DV Run Instructions

By: CWU Visual Knowledge Discovery Lab

Overview

- Preprocessing
- Program Startup
- Creating a Project
- Interacting with Data
- Analytics
- 3+ Class Visualizations
- Saving a Project

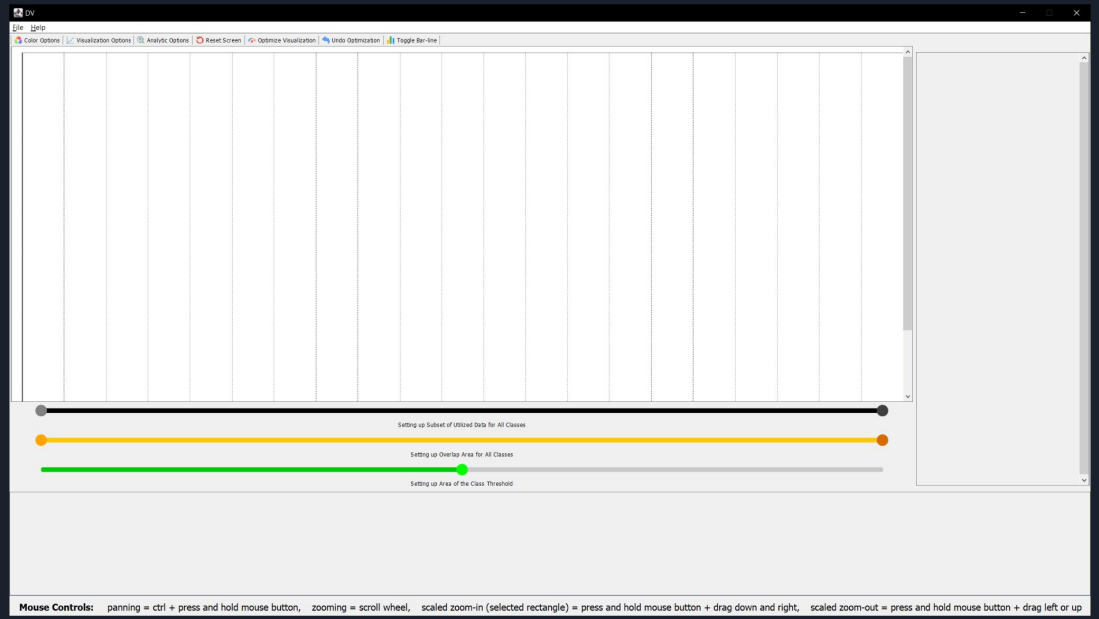
Preprocessing

- Must be a csv file or formatted similarly.
- Must have a header row and class column.
- The class column must be last.
- ID columns are allowed, but they must be the first column in the dataset.

ID	feature1	feature2	feature3	class
1	5	1	1	dog
2	5	4	1	dog
3	3	1	1	dog
4	6	8	1	cat
5	4	1	1	cat
6	8	10	1	cat
7	1	1	1	bird
8	2	1	1	bird
9	2	1	5	bird

