Short Report 3

Data:id 287 Wine_Quality

Dataset Overview:

Contains **two datasets**: red and white wine samples.
Focuses on the Portuguese "Vinho Verde" wine.
Inputs: Results from **physicochemical tests** (e.g., pH values).
Output: **Sensory data**, a quality score (0–10) evaluated by wine experts (median of at least three evaluations).

Tasks: Suitable for **regression** or **classification** approaches.

Classes are **ordered but imbalanced** (normal wines are more common than excellent or poor wines).

Total instances:

Red wine: 1,599 instances.

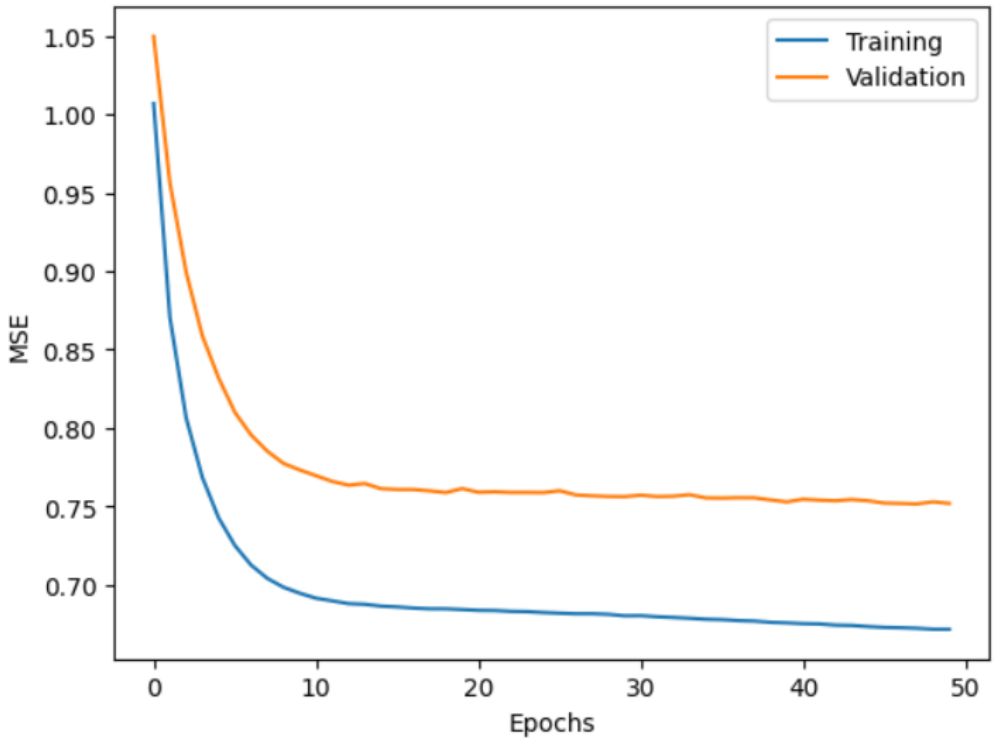
White wine: 4,898 instances (instances 1600–6497 in the combined dataset).

Attributes:

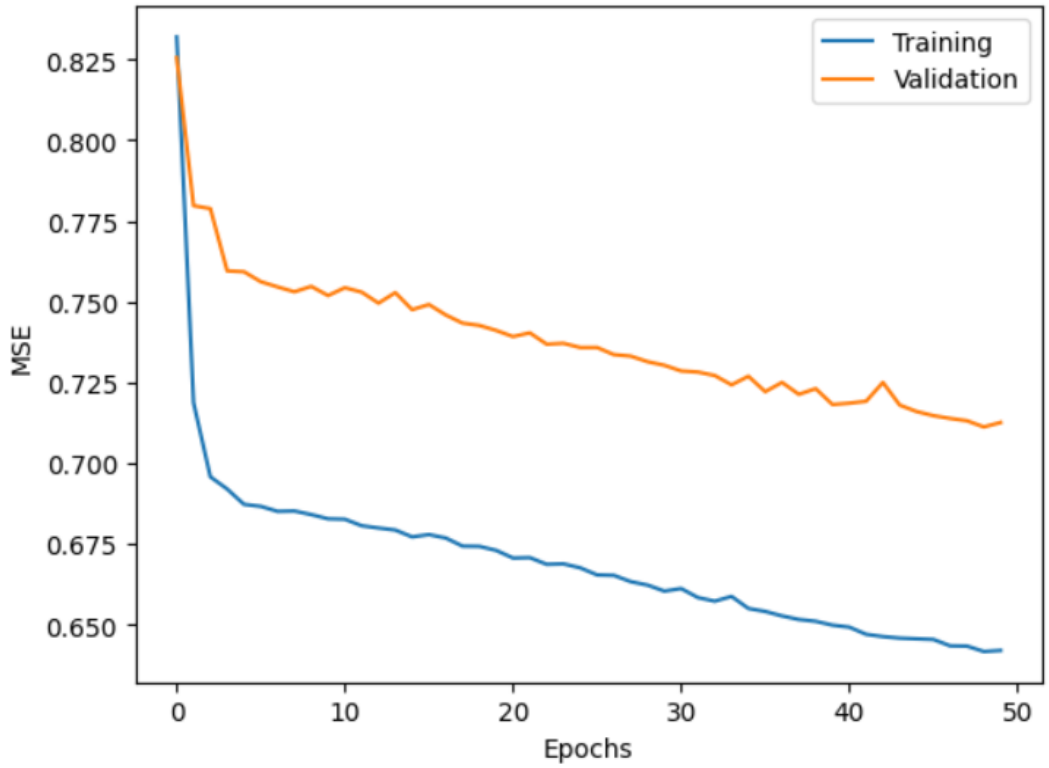
11 input attributes (physicochemical properties).

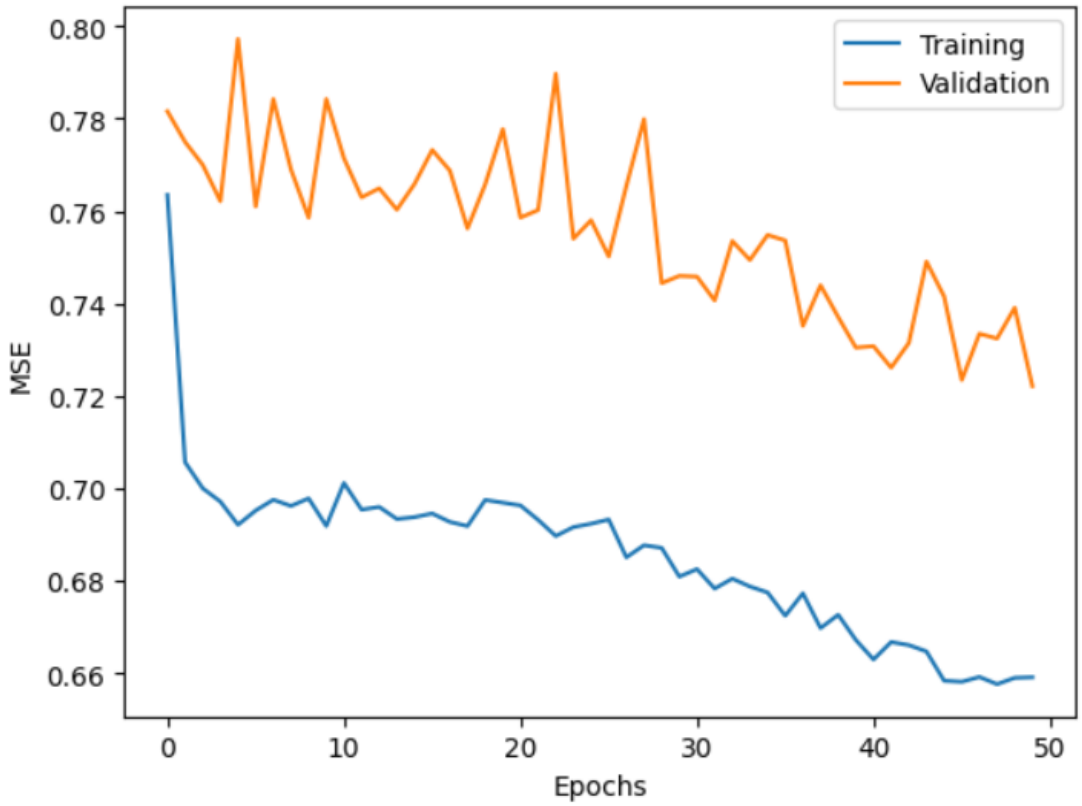
1 output attribute (quality score).

