2023

# DS 7333 | Quantifying the World

## FINAL EXAM | COST OPTIMIZED CLASSIFICATION

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# Introduction

## Background

In an increasingly data-driven business environment, the ability to accurately predict outcomes is paramount. The challenge often lies not just in the prediction itself but in the cost associated with the inaccuracies of such predictions. False predictions can be classified into two main categories: false positives and false negatives, each carrying its own implications and costs. A false positive occurs when the model incorrectly predicts a positive outcome, while a false negative is when the model fails to identify a positive outcome. The impact of these inaccuracies varies based on the nature of the business and the specific circumstances surrounding the predictive model's application.

## Objective

The primary objective of our predictive modeling endeavor is to develop a binary classification model that can discern between 'Yes' (positive) and 'No' (negative) outcomes with the highest possible accuracy. The model will be applied to an anonymized dataset with undisclosed features, emphasizing the minimization of the associated cost of incorrect predictions. Given the cost structure, where a false positive is penalized five times more heavily than a false negative ($100 versus $40), the model must prioritize the reduction of false positives without significantly increasing the false negatives. The ideal model will strike a balance between sensitivity (true positive rate) and specificity (true negative rate) to achieve the lowest possible total cost to the business. Various modeling techniques will be explored and evaluated based on their performance against this cost function to ensure the most economically advantageous outcome.

## Data Inspection

**Target Distribution**

The dataset at hand comprises 160,000 original observations, aimed at predicting a binary outcome—essentially a 'Yes' (1) or 'No' (0). The target variable distribution indicates a relatively balanced dataset with 95,803 instances of the 'No' class and 64,197 of the 'Yes' class. Such a distribution is beneficial as it does not heavily favor one class over the other, which can be a common issue in binary classification problems leading to a biased model.

**Missing Values**

Upon initial inspection, the dataset contains 1,608 missing values. The missing data represents 1% of the total observations, which is a relatively small proportion. There is no discernible pattern or correlation between the missing values and other variables in the dataset. Given the absence of a relationship and the comparatively low percentage of missing data, the decision has been made to proceed with the removal of these instances. This approach is deemed appropriate as it simplifies the modeling process without the risk of introducing bias or inaccuracies that could come with imputation methods.

**Numerical Variables**

The numerical features in the dataset exhibit a wide range of magnitudes, indicating the presence of variables measured on different scales. This observation suggests a need for normalization or standardization in the preprocessing phase to ensure that no single attribute dominates the model due to its scale.

**Categorical Variables**

The dataset includes several categorical variables which provide classificatory information:

- Country of origin with categories such as Asia, Europe, and America.
- Month of the year from January to December.
- Day of the week covering Monday to Friday.

These categorical variables are crucial for the model as they might hold significant predictive power. They will require appropriate encoding to transform them into a format that can be effectively utilized by the predictive algorithms.

**Financial Values**

Some columns represent financial figures initially in dollar terms, which have been converted to floating-point numbers to maintain consistency and to facilitate computation. Likewise, a percentage column has been adjusted by dividing by 100 and converting to a float. These transformations are essential for aligning all numerical variables on a similar scale and for preparing the data for analysis by various statistical and machine learning methods.

In summary, the initial data inspection has laid the groundwork for further preprocessing. The subsequent steps will involve handling missing values, transforming categorical variables, and normalizing numerical values to ensure the data is in an optimal form for modeling.

***Figure 1:*** *Count plot illustrating the distribution of the classification target.*


***Description***: *The count plot displays the class distribution for our target variable, highlighting the difference between the two instances. This visualization aids in identifying class balance present in the dataset.*

***Table 1:*** *Table detailing the distribution of target class.*

| **Distribution of Target Variable** | | |
|---|---|---|
| **Class** | **Class Counts** | **Class Percentages** |
| 0 (No) | 95803 | 59% |
| 1 (Yes) | 64197 | 41% |

***Description***: The table presents the distribution of occurrences of the data *target* variable. It succinctly highlights the number of instances for each class and the corresponding percentages.

# Modeling

## Preprocessing

**Data Splitting**:

- Initially, the dataset (df) is split into features (X) and target (y). The features are all columns except the target column 'y'.
- The data is then split into training and test sets using train_test_split from sklearn.model_selection. This is a common practice in machine learning to evaluate the performance of models on unseen data.
- The split is done in a way that 80% of the data is used for training (X_train_main, y_train_main) and 20% for testing (X_test, y_test).
- The stratify parameter ensures that the proportion of classes in the target variable is maintained in both training and test sets, which is crucial for maintaining a representative distribution, especially in imbalanced datasets.

**Feature Scaling**:

- Before splitting the data, feature scaling is applied using StandardScaler from sklearn.preprocessing. This is important because many machine learning algorithms perform better when numerical input variables are scaled to a standard range.
- The scaler is fitted and transformed on the columns specified in col_to_scale. This standardizes features by removing the mean and scaling to unit variance.
- The scaled data is then reassigned back to the corresponding columns in X.

**Validation Set Creation**:

- The main training set (X_train_main, y_train_main) is further split into a training set and a validation set.
- This split is again 75% for training (X_train, y_train) and 25% for validation (X_validation, y_validation), which allows for a separate dataset to tune hyperparameters and prevent overfitting.
- The use of stratify on y_train_main for this split ensures that the class distribution is consistent across the training and validation sets.

**Random State**:

- The random_state parameter set to 12 ensures reproducibility. It fixes the way the data is split, so the same results can be achieved if the code is rerun.

## Random Forest – (Benchmark) Base Model

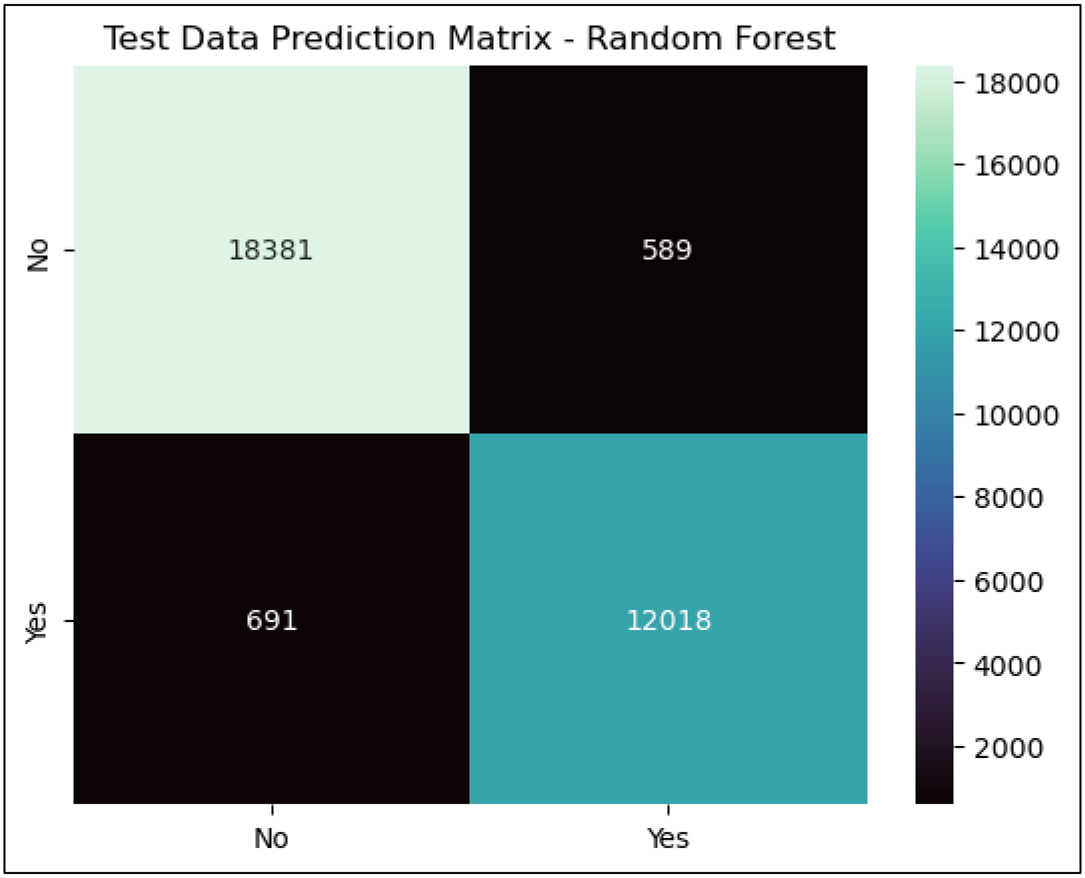
In the initial phase of our case study, we sought to establish a benchmark for performance using a base model. The Random Forest Classifier was selected for its versatility and robustness, particularly in managing datasets with potential class imbalances. Random Forest, an ensemble learning method, constructs a multitude of decision trees during training and outputs the class that is the mode of the classes for classification. Its inherent mechanism of averaging helps to prevent overfitting, often resulting in a solid baseline performance.

Upon configuring our Random Forest Classifier with a balanced class weight to adjust for imbalanced classes, we proceeded to fit the model on our training set, composed of X_train for the features and y_train for the labels. Following the training process, we predicted outcomes on a validation set, X_validation, to assess the model's generalization capabilities.