Program Startup

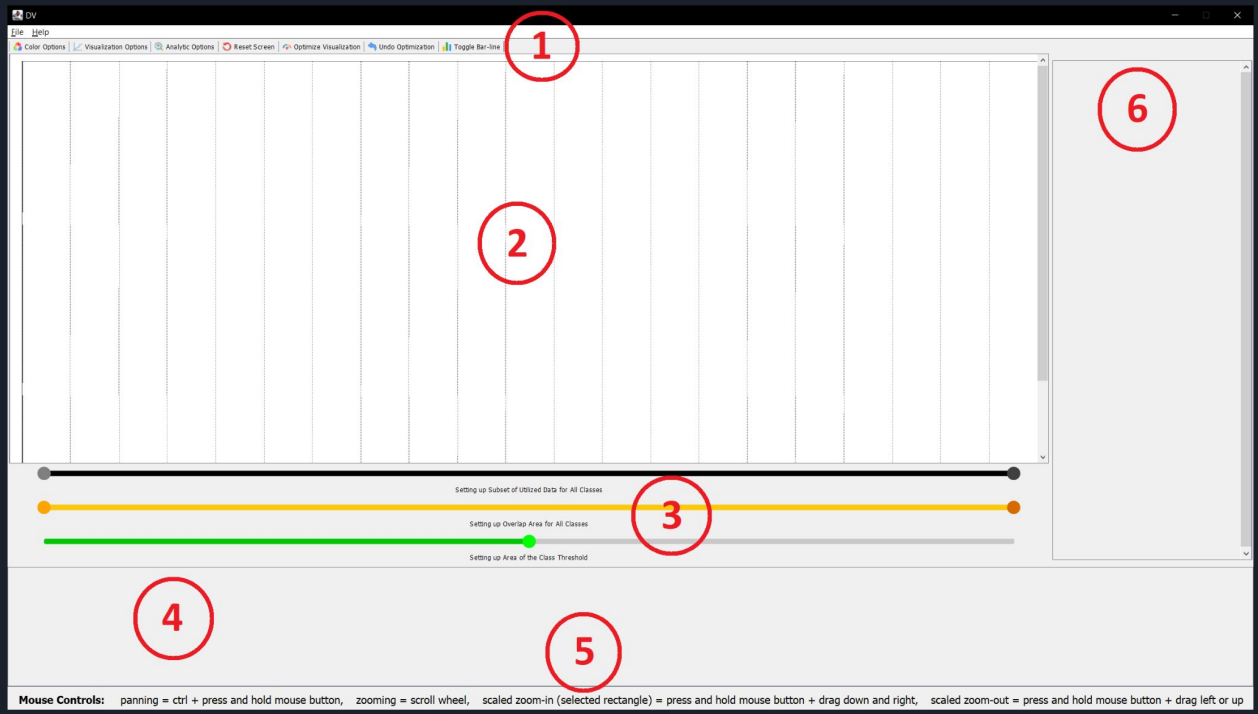
- After executing “DV.exe” the following screen will be displayed:



Program Startup

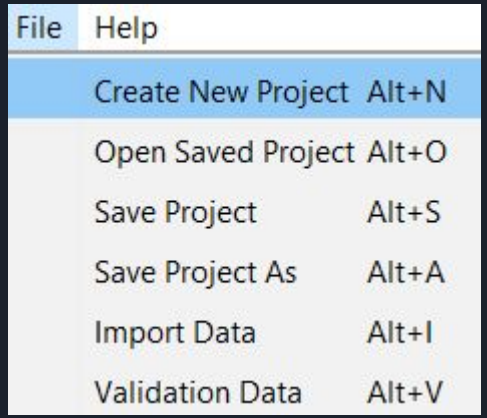
Key:

1. Menu & Toolbar
2. Graphs
3. Sliders
4. Analytics
5. Mouse Controls
6. Angles



Creating a Project

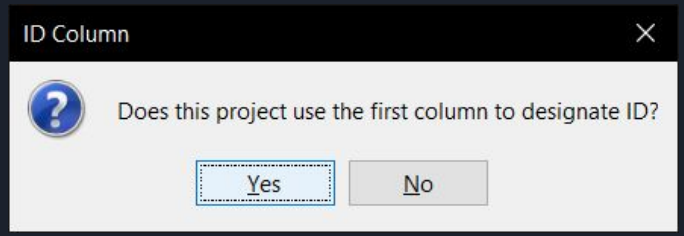
- Select “File” then “Create New Project.”
  - Or press Alt + N for a keyboard shortcut.
- Questions about the dataset will then appear.
  - Is the first column for ID?
  - Is the last column for classes?
  - Min-Max or z-Score Min-Max normalization?
- Answer the questions according to the dataset being visualized.