Missing Values: None.


Training
Validation
MSE
Epochs
1.05
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0
10
20
30
40
50

Epochs


Training
Validation
MSE
Epochs
0.825
0.800
0.775
0.750
0.725
0.700
0.675
0.650
0
10
20
30
40
50



Data:id 503 Wind

Dataset Description:

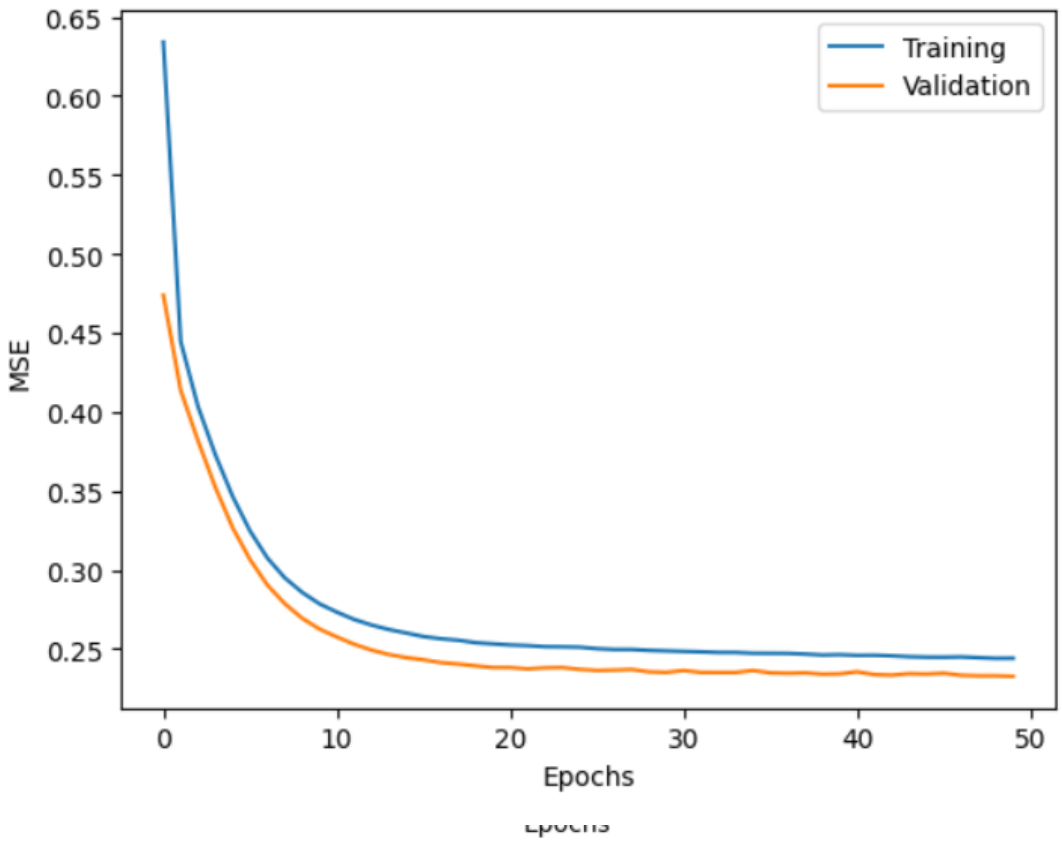
Contains daily average wind speeds from 1961 to 1978 at 12 synoptic meteorological stations in the Republic of Ireland.