The performance metrics were derived using a confusion matrix and a classification report on the test data. The confusion matrix revealed the number of true positive and true negative predictions, alongside the false positives and negatives, allowing us to gauge the model's predictive accuracy in a binary classification context. The classification report provided further insight with precision, recall, and f1-score metrics for each class, as well as overall accuracy. These metrics are indispensable for understanding the model's performance nuances, particularly in the context of an imbalanced dataset where traditional accuracy may not fully reflect the model's effectiveness.

Our base model demonstrated commendable predictive power, with an overall accuracy of 0.91. The macro and weighted averages for precision, recall, and the f1-score were consistent at approximately 0.91, indicating a balanced performance between the sensitivity and specificity of the model. These results provide a solid foundation for comparison as we proceed to explore more complex models and techniques. The elucidation of these findings will inform our subsequent steps in model refinement and selection, ensuring that any improvements are measured against a robust and well-understood baseline.

***Figure 2:*** *A visual of the Random Forest Base model prediction matrix.*




***Description****: The plot above illustrates the confusion matrix for the predictions made by the Random Forest Baseline model. On the x-axis, we have the predicted labels, and on the y-axis, we have the true labels.*

***Table 2 :*** *Classification Report for Random Forest Base Model*

| Random Forest - Classification Report | | | | |
|---|---|---|---|---|
| | **Precision** | **Recall** | **F1- Score** | **Support** |
| **No** | 0.90 | 0.95 | 0.93 | 18970 |
| **Yes** | 0.92 | 0.85 | 0.88 | 12709 |
| **Accuracy** | | | 0.91 | 31679 |
| **Macro Avg** | 0.91 | 0.90 | 0.90 | 31679 |
| **Weighted Avg** | 0.91 | 0.91 | 0.91 | 31679 |

***Description****: The classification report indicates that the model achieved a precision of 0.90 for class No and 0.92 for class 1, a recall of 0.95 for class No and 0.85 for class Yes, and an overall accuracy of 91%*

***Table 3:*** *Misclassification Cost Report for Random Forest Base Model*

| Random Forest – Cost of Misclassification Report | | | | |
|---|---|---|---|---|
| | **Cost Per Misclassification** | **Number of Misclassifications** | **Total Cost** | **Total Cost Combined** |
| **False Positive** | $100 | 977 | $97,700 | $173,940 |
| **False Negative** | $40 | 1906 | $76,240 | |

***Description****: Table 3 provides a breakdown of the costs associated with misclassifications for the Random Forest base model, detailing the financial impact of false positives and false negatives, leading to a total combined misclassification cost of $173,940.*

## XGBoost Model – F1 Optimized

Following the establishment of a Random Forest baseline, the case study advanced to incorporate the XGBoost algorithm, a sophisticated and powerful machine learning technique that stands for Extreme Gradient Boosting. XGBoost is particularly renowned for its speed and performance, which is largely attributed to its capability of parallel processing and its efficient handling of sparse data.

In preparation for model training and validation, data matrices for training, validation, and testing were constructed using the XGBoost library's DMatrix data structure, which optimizes both memory efficiency and speed. The datasets, denoted as dtrain, dvalidation, and dtest, were subsequently utilized within the XGBoost training framework.

The process of parameter tuning is vital in optimizing the XGBoost model's performance. A systematic search across a range of hyperparameters was conducted, including max_depth for controlling the depth of the trees, subsample and colsample_bytree to manage the sampling of the dataset, and eta as the learning rate. This search was operationalized through a randomized search strategy, iterating over combinations of these hyperparameters to identify the configuration that minimizes the loss function, in this case, the log loss, which is suitable for binary classification problems.

The final model was subjected to cross-validation with the identified optimal parameters, a crucial step in assessing the model's robustness and generalizability. A 5-fold cross-validation was employed, which partitions the data into five sets, iteratively using one set for validation and the remaining four for training. This technique provides a thorough insight into the model's stability across different subsets of the data.

The cross-validation phase employed 1000 boosting rounds with an early stopping of 5 rounds to prevent overfitting. This means that the training would cease if the validation metric does not improve for five consecutive iterations, thereby ensuring that the model does not learn the noise in the training data.

**Results**:

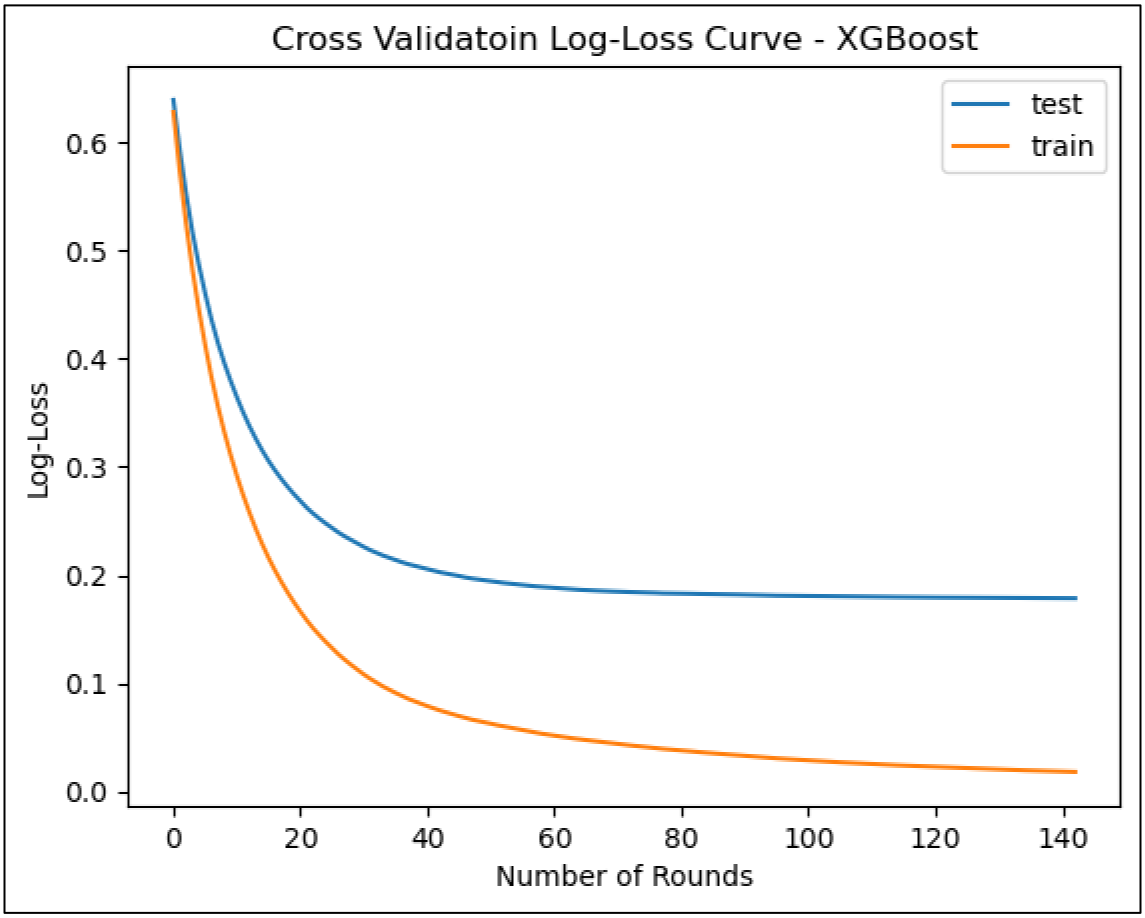
the performance of the XGBoost model, which has been optimized using an F1 score-based threshold determination. The F1 score serves as a harmonic mean of precision and recall, providing a balance between the two metrics, particularly in scenarios where the class distribution is uneven. This optimization is critical in applications where the cost of false negatives and false positives is high, and a trade-off between precision and recall is necessary.

To optimize the threshold for binary classification, a series of potential thresholds ranging from 0 to 1 were evaluated. The model's prediction probabilities were converted to binary outputs based on these thresholds, and the corresponding F1 scores were calculated. Through this method, the threshold that yielded the highest F1 score was determined to be the optimal point for classifying the test data.

The optimal threshold was identified to be notably different from the default of 0.5, indicating that a tailored threshold was indeed beneficial for model performance in this specific context. Upon applying this optimized threshold, the model achieved a refined balance between precision and recall, as evidenced by the improved F1 scores for both classes.