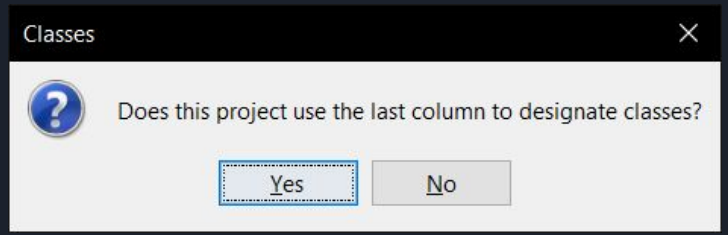


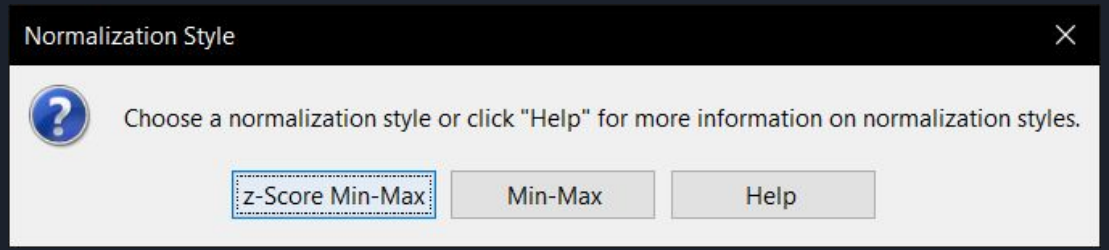
UCI Machine Learning Repository Dataset

- Wisconsin Breast Cancer
  - Answer “Yes” to the first column being for ID.
  - Answer “Yes” to the last column being for classes.
  - Select “z-Score Min-Max Normalization”

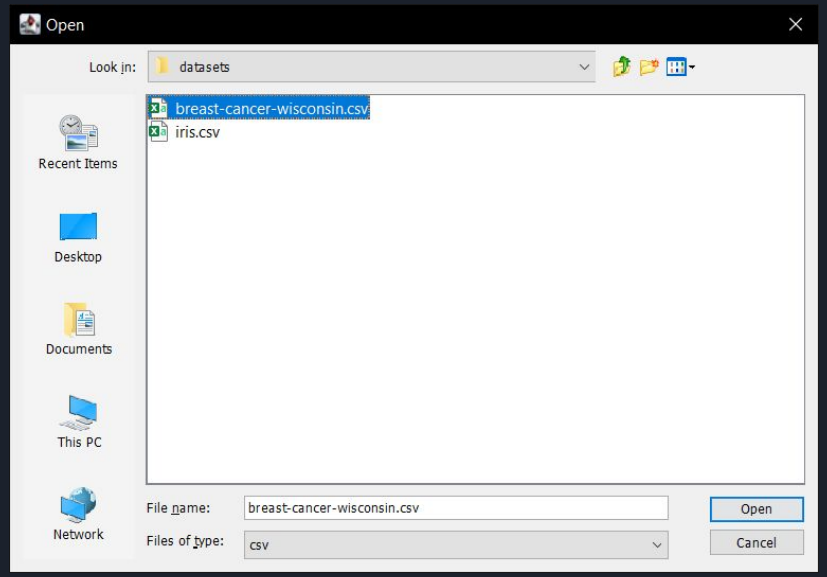
Setting up Wisconsin Breast Cancer Dataset

1. 

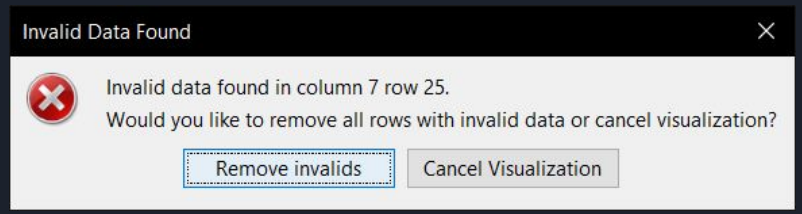
2. 

3. 

