DengAI : Specification

Feature / Specification	Value
Model Type	Bi-LSTM (Bidirectional Long Short-Term Memory)
Hyperparameter Tuning Method	Bayesian Optimization
Trials	3
Learning Rate	0.001
Number of Epochs	500
Batch Size	16
Patience for Early Stopping	30
Reduce Learning Rate Factor	0.8
Patience for Reducing LR	5
Minimum LR	1e-6
LSTM Units (First Layer)	Randomly sampled from [50, 100, 150, 200]
Dropout Rate (First Layer)	Randomly sampled from [0.2, 0.3, 0.4, 0.5]
LSTM Units (Second Layer)	Randomly sampled from [50, 100, 150, 200]
Dropout Rate (Second Layer)	Randomly sampled from [0.2, 0.3, 0.4, 0.5]
Initial Validation Loss	3387.3547
Initial Validation MAE	26.1888
Final Validation Loss	94.1017
Final Validation MAE	4.0697
Validation R-squared	0.9727
Accuracy within ±16.3	97.26%

Each Portion in Little Details:

- **Model Type: Bi-LSTM (Bidirectional Long Short-Term Memory)**
    - **Description**: Bi-LSTM is an extension of LSTM (Long Short-Term Memory) networks, which are a type of recurrent neural network (RNN). Bi-LSTM processes data in both forward and backward directions, capturing information from both past and future states in the sequence.
    - **Purpose**: To improve the model's ability to learn temporal dependencies in sequential data, which is useful for time series prediction tasks like dengue case forecasting.
- **Hyperparameter Tuning Method: Bayesian Optimization**
    - **Description**: Bayesian Optimization is a method for optimizing hyperparameters that uses a probabilistic model to explore the hyperparameter space efficiently.
    - **Purpose**: To find the best combination of hyperparameters for the model to achieve the lowest validation loss.
- **Trials: 3**

- **Description**: The number of different hyperparameter configurations the tuner will try.
- **Purpose**: To explore different hyperparameter settings and identify the best configuration within the specified number of trials.

- **Learning Rate: 0.001**

  - **Description**: The step size used by the optimizer to update the model parameters.
  - **Purpose**: Controls how quickly the model learns; a smaller learning rate can lead to more stable training but might require more epochs.

- **Number of Epochs: 500**

  - **Description**: The number of complete passes through the training dataset.
  - **Purpose**: To provide enough iterations for the model to learn the data patterns effectively.

- **Batch Size: 16**

  - **Description**: The number of samples processed before the model's internal parameters are updated.
  - **Purpose**: Balances the trade-off between training speed and the stability of the optimization process.

- **Patience for Early Stopping: 30**

  - **Description**: The number of epochs with no improvement in validation loss after which training will be stopped.
  - **Purpose**: To prevent overfitting by stopping training when the model's performance on the validation set stops improving.

- **Reduce Learning Rate Factor: 0.8**

  - **Description**: The factor by which the learning rate will be reduced when the performance plateaus.
  - **Purpose**: To fine-tune the learning process and help the model converge to a better minimum by reducing the learning rate when progress stalls.

- **Patience for Reducing LR: 5**

  - **Description**: The number of epochs with no improvement after which the learning rate will be reduced.
  - **Purpose**: To dynamically adjust the learning rate to improve the model's convergence.

- **Minimum LR: 1e-6**

  - **Description**: The lowest learning rate value to which the learning rate can be reduced.

    - **Purpose**: To prevent the learning rate from becoming too small, which would hinder the training process.

- **LSTM Units (First Layer): Randomly sampled from [50, 100, 150, 200]**

    - **Description**: The number of LSTM units in the first layer of the model.
    - **Purpose**: To determine the capacity of the model in capturing the data patterns.

- **Dropout Rate (First Layer): Randomly sampled from [0.2, 0.3, 0.4, 0.5]**

    - **Description**: The fraction of input units to drop during training to prevent overfitting.
    - **Purpose**: To regularize the model and improve its generalization ability.

- **LSTM Units (Second Layer): Randomly sampled from [50, 100, 150, 200]**

    - **Description**: The number of LSTM units in the second layer of the model.
    - **Purpose**: To add more depth to the model and capture more complex patterns in the data.

- **Dropout Rate (Second Layer): Randomly sampled from [0.2, 0.3, 0.4, 0.5]**

    - **Description**: The fraction of input units to drop during training to prevent overfitting in the second layer.
    - **Purpose**: To regularize the model and improve its generalization ability.

- **Initial Validation Loss: 3387.3547**

    - **Description**: The validation loss at the beginning of the training process.
    - **Purpose**: To provide a baseline for evaluating the model's improvement during training.

- **Initial Validation MAE: 26.1888**

    - **Description**: The mean absolute error on the validation set at the beginning of training.
    - **Purpose**: To provide a baseline for evaluating the model's performance improvement.

- **Final Validation Loss: 94.1017**

    - **Description**: The validation loss after training is complete.
    - **Purpose**: To measure the model's final performance on the validation set.

- **Final Validation MAE: 4.0697**

    - **Description**: The mean absolute error on the validation set after training is complete.
    - **Purpose**: To measure the model's accuracy in predicting the target variable.

- **Validation R-squared: 0.9727**

    - **Description**: The R-squared value indicating how well the model's predictions match the actual values on the validation set.
    - **Purpose**: To provide a measure of the goodness of fit of the model.

- **Accuracy within ±16.3: 97.26%**

    - **Description**: The percentage of predictions that are within ±16.3 units of the actual values.
    - **Purpose**: To evaluate the model's accuracy within a specified tolerance range.