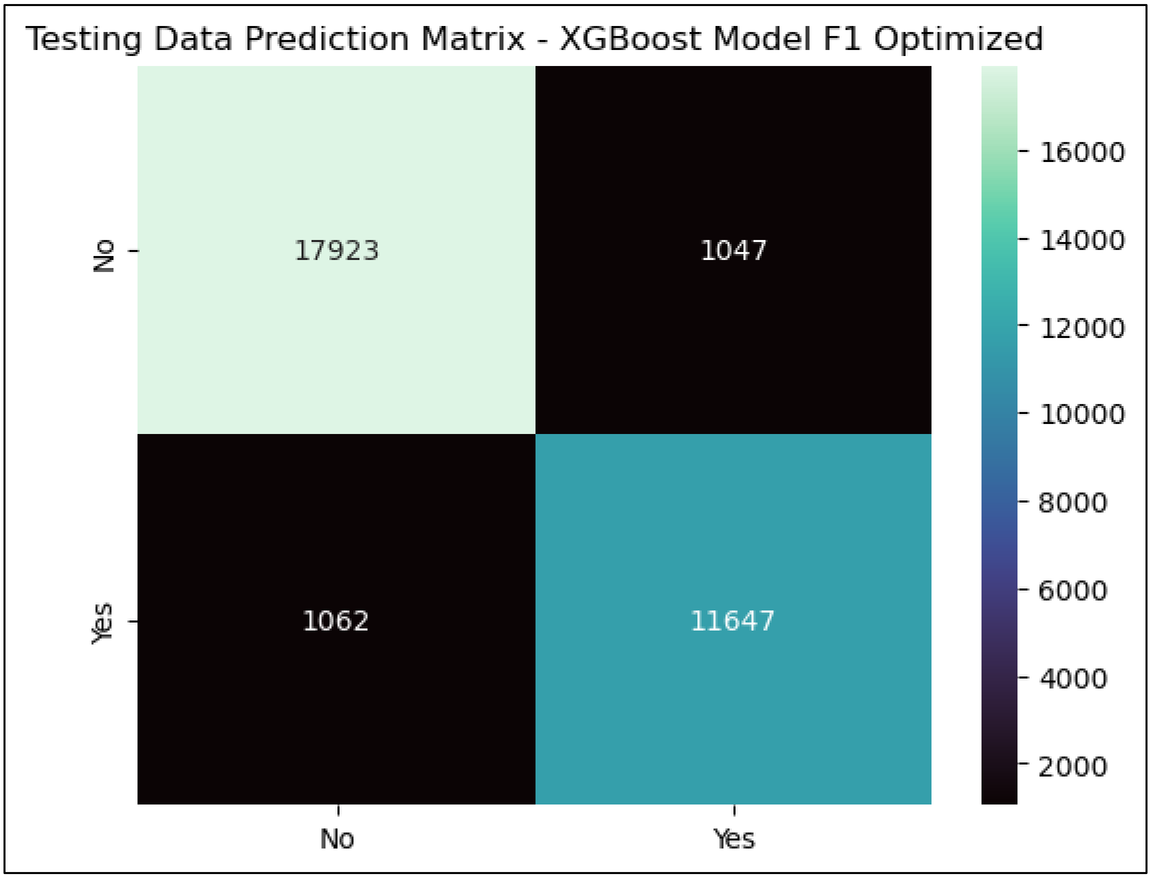
The resulting confusion matrix and classification report reveal that the model, with the F1 optimized threshold, exhibits a higher degree of precision and recall compared to the base model. This is demonstrated by precision and recall scores of 0.94 and 0.92 for class 0 and class 1, respectively, leading to an F1 score of 0.94 for class 0 and 0.92 for class 1. The overall accuracy of the model stands at 0.93, with the macro and weighted averages across precision, recall, and the F1 score mirroring this figure. These metrics underscore the model's robustness and its capability to generalize well on unseen data.

***Figure 3**: Cross validation Log-Loss Curve*




***Description**: This plot illustrates the model's cross validation log loss per round, demonstrating how the losses decrease and stabilize over time, indicating the model's learning and stabilization, with minimal overfitting as evidenced by the parallel trajectories of both curves.*

***Figure 4:*** *A visual of the XGBoost prediction matrix*




***Description****: The plot above illustrates the confusion matrix for the predictions made by the XGBoost Model with threshold optimized for the best F1 Score. On the x-axis, we have the predicted labels, and on the y-axis, we have the true labels.*

***Table 4 :*** *Classification Report for XGBoost F1 Optimized Classification Model*

| **XGBoost Classification Report** | | | | |
|---|---|---|---|---|
| | **Precision** | **Recall** | **F1- Score** | **Support** |
| **No** | 0.94 | 0.94 | 0.94 | 18970 |
| **Yes** | 0.92 | 0.92 | 0.92 | 12709 |
| **Accuracy** | | | 0.93 | 31679 |
| **Macro Avg** | 0.93 | 0.93 | 0.93 | 31679 |
| **Weighted Avg** | 0.93 | 0.93 | 0.93 | 31679 |

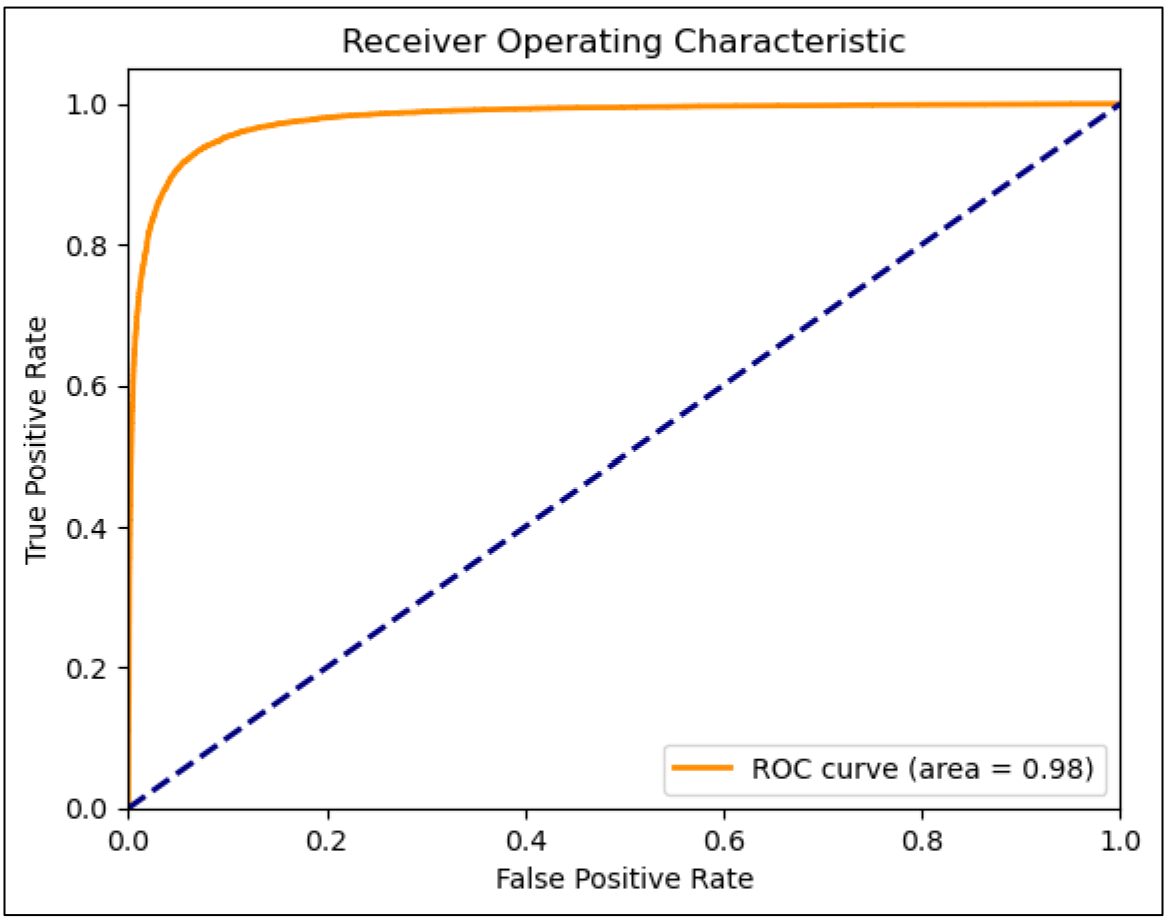
***Description****: The classification report indicates that the model achieved a precision of 0.94 for class No and 0.92 for class Yes, a recall of 0.94 for class No and 0.92 for class Yes, and an overall accuracy of 93%*

***Table 5:*** *Misclassification Cost Report for XGBoost Base Model*

| XGBoost – Cost of Misclassification Report | | | | |
|---|---|---|---|---|
| | **Cost Per Misclassification** | **Number of Misclassifications** | **Total Cost** | **Total Cost Combined** |
| **False Positive** | $100 | 1047 | $104,700 | $147,180 |
| **False Negative** | $40 | 1062 | $42,480 | |

***Description****: Table 5 provides a breakdown of the costs associated with misclassifications for the XGBoost model optimized for the best F1 Score, detailing the financial impact of false positives and false negatives, leading to a total combined misclassification cost of $147,180.*

***Figure 5****: ROC Curve Analysis Demonstrating Model's Discriminative Performance*




***Description****: The plot above illustrates the Receiver Operating Characteristic (ROC) curve, highlighting the model's excellent capability in distinguishing between the classes with a high area under the curve (AUC) of 0.98.*

## XGBoost Model – Threshold Optimized for Misclassification

In refining our XGBoost model, we incorporated a cost-sensitive approach to optimize the decision threshold based on the financial impact of misclassifications. This optimization is particularly crucial in scenarios where the consequences of false positives and false negatives carry different cost implications. By defining a cost of $100 for false positives and $40 for false negatives, we sought a threshold that minimized the total cost of errors made by the model.