Setting up Wisconsin Breast Cancer Dataset

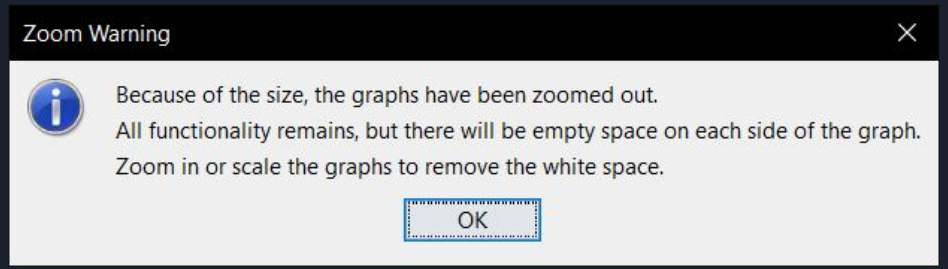


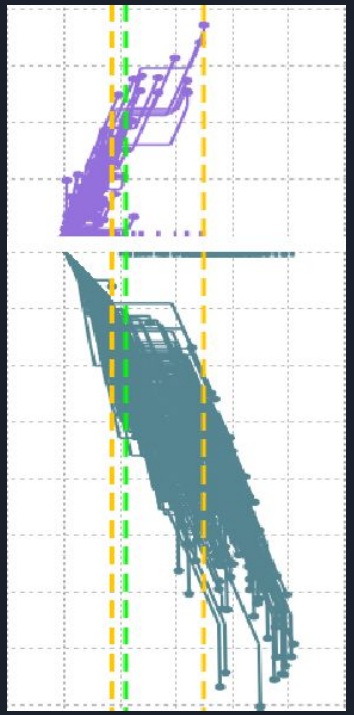
- Load from dataset directory in the same folder where the program is located.
- WBC has invalid/incomplete data.
- Select “Remove Invalids” to visualize valid data.



Interacting with Data

- A Zoom Warning will appear signifying the graphs have been scaled.





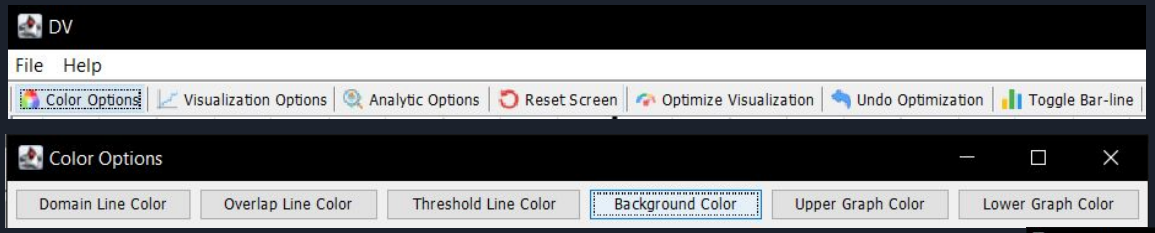
Interacting with Data

Basic User Tool Examples:

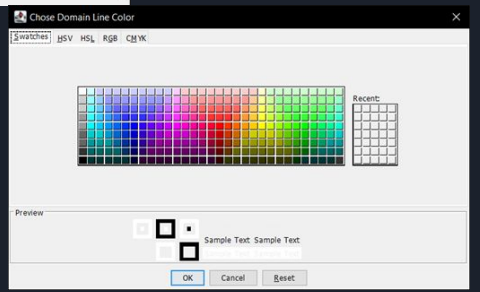
- Panning
  - crtl + press and hold mouse button
- Zooming
  - scroll wheel
- Scaled Zoom In (selected area)
  - press and hold mouse button + drag down and right
- Scaled Zoom Out
  - press and hold mouse button + drag up or left
- Reset
  - Reset button on toolbar

Interacting with Data

- Colors
  - To change the colors of any part of the visualization, select the “Color Options” button on the toolbar.

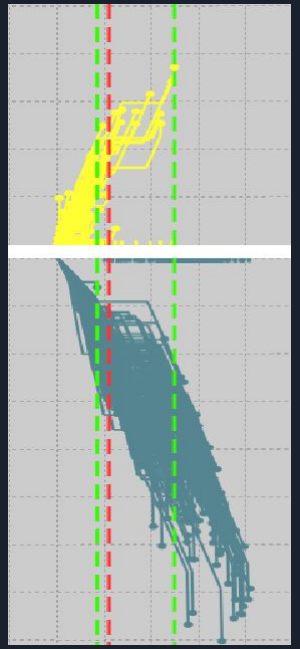


  - Selecting any of the options will result in a color choosing menu appearing.



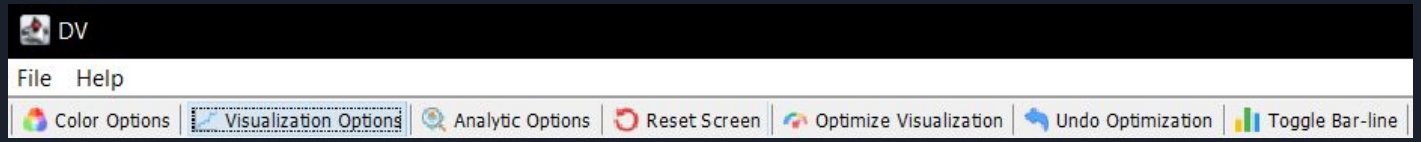
Interacting with Data

- Colors
  - Changing the “Upper Graph,” “Threshold Line,” “Overlap Lines,” and “Background” colors to yellow, red, green, and grey results in the shown visualization.



