**Data Pre-processing**

* Loading and Inspecting Data (delimiter → corrected dataset)
* Checking for Missing Values: none for both dataset
* Feature and Target Separation:

Red wine:

A screenshot of a computer

Description automatically generated

White wine:

A screenshot of a computer

Description automatically generated

**Standard Deviation Analysis**:

Red wine：

A graph of a bar graph

Description automatically generated with medium confidence

A graph with blue bars

Description automatically generatedWhite wine：

Red wine:

A screenshot of a graph

Description automatically generated

White wine:

A screenshot of a data table

Description automatically generated

Red wine:

A graph with blue squares

Description automatically generated

White wine:

A graph with blue squares

Description automatically generated

A graph of blue bars

Description automatically generated with medium confidence

A graph of a bar graph

Description automatically generated with medium confidence

A screenshot of a computer

Description automatically generated

A group of graphs showing different sizes and colors

Description automatically generated

A group of diagrams with text

Description automatically generated with medium confidence

A screenshot of a computer

Description automatically generated

A screen shot of a computer

Description automatically generated

A screenshot of a computer program

Description automatically generated

With Lagrangian Relaxation:

A black screen with white text

Description automatically generated

Optimize Branch-and-Cut:

A screenshot of a computer

Description automatically generated

Kfold：  
A screenshot of a computer program

Description automatically generated