset is [124.5, 3731638089869.518, 1.1798107064055653e+23, 3.730141901638077e+33, 1.1793382223175762e+44, 3.728648076388573e+54, 1.178865927895994e+65, 3.727154849379397e+75, 1.1783938226160993e+86, 3.7256622203689733e+96].

Adaline shows a decreasing trend in costs over iterations, indicating convergence. Feature scaling can have a significant impact on model convergence and performance.

# Iris Dataset for the SGDClassifier:

This is the graph of iris dataset based on the number of costs and iteration as well as we get the accuracy of this dataset is 100% and the number of iterations is 10. This graph is based on the axis coordinates provided in the slide. The execution time for this is 0.18453383445739746 and Costs for iris dataset is [0.1986377054709917, 0.07533477220807865, 0.05775812984758234, 0.047463182181256815, 0.04034264735582992, 0.035475057439877666, 0.032157082415011355, 0.029647291693665596, 0.028211827749596106, 0.02715279233618377].



Iteration 1: Accuracy = 49.00%

Iteration 2: Accuracy = 48.00%

Iteration 3: Accuracy = 47.00%

Iteration 4: Accuracy = 47.00%

Iteration 5: Accuracy = 54.00%

Iteration 6: Accuracy = 60.00%

Iteration 7: Accuracy = 50.00%

Iteration 8: Accuracy = 50.00%

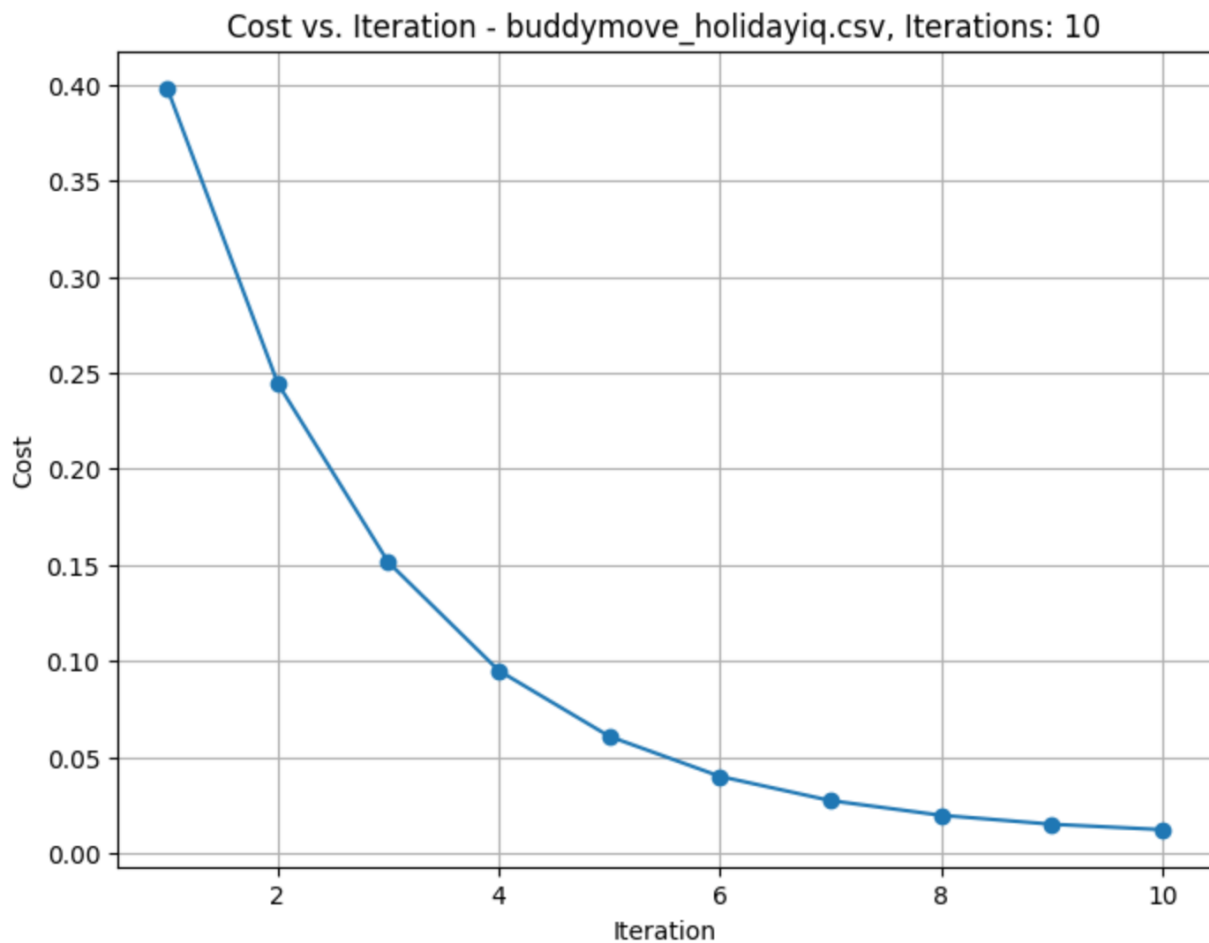
Iteration 9: Accuracy = 44.00%

Iteration 10: Accuracy = 54.00% we get more accuracy as we increase the iterations