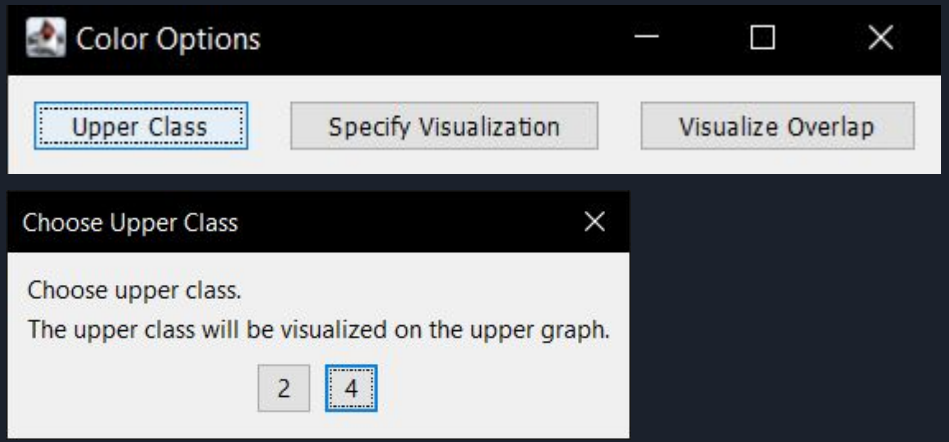
Interacting with Data: data visualization

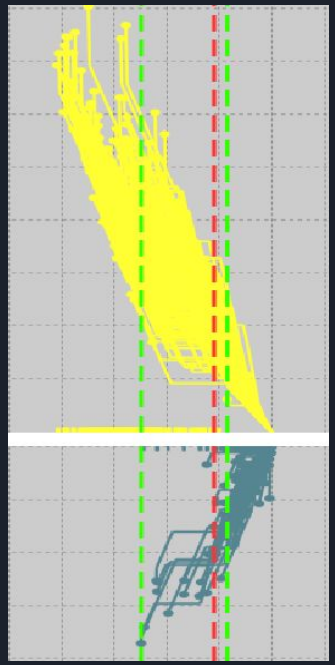
- Class Graphs
  - By selecting “Visualization Options” we can change which class is visualized on which graph.
  - We can also choose to “Visualize Overlap” to visualize only the overlapping datapoints.



Interacting with Data

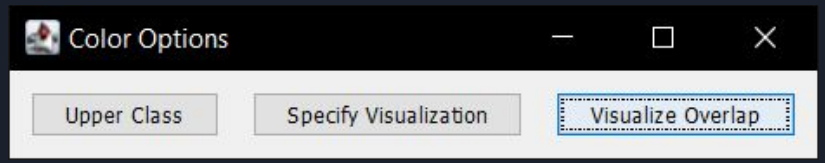
- Changing which class is on the Upper Graph.
  - Changing the class to “4” results in the shown visualization.



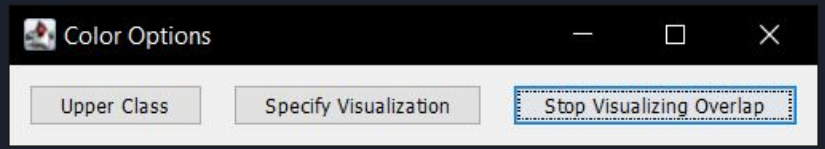


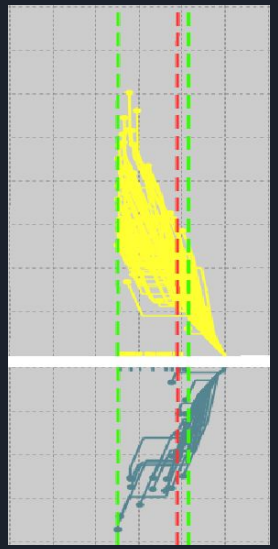
Interacting with Data

- Visualizing overlap
  - Selecting “Visualize Overlap” will result in the shown visualization.