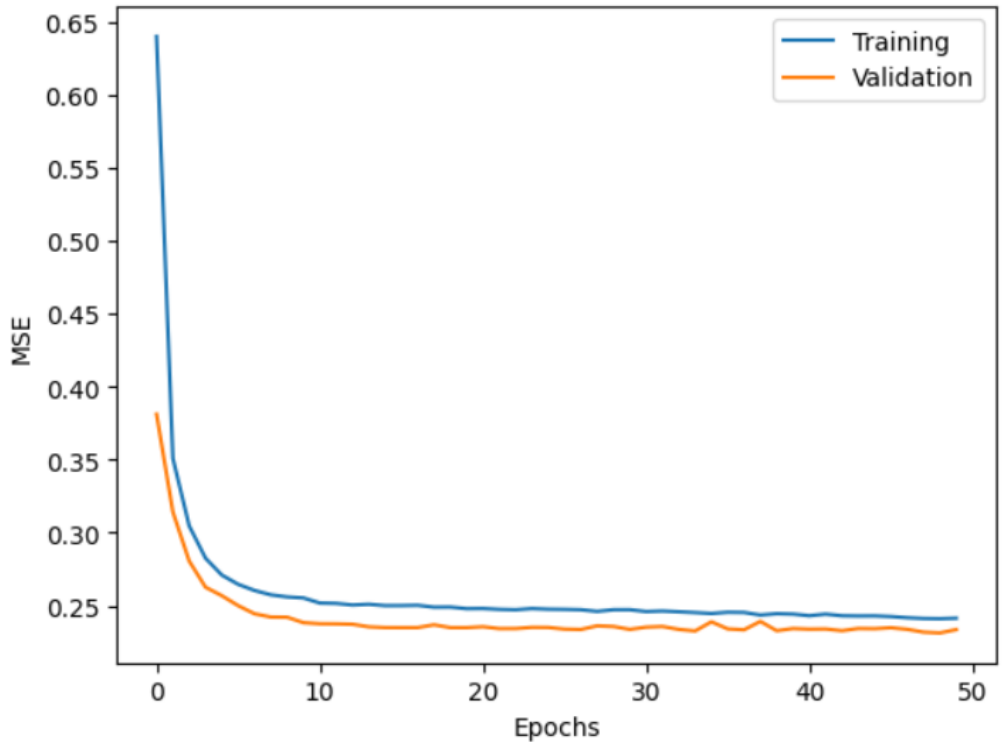
Data Format:

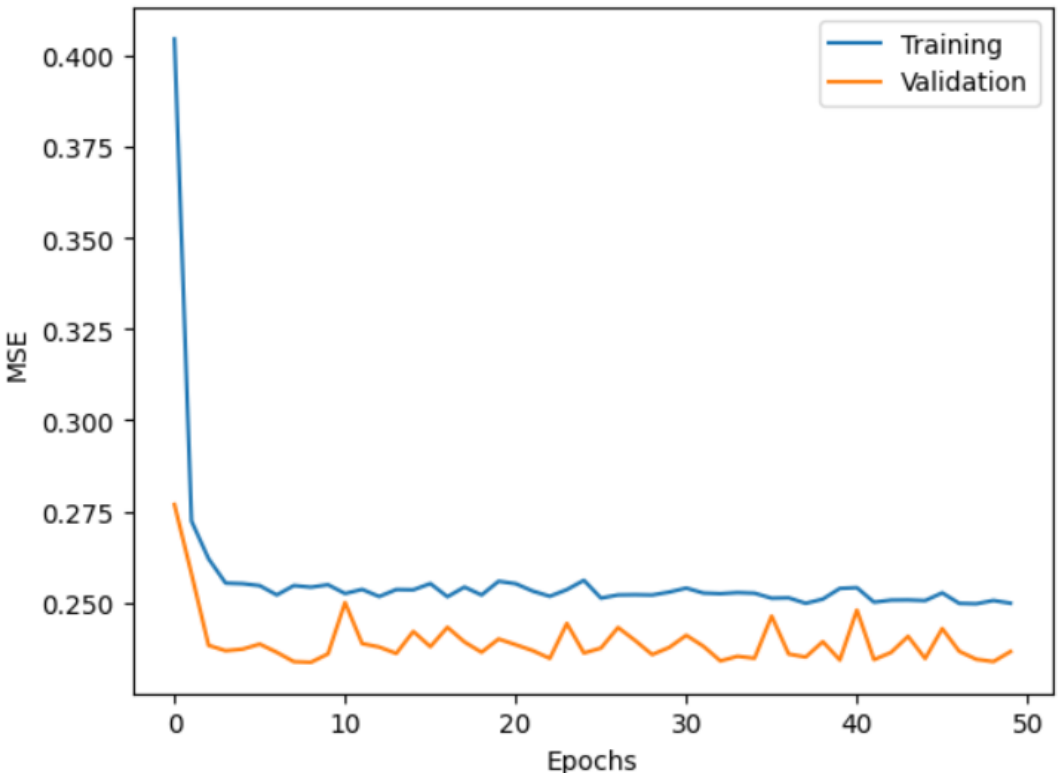
Columns: Year, Month, Day, and Average Wind Speed at 12 stations. Stations (in order): RPT, VAL, ROS, KIL, SHA, BIR, DUB, CLA, MUL, CLO, BEL, MAL.

Dataset Characteristics:

CLASSTYPE: Numeric.
CLASSINDEX: None specified.


Training
Validation
MSE
Epochs
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0
10
20
30
40
50


Training
Validation
MSE
Epochs
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0
10
20
30
40
50



	Dataset	Model	Test MSE
0	Dataset 287	Model 1	0.667163
1	Dataset 287	Model 2	0.666216
2	Dataset 287	Model 3	0.690951
3	Dataset 503	Model 1	0.215052
4	Dataset 503	Model 2	0.219433
5	Dataset 503	Model 3	0.221257

Discussion

Dataset: Wine Quality

1. **Dataset Characteristics**:
    - Suitable for regression and classification tasks.
    - **Input Variables**: 11 physicochemical properties (e.g., pH, alcohol content).
    - **Output Variable**: Quality score (0–10, evaluated by experts).
    - Imbalanced classes: Normal quality wines significantly outnumber excellent or poor wines.
2. **Model Analysis**:

- **Regression Models**: Analyze how physicochemical properties influence quality scores.
- **Classification Models**: Classify wines into excellent, normal, or poor categories.
- Support Vector Machines (SVM) performed best, but modern models (e.g., Random Forest, Gradient Boosting) may achieve better results.

First Chart: Both training and validation MSE decrease rapidly and stabilize, showing the best performance and strong generalization ability.
Second Chart: Training MSE continues to decline, but validation MSE decreases more slowly, with a noticeable gap, indicating slight overfitting.
Third Chart: Training MSE decreases significantly, but validation MSE fluctuates and remains high, suggesting severe overfitting.

Dataset: Wind

1. **Dataset Characteristics**:
   - Contains daily average wind speeds (1961–1978).
   - Data collected from 12 meteorological stations in Ireland.
   - Each row includes the year, month, day, and wind speeds from 12 stations.
2. **Model Analysis**:
   - **Time-Series Models**: Analyze seasonal and annual variations in wind speeds.
   - **Spatial Analysis Models**: Compare wind speed distributions across regions to assess wind energy potential.
   - Anomaly detection methods (e.g., removing extreme wind speeds) can improve model stability.

First Chart: The best-performing model with stable and close training and validation MSE, indicating strong generalization.
Second Chart: Stable performance with slower learning, suitable for simpler models.
Third Chart: Shows fluctuations in validation MSE, indicating potential overfitting; optimization is needed.