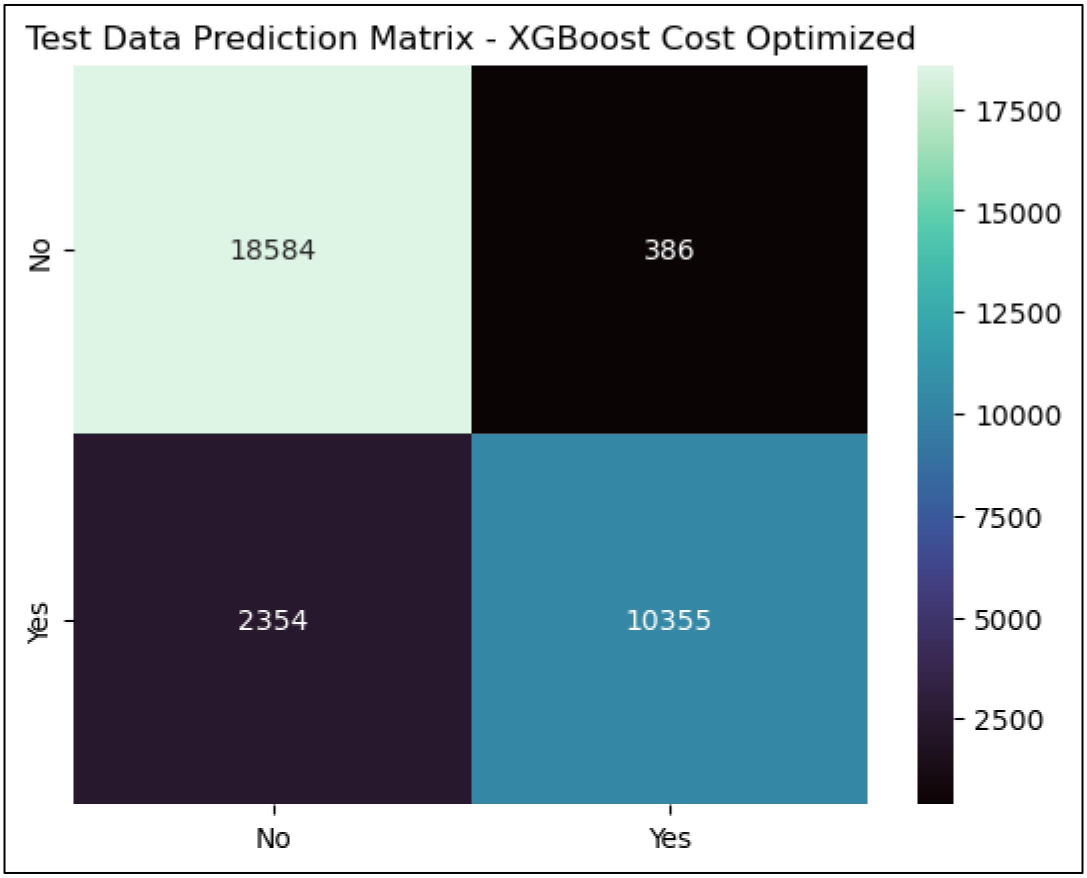
A rigorous search across a spectrum of thresholds was executed, assessing the resultant confusion matrix for each to calculate the total cost. This cost-optimized strategy yielded an updated threshold that deviates from the standard 0.5, chosen to minimize the financial loss due to prediction errors.

Upon applying this optimized threshold, the confusion matrix and classification report were updated. The new confusion matrix shows a decrease in false positives to 386 (from 1047), an improvement that significantly reduces the cost associated with this type of error. However, this reduction in false positives resulted in an increase in false negatives to 2354 (from 1062), reflecting a trade-off inherent in the cost-optimization process.

The updated classification metrics show a slight decrease in overall accuracy from 0.93 to 0.91, and shifts in precision and recall for the positive class, which now stands at 0.96 precision and 0.81 recall, compared to the previous 0.92 for both. This indicates a higher cost for false negatives has led to a model that prioritizes reducing false positives.

Comparatively, while the optimized model may have a lower overall accuracy and altered precision-recall balance, the reduction in the total number of false positives is financially advantageous. This cost-optimized threshold approach demonstrates that model performance cannot be solely judged on conventional metrics when the cost of errors is asymmetrical. It emphasizes the importance of aligning model evaluation with the specific cost structure of the application at hand. The results underscore the necessity of a holistic view of model performance, where financial implications are factored into the optimization process, potentially offering substantial savings despite a modest sacrifice in accuracy.

***Figure 6:*** *A visual of the XGBoost prediction matrix*




***Description****: The plot above illustrates the confusion matrix for the predictions made by the XGBoost Model with threshold optimized for business cost savings. On the x-axis, we have the predicted labels, and on the y-axis, we have the true labels.*

***Table 6 :*** *Classification Report for XGBoost Cost Optimized Classification Model*

| XGBoost Classification Report | | | | |
|---|---|---|---|---|
| | **Precision** | **Recall** | **F1- Score** | **Support** |
| **No** | 0.89 | 0.98 | 0.93 | 18970 |
| **Yes** | 0.96 | 0.81 | 0.88 | 12709 |
| **Accuracy** | | | 0.91 | 31679 |
| **Macro Avg** | 0.93 | 0.90 | 0.91 | 31679 |
| **Weighted Avg** | 0.92 | 0.91 | 0.91 | 31679 |

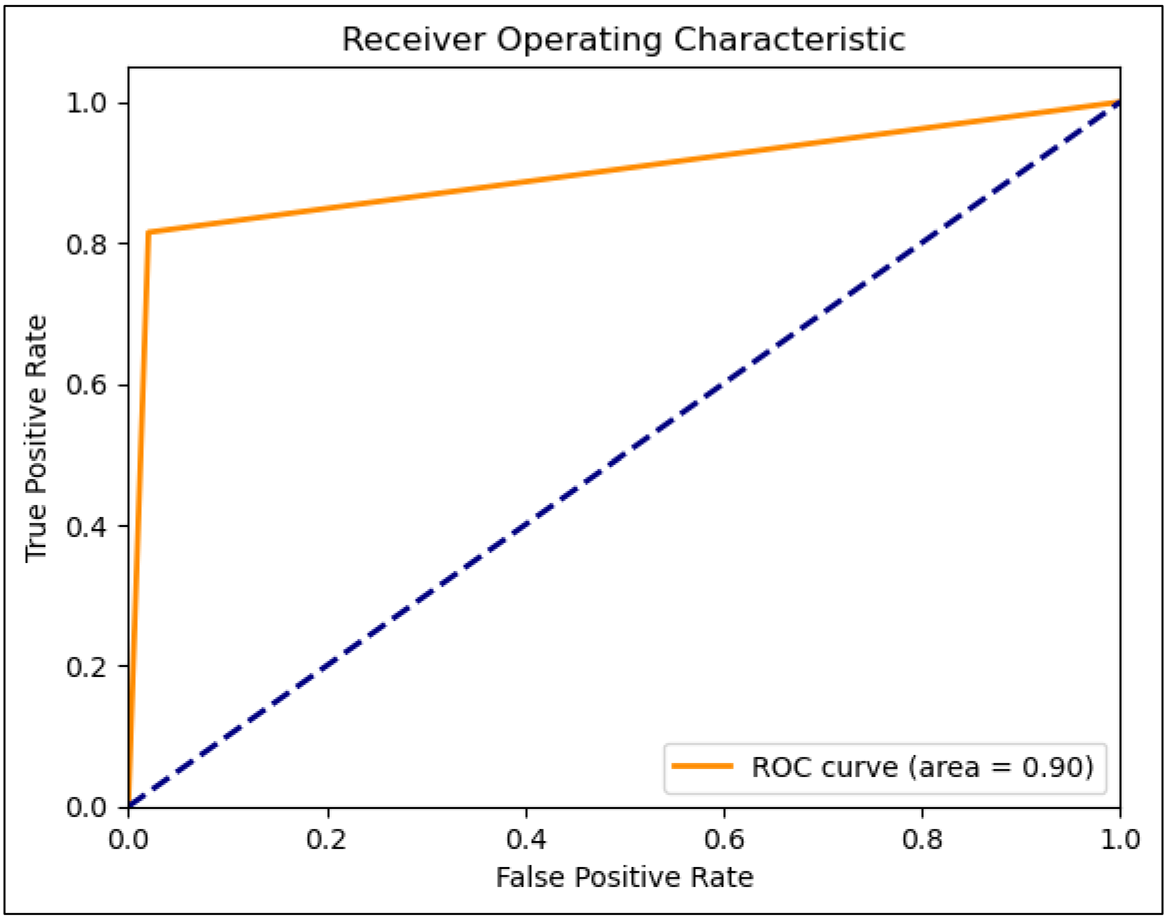
***Description****: The classification report indicates that the model achieved a precision of 0.89 for class No and 0.96 for class Yes, a recall of 0.98 for class No and 0.81 for class Yes, and an overall accuracy of 91%*

***Table 7:*** *Misclassification Cost Report for XGBoost Model*

| XGBoost Cost Optimized – Cost of Misclassification Report | | | | |
|---|---|---|---|---|
| | **Cost Per Misclassification** | **Number of Misclassifications** | **Total Cost** | **Total Cost Combined** |
| **False Positive** | $100 | 386 | $38,600 | $132,760 |
| **False Negative** | $40 | 2354 | $94,160 | |

***Description****: Table 7 provides a breakdown of the costs associated with misclassifications for the XGBoost model optimized for the best business savings, detailing the financial impact of false positives and false negatives, leading to a total combined misclassification cost of $132,760.*

***Figure 7****: ROC Curve Analysis Demonstrating Model's Discriminative Performance*




***Description****: The plot above illustrates the Receiver Operating Characteristic (ROC) curve, highlighting the model's excellent capability in distinguishing between the classes with a high area under the curve (AUC) of 0.90.*

## Neural Network

In the progression of our case study's modeling endeavors, a Deep Neural Network (DNN) model was constructed using TensorFlow's Keras API to explore the capabilities of deep learning in our classification task. The dataset presented to the DNN comprised 95,034 instances, each with 64 features, signifying a high-dimensional space well-suited for deep learning techniques.