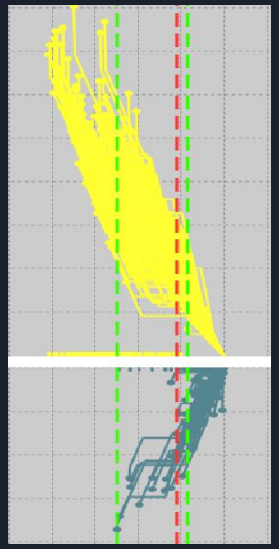


- Selecting “Stop Visualizing Overlap” will display all data again.





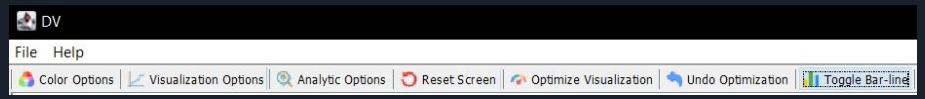
Overlap

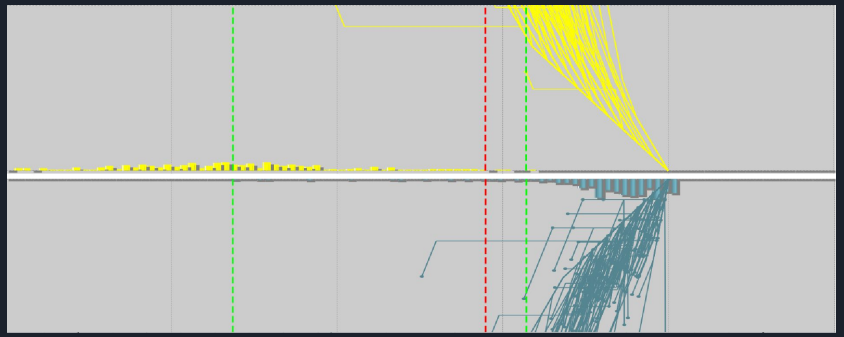


All Data

Interacting with Data

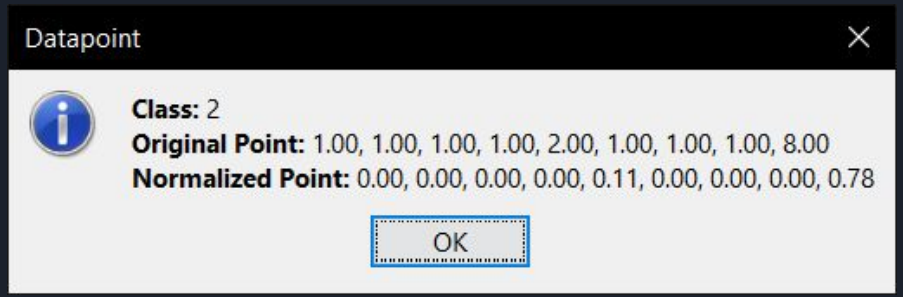
- Bar-line
  - The option is to show grouped frequency bars instead of bars for individual values when data are packed in the small area.
  - By zooming in and scaling the graph, we can get the visualization below.





Interacting with Data

- Individual datapoints
  - Selecting the endpoint of a line will result in the datapoint's information being shown.