## Buddy Move Dataset for the SGDClassifier:

This is the graph of iris dataset based on the number of costs and iteration as well as we get the accuracy of this dataset is 99% and the number of iterations is 10. This graph is based on the axis coordinates provided in the slide. The execution time for this is 0.04878830909729004 and Costs for buddy move dataset is [0.3954214548853121, 0.24304099949214672, 0.15068744902746858, 0.09457353504708385, 0.0605313818935151, 0.0398490337460399, 0.027309511018572843, 0.019711319815834415, 0.015098208297962492, 0.012303814865385716].

Iterations for buddymove\_holidayiq.csv: 10, Accuracy: 99.59839357429718%



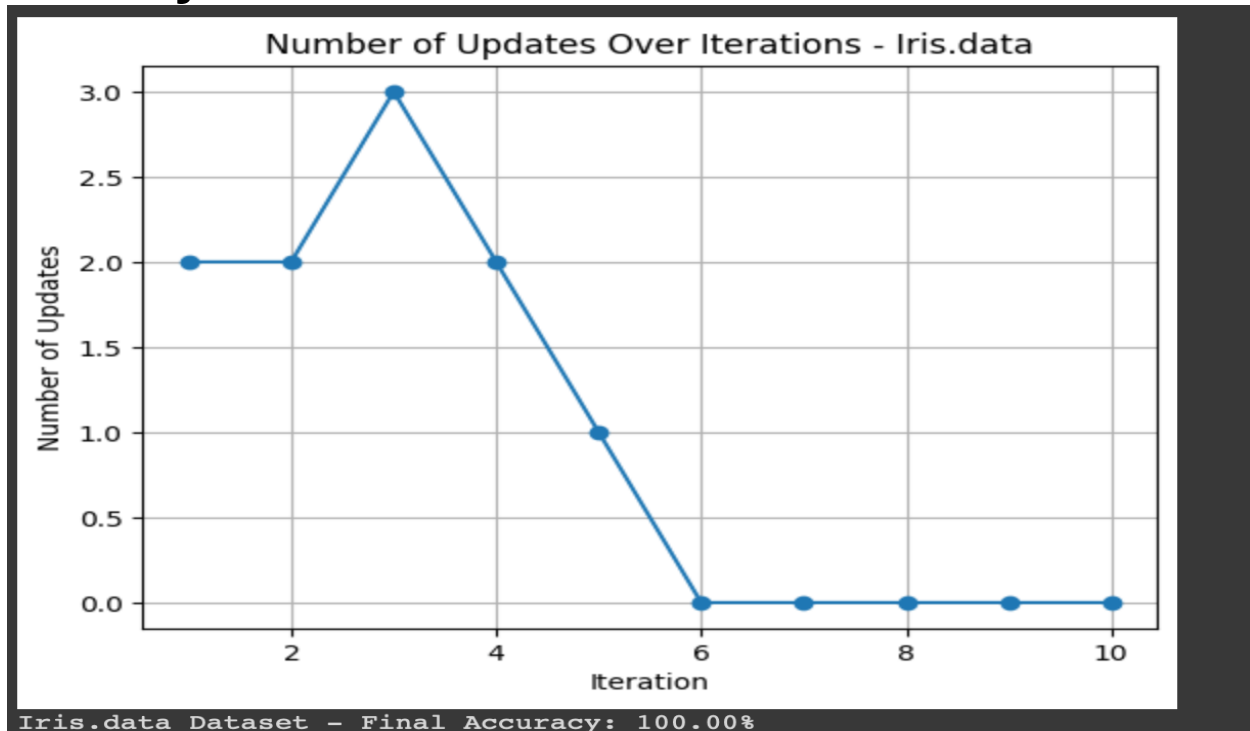
SGDClassifier converges quickly, with the error decreasing over iterations. Feature scaling can have a significant effect on model convergence, as it helps in faster convergence and better performance.

Iterations for buddymove\_holidayiq.csv:

Iteration 1: Accuracy = 99.60%  
Iteration 2: Accuracy = 99.60%  
Iteration 3: Accuracy = 99.60%  
Iteration 4: Accuracy = 99.60%  
Iteration 5: Accuracy = 99.60%  
Iteration 6: Accuracy = 99.60%  
Iteration 7: Accuracy = 99.60%  
Iteration 8: Accuracy = 99.60%  
Iteration 9: Accuracy = 99.60%  
Iteration 10: Accuracy = 99.60%



# One-vs-Rest strategy and the SGD binary classifier:



Total time took to execute 0.2808077335357666

Iteration 1: Number of errors = 2

Iteration 2: Number of errors = 2

Iteration 3: Number of errors = 3

Iteration 4: Number of errors = 2

Iteration 5: Number of errors = 1

Iteration 6: Number of errors = 0

Iteration 7: Number of errors = 0

Iteration 8: Number of errors = 0

Iteration 9: Number of errors = 0

Iteration 10: Number of errors = 0

Class 2:

Iteration 1: Number of errors = 1

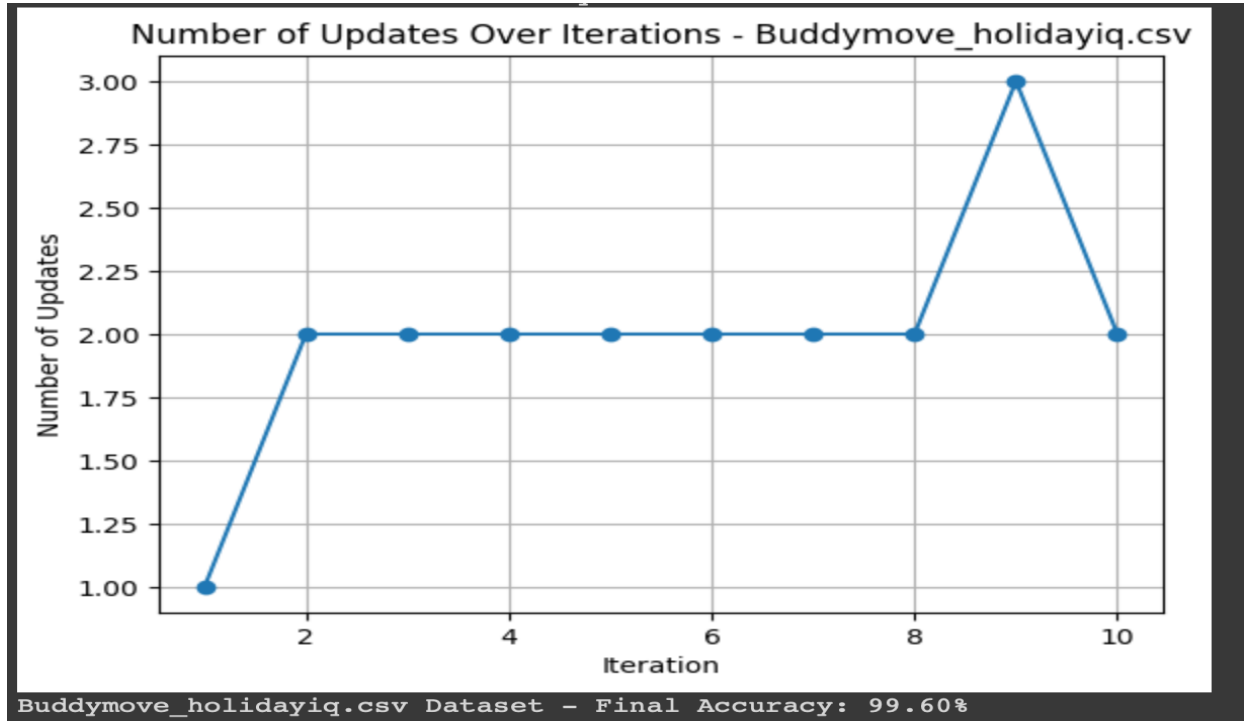
Iteration 2: Number of errors = 3

Iteration 3: Number of errors = 3

Iteration 4: Number of errors = 2

Iteration 5: Number of errors = 1

Iteration 6: Number of errors = 0  
Iteration 7: Number of errors = 0  
Iteration 8: Number of errors = 0  
Iteration 9: Number of errors = 0  
Iteration 10: Number of errors = 0



Total time took to execute 0.6244475841522217

Iteration 1: Number of errors = 1  
Iteration 2: Number of errors = 2  
Iteration 3: Number of errors = 2  
Iteration 4: Number of errors = 2  
Iteration 5: Number of errors = 2  
Iteration 6: Number of errors = 2  
Iteration 7: Number of errors = 2  
Iteration 8: Number of errors = 2  
Iteration 9: Number of errors = 3  
Iteration 10: Number of errors = 2

Class 2:

Iteration 1: Number of errors = 3  
Iteration 2: Number of errors = 2  
Iteration 3: Number of errors = 2  
Iteration 4: Number of errors = 2  
Iteration 5: Number of errors = 2

Iteration 6: Number of errors = 2  
Iteration 7: Number of errors = 2  
Iteration 8: Number of errors = 3  
Iteration 9: Number of errors = 2  
Iteration 10: Number of errors = 1

The number of updates for iris dataset is 0 and body move dataset number of updates is 2 in One-vs-Rest strategy and the SGD binary classifier.

### Results:

The choice of learning rate affects the convergence rate and overall performance of the classifiers. A higher learning rate may lead to faster convergence but can also result in overshooting the minimum. Iris Dataset for the Adaline has the least time with the time 0.02318859100341797

### Conclusion:

In conclusion, The classifiers show promising performance in terms of accuracy and convergence behavior. Feature scaling and careful selection of hyperparameters such as learning rate are crucial for optimizing model performance. Further experimentation and tuning may be required for specific datasets and tasks. Iris Dataset for the Adaline has the least time with the time 0.02318859100341797