The architecture of the DNN consisted of a sequential model with an input layer designed to accept the 64 features. It was followed by three hidden layers with 32, 64, and 32 neurons, respectively, all utilizing the ReLU (Rectified Linear Unit) activation function, known for its efficiency and effectiveness in non-linear transformations. The output layer was a single neuron employing the sigmoid activation function, apt for binary classification as it outputs a probability between 0 and 1.

The model was compiled with the Adam optimizer, a popular choice for deep learning applications due to its adaptive learning rate capabilities. The loss function used was Binary Crossentropy, which is suitable for binary classification problems. The primary metric for model performance evaluation was set as accuracy.

Training of the DNN was guided by an early stopping mechanism to prevent overfitting. This callback monitored the validation loss and would stop the training process if no improvement was observed for 10 consecutive epochs. The model was trained for a maximum of 1000 epochs with a batch size of 100, ensuring that the model had ample opportunity to learn from the data without overfitting to the training set.

During training, the model's performance was validated against a separate validation set to monitor its generalization to new data. The use of the validation set is crucial in deep learning to ensure that the model's performance is not merely a reflection of its memorization of the training data but its ability to make predictions on data it has not seen before.

**Results**:

This model was specifically tuned to minimize the financial impact of misclassifications, with costs of $100 for false positives and $40 for false negatives.

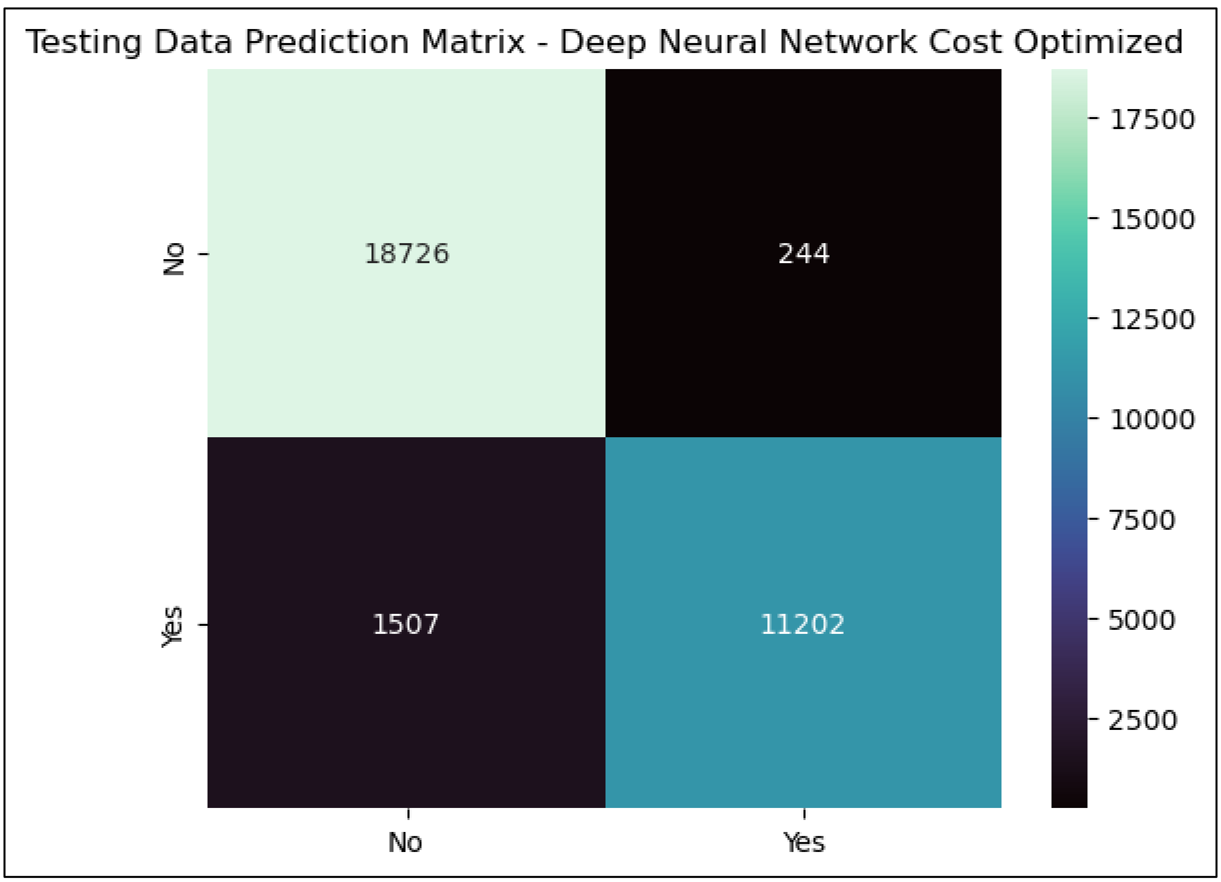
The DNN model's probabilities were converted to binary predictions over a range of thresholds to determine the most cost-effective threshold. The optimal threshold was calculated to be approximately 0.878, which is notably different from the default threshold of 0.5. This indicates that the model's threshold required significant adjustment to align with the cost considerations of the classification task.

Utilizing this cost-optimized threshold, the DNN model achieved impressive results, as evidenced by the generated confusion matrix and classification report. The confusion matrix exhibited a significant reduction in false positives to 244, compared to the Random Forest model, which had 977 false positives. Similarly, the number of false negatives also decreased to 1507.

The classification report revealed high precision and recall across both classes, with class 0 achieving a precision of 0.93 and recall of 0.99, and class 1 achieving a precision of 0.98 and recall of 0.88. These metrics resulted in an F1-score of 0.96 for class 0 and 0.93 for class 1, contributing to an overall accuracy of 0.94, and macro and weighted averages of precision, recall, and the F1-score at 0.95 and 0.94, respectively.

The results demonstrate the effectiveness of the DNN model when incorporating a financial perspective into the performance optimization process. The DNN model not only maintained high accuracy but also significantly reduced the total cost of misclassifications by effectively balancing the trade-off between false positives and false negatives. This cost-optimized threshold approach is critical in practical scenarios where the financial stakes of prediction errors are high, showcasing the DNN model's ability to adapt to different cost structures while maintaining robust predictive performance.

***Figure 8:*** *A visual of the Neural Network prediction matrix*



***Description**: The plot above illustrates the confusion matrix for the predictions made by the Neural Network Model with threshold optimized for business cost savings. On the x-axis, we have the predicted labels, and on the y-axis, we have the true labels.*

***Table 8 :** Classification Report for Neural Network Classification Model*

| Neural Network Classification Report | | | | |
|---|---|---|---|---|
| | **Precision** | **Recall** | **F1- Score** | **Support** |
| **No** | 0.93 | 0.99 | 0.96 | 18970 |
| **Yes** | 0.98 | 0.88 | 0.93 | 12709 |
| **Accuracy** | | | 0.94 | 31679 |
| **Macro Avg** | 0.95 | 0.93 | 0.94 | 31679 |
| **Weighted Avg** | 0.95 | 0.94 | 0.94 | 31679 |