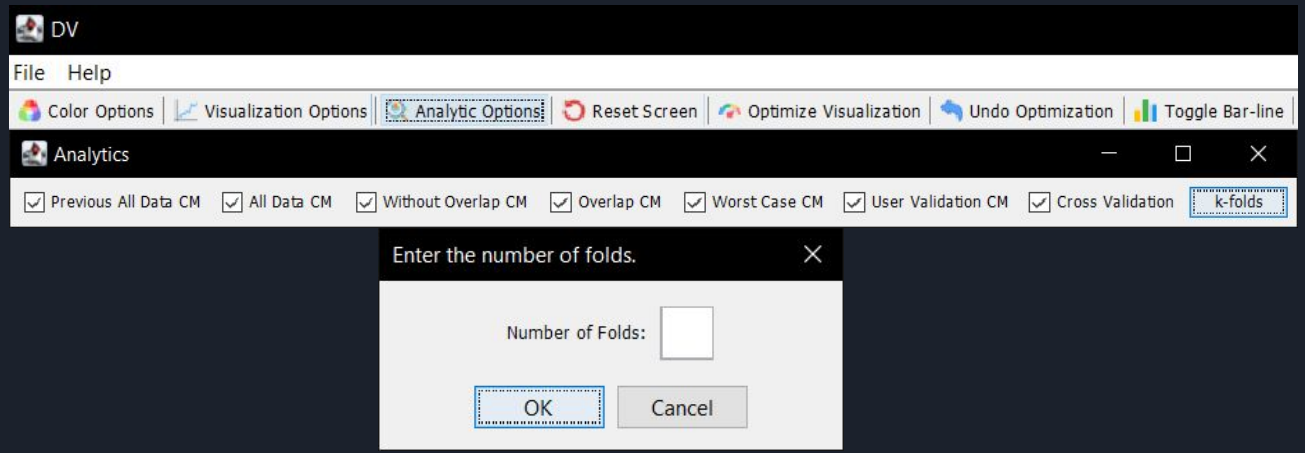


Interacting with Data

- Sliders
  - Setting up Subset of Utilized Data:
    - changes the area of utilized data
  - Setting up Overlap Area for All Classes:
    - changes the overlap area
  - Setting up Area of the Class Threshold:
    - changes the threshold
  - Angles:
    - changes the angle of the specified feature.

Analytics to activate

- User Options:
  - Toggle on/off any analytic option
  - Choose number of folds for k-fold cross validation



Analytics

By enabling all analytic options, we get confusion Matrices for classifiers constructed on:

1) All Data
2) Data without Overlap area
3) Overlap Data only
4) Worst Case Data validation set

All Data Analytics

Real Class	Predictions 1	0
1	236	3
0	15	429

Accuracy: 97.36%

Data Used: 100.00%

Data Without Overlap Analytics

Real Class	Predictions 1	0
1	129	1
0	1	421

Accuracy: 99.64%

Data Used: 80.82%

Overlap Analytics

Real Class	Predictions 1	0
1	104	6
0	13	10

Accuracy: 85.71%

Data Used: 19.47%

Worst Case Data Analytics

Real Class	Predictions 1	0
1	82	28
0	8	15

Accuracy: 72.93%

Data Used: 19.47%

Analytics

- k-fold Cross Validation

k-Fold Cross Validation

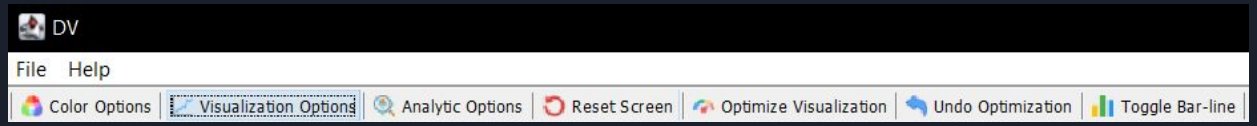
Model	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Fold 6	Fold 7	Fold 8	Fold 9	Fold 10	AVG
DT	95.65%	94.20%	94.20%	92.65%	95.59%	94.12%	97.06%	97.06%	97.06%	95.59%	95.32%
SGD	91.30%	97.10%	94.20%	94.12%	98.53%	97.06%	98.53%	100.00%	98.53%	98.53%	96.79%
NB	92.75%	95.65%	94.20%	94.12%	98.53%	95.59%	97.06%	97.06%	98.53%	97.06%	96.05%
SVM	92.75%	98.55%	95.65%	94.12%	98.53%	97.06%	97.06%	100.00%	98.53%	98.53%	97.08%
KNN	91.30%	98.55%	95.65%	94.12%	100.00%	97.06%	98.53%	100.00%	98.53%	98.53%	97.23%
LR	92.75%	91.30%	95.65%	94.12%	98.53%	97.06%	97.06%	98.53%	98.53%	100.00%	96.35%
LDA	89.86%	89.86%	97.10%	94.12%	100.00%	97.06%	97.06%	98.53%	97.06%	100.00%	96.06%
MLP	91.30%	95.65%	95.65%	94.12%	98.53%	95.59%	95.59%	98.53%	98.53%	100.00%	96.35%
RF	92.75%	97.10%	95.65%	94.12%	98.53%	97.06%	98.53%	98.53%	98.53%	98.53%	96.93%
AVG	92.27%	95.33%	95.33%	93.95%	98.53%	96.41%	97.39%	98.69%	98.20%	98.53%	96.46%
St. Dev.	1.62%	3.06%	0.97%	0.49%	1.27%	1.07%	0.98%	1.15%	0.65%	1.47%	1.27%

