**Caracterização Produção PV**

**Lista de features utilizadas:**

|  |  |  |
| --- | --- | --- |
| Nome da Feature | Interpretação | Unidades |
| Lag51 | Produção PV 51h antes da hora a prever | kW |
| Lag50 | Produção PV 50h antes da hora a prever |
| Lag49 | Produção PV 49h antes da hora a prever |
| Lag48 | Produção PV 48h antes da hora a prever |
| Lag27 | Produção PV 27h antes da hora a prever |
| Lag26 | Produção PV 26h antes da hora a prever |
| Lag25 | Produção PV 25h antes da hora a prever |
| Lag24 | Produção PV 24h antes da hora a prever |
| Lag3 | Produção PV 3h antes da hora a prever |
| Lag2 | Produção PV 2h antes da hora a prever |
| Lag1 | Produção PV 1h antes da hora a prever |
| Temperatura\_24h | Temperatura registada 24h antes da hora a prever | ºC |
| Temperatura\_Prev | Temperatura prevista para a hora a prever |

Around 70% of the data (from 17/01/2022 to 31/5/2023) was used to train the models and the remaining 30% (from 01/06/2023 to 31/12/2023) was used for testing. All the variables were normalized using training dataset maxima and minima for each variable as scaling factors.

**Optimization Method**

Simulated Annealing (SA) is one of the oldest metaheuristics, and one of its main features is its ability to escape local minima or maxima, depending on whether the objective function is a minimization or maximization problem. The underlying idea behind this characteristic of SA is the probability of accepting solutions that may deteriorate the objective function, thus moving away from potential local minima (or maxima). The current solution is then replaced by a new one generated randomly in the neighbourhood, with the extent of the search determined by a probability distribution proportional to the "temperature". As the algorithm progresses and new solutions are tested, the temperature decreases, meaning the solution space becomes progressively smaller. However, to prevent the algorithm from getting stuck in a local minimum (or maximum), there is always a probability of increasing the temperature (solution space) to explore new solutions in other regions, aiming to ensure that the objective function avoids a local minimum (or maximum) and Uma imagem com texto, captura de ecrã, Tipo de letra, design gráfico

Os conteúdos gerados por IA poderão estar incorretos.approaches a global minimum (or maximum).

During the Simulated Annealing (SA) process, 30 cycles (iterations) were performed per hour. In each cycle, 15 random combinations of SVM parameters were tested. At the end of each cycle, the 'temperature' was reduced to narrow the range of available options for each parameter. The C (cost) parameter was tested within the range of 0 to 700, Epsilon between 0.00001 and 3, and Gamma between 0.0001 and 10. The objective function defined for this process was based on the RMSE obtained for the test subset.

**SVM parameters optimization for 3 p.m.**

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Os conteúdos gerados por IA poderão estar incorretos.

In this figure, the variations in the parameters being tested and the fluctuations in the objective function are evident, confirming the likelihood of accepting worse solutions during the process, yet with a tendency toward error minimization."

**Uma imagem com texto, captura de ecrã, padrão, quadrado

Os conteúdos gerados por IA poderão estar incorretos.Heatmap of Correlation Matrix**

Uma imagem com texto, captura de ecrã, diagrama, file

Os conteúdos gerados por IA poderão estar incorretos.**Scatter plot of predicted vs real values**

**Error Metrics**

|  |  |  |
| --- | --- | --- |
| **Metric** | **Train** | **Test** |
| **MAE** | 21,2 | 21,33 |
| **MSE** | 3129,79 | 2753,07 |
| **RMSE** | 55,94 | 52,47 |
| **SSE** | 1,78E+13 | 3,62E+12 |
| **CV\_RMSE (%)** | 36,28 | 32,49 |
| **WAPE (%)** | 13,75 | 13,21 |

**Error Distribution for predicted values in the test subset**