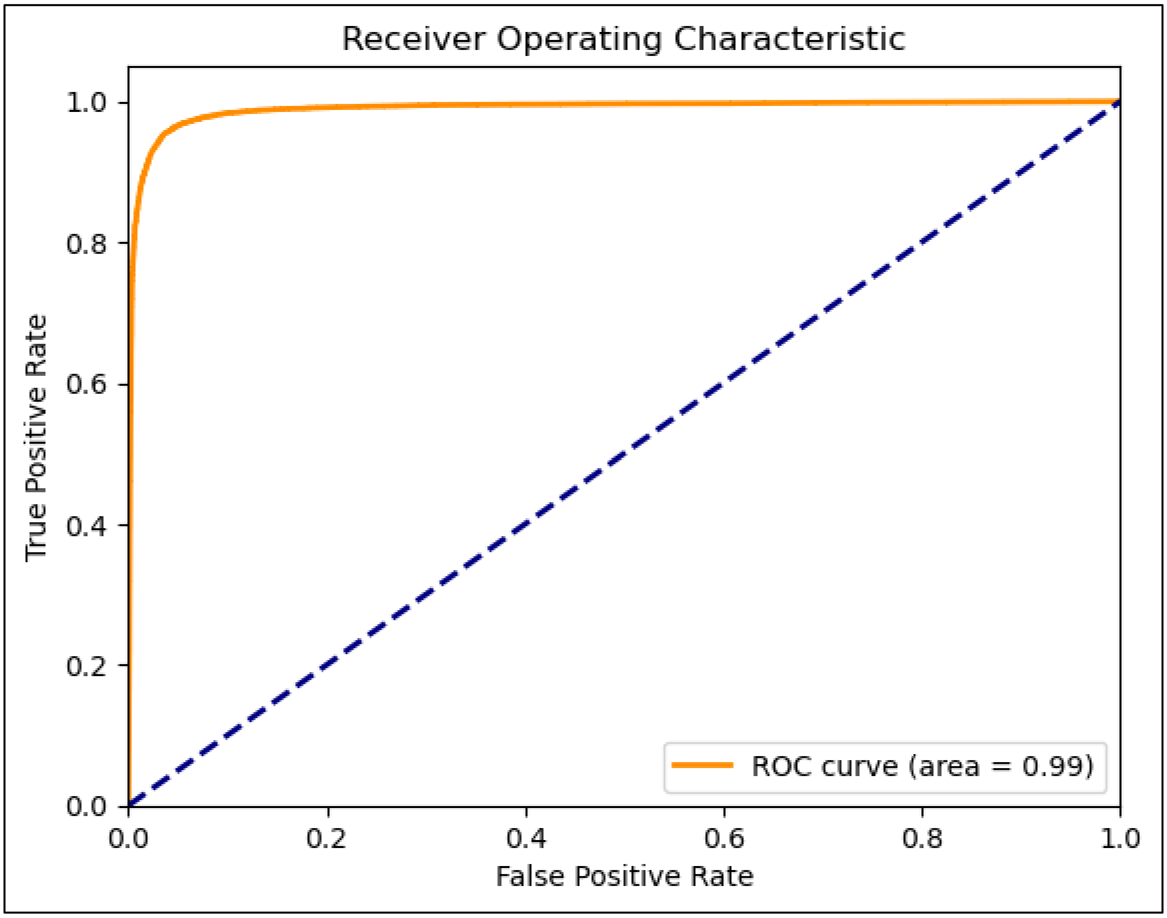
***Description**: The classification report indicates that the model achieved a precision of 0.93 for class No and 0.98 for class Yes, a recall of 0.99 for class No and 0.88 for class Yes, and an overall accuracy of 94%*

***Table 9:** Misclassification Cost Report for Neural Network Model*

| Neural Network – Cost of Misclassification Report | | | | |
|---|---|---|---|---|
| | **Cost Per Misclassification** | **Number of Misclassifications** | **Total Cost** | **Total Cost Combined** |
| **False Positive** | $100 | 244 | $24,400 | $84,680 |
| **False Negative** | $40 | 1507 | $60,280 | |

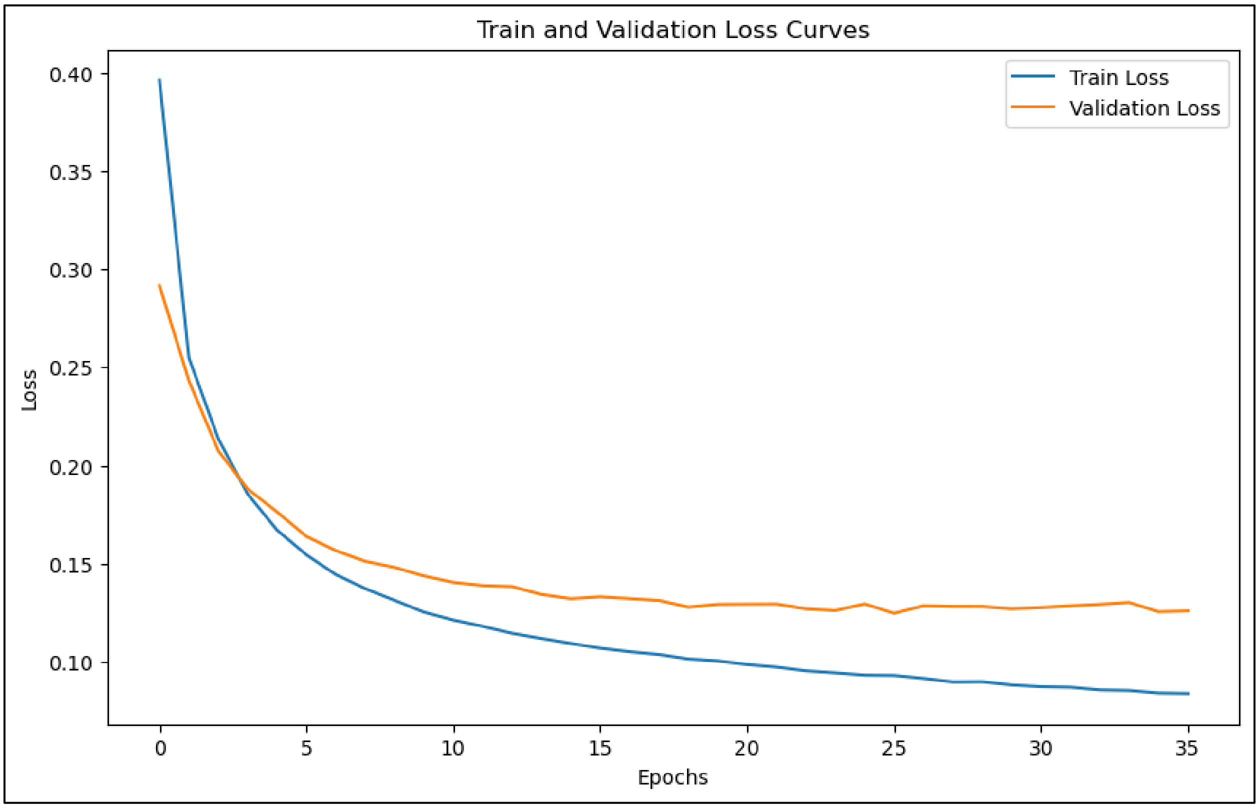
***Description**: Table 9 provides a breakdown of the costs associated with misclassifications for the Neural Network model optimized for the best business savings, detailing the financial impact of false positives and false negatives, leading to a total combined misclassification cost of $84,680.*

*__Figure 9__: ROC Curve Analysis Demonstrating Model's Discriminative Performance*




***Description**: The plot above illustrates the Receiver Operating Characteristic (ROC) curve, highlighting the model's excellent capability in distinguishing between the classes with a high area under the curve (AUC) of 0.99.*

*Figure 10: Cross validation Log-Loss Curve*




***Description**: This plot illustrates the model's cross validation log loss per epoch, demonstrating how the losses decrease and stabilize over time, indicating the model's learning and stabilization, with minimal overfitting as evidenced by the parallel trajectories of both curves.*

## Cross Val Prediction Results

In this section, we delve into the results achieved by our binary classification model, emphasizing the use of cross-validation predict (cross_val_predict) to assess performance. This method is pivotal in approximating real-world results, as it allows for the evaluation of the model across nearly the entirety of the dataset.