3+ Class Visualizations

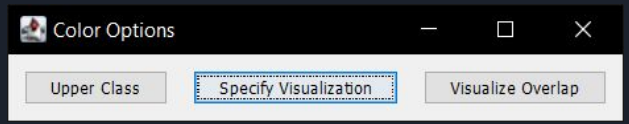
- The DV Program is only capable of visualizing two classes at once.
- For 3+ class visualizations the upper graph displays one class while the lower graph displays all others.
- Classes in the lower graph can then be removed one by one until eventually only two classes remain.

3+ Class Visualizations

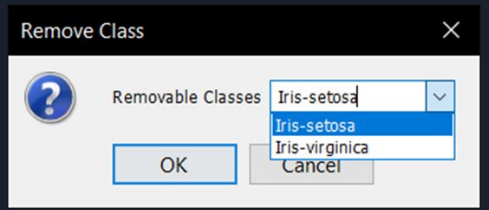
- To remove a class from the lower graph select “Visualization Options”



- Select “Specify Visualization”

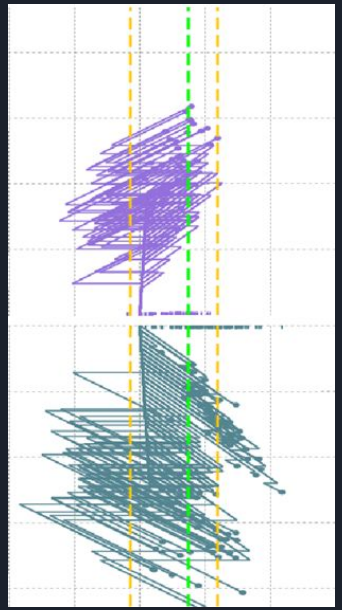


- Select the class you wish to remove

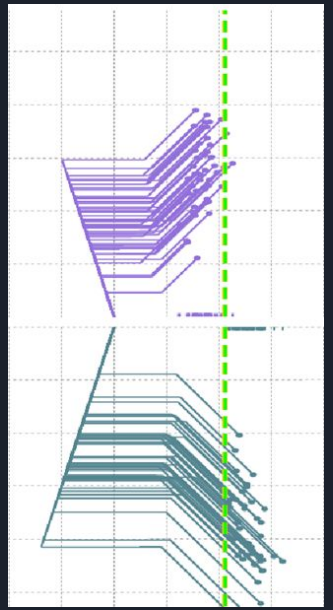


3+ Class Visualizations

- Initial Visualization:
  - Upper Graph: Iris-Versicolor
  - Lower Graph: Iris-Setosa & Iris-Virginica
- Iris-Setosa Class removed



Initial Visualization



Iris-Versicolor Class Removed

3+ Class Visualizations

- Analytics:
  - The “All Data Analytics” confusion matrix is saved when removing classes.
  - New “All Data Analytics” confusion matrix displays overall accuracy of the combined visualizations.

Iris-Versicolor
vs
Iris-Setosa &
Iris-Virginica

All Data Analytics

Real Class	Predictions 1	0,2
1	40	10
0,2	26	74

Accuracy: 76.00%

Data Used: 100.00%

Iris-Versicolor
vs
Iris Virginica

All Data Analytics

Real Class	Predictions 1	2
1	48	2
2	1	49

Accuracy: 97.00%

Overall Accuracy: 84.40%

Data Used: 66.67%

Saving a Project

- Select “File” then “Save Project As.”
  - Or press Alt + A for a keyboard shortcut.
- Select a file location and name the project.
- To open the project simply select “Open Saved Project” and select the project save.
- Once the project save is established, simply select “Save Project” to save all subsequent edits.