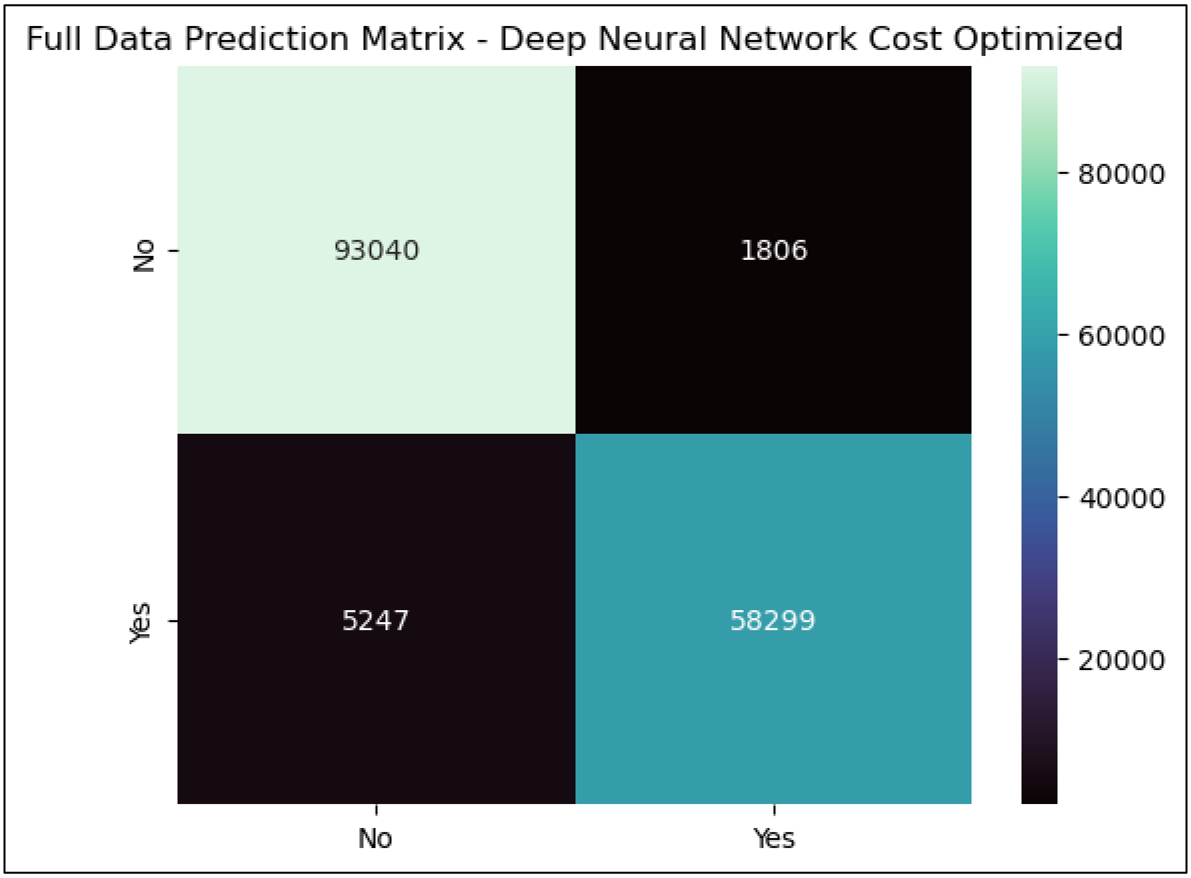
Final Best Threshold: 0.88

The adoption of a threshold of approximately 0.889 plays a crucial role in balancing false positives and false negatives, especially under our cost structure. This higher threshold ensures the model is judicious in predicting a positive ('Yes') outcome, aligning with our objective to minimize expensive false positives.

Confusion Matrix: Comprehensive Data Coverage

This matrix is particularly valuable because it encapsulates the model's behavior over a comprehensive range of data scenarios, offering a closer approximation to real-world application.

***Figure 11 :*** *A visual of the Neural Network prediction matrix*




***Description****: The plot above illustrates the confusion matrix for the predictions made by the Neural Network Model with threshold optimized for business cost savings. On the x-axis, we have the predicted labels, and on the y-axis, we have the true labels.*

***Table 10 :*** *Classification Report for Neural Network Classification Model*

| Neural Network Classification Report – Cross Val Predict | | | | |
|---|---|---|---|---|
| | **Precision** | **Recall** | **F1- Score** | **Support** |
| **No** | 0.95 | 0.98 | 0.96 | 94846 |
| **Yes** | 0.97 | 0.92 | 0.94 | 63546 |
| **Accuracy** | | | 0.96 | 158392 |
| **Macro Avg** | 0.96 | 0.95 | 0.95 | 158392 |
| **Weighted Avg** | 0.96 | 0.96 | 0.96 | 158392 |

***Description****: The classification report indicates that the model achieved a precision of 0.95 for class No and 0.97 for class Yes, a recall of 0.98 for class No and 0.92 for class Yes, and an overall accuracy of 96%*

**Precision:**

Class 0 (Negative): 95%

Class 1 (Positive): 97%

The high precision scores for both classes, evaluated over the entire dataset, reinforce the model's accuracy in its predictions.

**Recall:**

Class 0: 98%

Class 1: 92%

The recall metrics, especially for Class 0, highlight the model's efficacy in identifying true negatives, an insight gained by examining performance over the full data spread.

**F1-Score:**

Class 0: 96%

Class 1: 94%

These scores, representing a balance between precision and recall, are indicative of the model's overall robustness, validated through comprehensive data evaluation.

**Accuracy:**

Overall: 96%

This high accuracy rate, achieved through cross-validation, reflects the model's effectiveness in classifying outcomes over a wide array of data points.

**Macro and Weighted Averages:**

Macro Average: 95%

Weighted Average: 96%

These averages consider class imbalance and are significant as they underscore the model's consistent performance across diverse data segments.

***Table 11:*** *Misclassification Cost Report for Neural Network Model*

| Neural Network – Cost of Misclassification Report | | | | |
|---|---|---|---|---|
| | **Cost Per Misclassification** | **Number of Misclassifications** | **Total Cost** | **Total Cost Combined** |
| **False Positive** | $100 | 1806 | $180,600 | $397,680 |
| **False Negative** | $40 | 5247 | $217,080 | |

***Description****: Table 11 provides a breakdown of the costs associated with misclassifications for the Neural Network model optimized for the best business savings, detailing the financial impact of false positives and false negatives, leading to a total combined misclassification cost of $397,680.*

# Conclusion

In the final part of our case study, we pivot to a crucial aspect of model evaluation: the cost of misclassification. This is a key consideration, as our primary objective is to mitigate financial losses arising from incorrect predictions. We compare the cost implications of four distinct models: the Random Forest base model, the XGBoost base model, the XGBoost cost-optimized model, and the Neural Network model.

Random Forest Base Model

The Random Forest base model presented a total combined cost of $173,940. This figure was the highest among all models tested, indicating a relatively less effective approach in managing the cost impact of misclassifications under our specific cost structure.

XGBoost Base Model

The XGBoost base model showed a slight improvement over the Random Forest model, with a total combined cost of $147,180. This reduction suggests that the XGBoost model inherently possesses some efficiency in handling misclassifications, although not to an optimal extent.

XGBoost Cost-Optimized Model

Significant improvements were observed with the XGBoost cost-optimized model, which brought down the total combined cost to $132,760. This reduction underscores the effectiveness of the cost optimization strategies applied to the XGBoost model. By fine-tuning the model parameters with a focus on cost reduction, it demonstrates a better alignment with our financial objectives.

Neural Network Model

The Neural Network model emerged as the clear leader in terms of cost savings, achieving the lowest total combined cost of $84,680. This model's success can be largely attributed to its minimal number of false positives, which are the most heavily penalized misclassification according to our cost structure. The lower occurrence of false positives directly translates into considerable cost savings, making the Neural Network model the most economically viable option among those tested.

After assessing various models, we implemented a cross-validation approach on the Neural Network model, identified as the most effective in terms of cost efficiency. This step was crucial to understand its performance across a majority of the dataset, ensuring a robust and comprehensive evaluation.

Cost Analysis of the Cross-Validated Neural Network Model

The application of cross-validation on the Neural Network model led to a total combined cost of $397,680. This figure is essential for understanding the model's performance in a more realistic, varied dataset scenario, as opposed to more controlled or specific data segments.

Finally, the comparative analysis of these models from a cost perspective highlights the importance of selecting and optimizing models not just for accuracy but also for their economic impact. The Neural Network model, with its significant reduction in costly misclassifications, stands out as the most effective option in minimizing financial loss due to prediction errors. This insight reinforces the value of integrating cost considerations into the model selection and optimization process, ensuring that predictive models align closely with business objectives.

The cross-validation of the Neural Network model, resulting in a total cost of $397,680, provides a more nuanced understanding of the model's performance across a wider data spectrum. While the cost is higher in this comprehensive testing scenario, it offers invaluable insights into the model's real-world effectiveness and reliability. This extensive evaluation reaffirms the Neural Network model's suitability for deployment, balancing accuracy, and cost-efficiency, and highlighting its capability to handle diverse and extensive data in practical applications.

# Appendix

In [ ]:
```python
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [ ]:
```python
df = pd.read_csv('final_project(5).csv')
df.head()
```

Out[ ]:

| | x0 | x1 | x2 | x3 | x4 | x5 | x6 | x7 | x8 | x9 | ... | x41 | x42 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | -0.166563 | -3.961588 | 4.621113 | 2.481908 | -1.800135 | 0.804684 | 6.718751 | -14.789997 | -1.040673 | -4.204950 | ... | -1.497117 | 5.414063 |
| **1** | -0.149894 | -0.585676 | 27.839856 | 4.152333 | 6.426802 | -2.426943 | 40.477058 | -6.725709 | 0.896421 | 0.330165 | ... | 36.292790 | 4.490915 |
| **2** | -0.321707 | -1.429819 | 12.251561 | 6.586874 | -5.304647 | -11.311090 | 17.812850 | 11.060572 | 5.325880 | -2.632984 | ... | -0.368491 | 9.088864 |
| **3** | -0.245594 | 5.076677 | -24.149632 | 3.637307 | 6.505811 | 2.290224 | -35.111751 | -18.913592 | -0.337041 | -5.568076 | ... | 15.691546 | -7.467775 |
| **4** | -0.273366 | 0.306326 | -11.352593 | 1.676758 | 2.928441 | -0.616824 | -16.505817 | 27.532281 | 1.199715 | -4.309105 | ... | -13.911297 | -5.229937 |

5 rows × 51 columns

# Goal

- Last Column is Target Variable
- Enter into production we lose money.
  - class one prediction that is not actually class one = 100 loss
  - class 0 prediction that is not class zero = 40 loss

Accurately predict the class that minimizes the financial losses.

# I HATE LOSING MONEY

# Data Inspection

In [ ]:
```python
df.shape
```

Out[ ]:
```
(160000, 51)
```

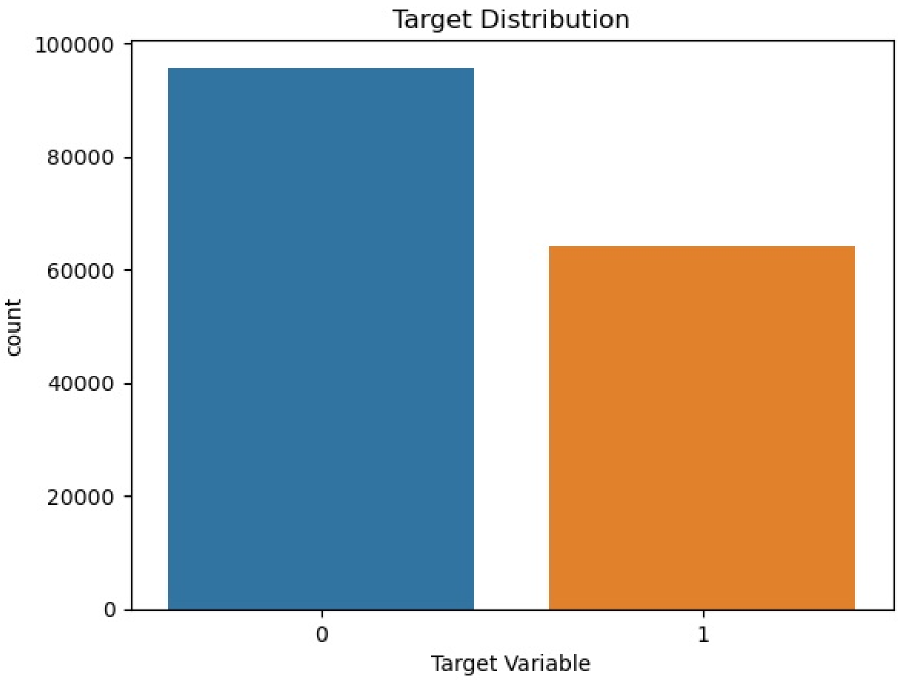
160k rows, and 51 columns

In [ ]:
```python
df['y'].value_counts()
```

Out[ ]:
```
0    95803
1    64197
Name: y, dtype: int64
```

In [ ]:
```python
sns.countplot(data = df, x = 'y')
plt.title('Target Distribution')
plt.xlabel('Target Variable')
```

Out[ ]:
```
Text(0.5, 0, 'Target Variable')
```

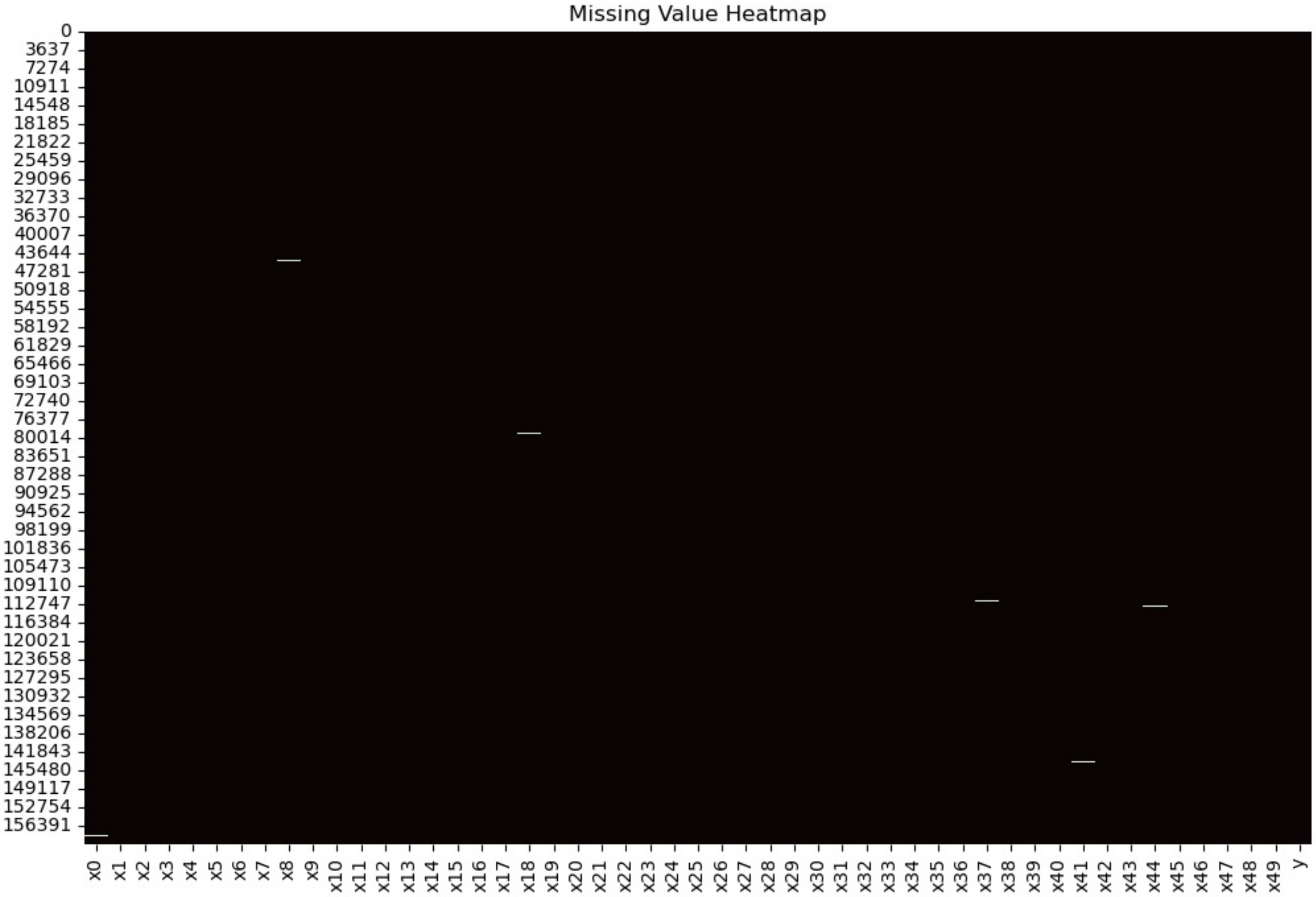



2 classes to predict, slight imbalance. 59% are 0

In [ ]:
```
df.isna().sum()
```

Out[ ]:
```
x0      26
x1      25
x2      38
x3      37
x4      26
x5      37
x6      26
x7      27
x8      21
x9      30
x10     43
x11     30
x12     36
x13     31
x14     34
x15     35
x16     26
x17     27
x18     40
x19     35
x20     38
x21     29
x22     27
x23     47
x24     28
x25     22
x26     36
x27     30
x28     35
x29     30
x30     30
x31     39
x32     31
x33     41
x34     41
x35     30
x36     27
x37     23
x38     31
x39     23
x40     36
x41     40
x42     26
x43     37
x44     40
x45     29
x46     31
x47     37
x48     32
x49     32
y        0
dtype: int64
```

In [ ]:
```
plt.figure(figsize=(12,8))
sns.heatmap(df.isnull(),
            cmap = 'mako',
            cbar=False)
plt.title('Missing Value Heatmap')
plt.show()
```




In [ ]:

```
def missing_val_percentage(df):
    total = len(df)
    percentage = (df.isna().sum()/total) * 100
    print(percentage)

missing_val_percentage(df)
```

```
x0     0.016250
x1     0.015625
x2     0.023750
x3     0.023125
x4     0.016250
x5     0.023125
x6     0.016250
x7     0.016875
x8     0.013125
x9     0.018750
x10    0.026875
x11    0.018750
x12    0.022500
x13    0.019375
x14    0.021250
x15    0.021875
x16    0.016250
x17    0.016875
x18    0.025000
x19    0.021875
x20    0.023750
x21    0.018125
x22    0.016875
x23    0.029375
x24    0.017500
x25    0.013750
x26    0.022500
x27    0.018750
x28    0.021875
x29    0.018750
x30    0.018750
x31    0.024375
x32    0.019375
x33    0.025625
x34    0.025625
x35    0.018750
x36    0.016875
x37    0.014375
x38    0.019375
x39    0.014375
x40    0.022500
x41    0.025000
x42    0.016250
x43    0.023125
x44    0.025000
x45    0.018125
x46    0.019375
x47    0.023125
x48    0.020000
x49    0.020000
y      0.000000
dtype: float64
```

Such as small amount of data is missing, additionally there appears to be no patterns to explain the missingness in the data. we will proceed with removal of the missing values. effectively this means removing 1608 values from our data.

In [ ]:
```python
import pandas as pd

# Create a new DataFrame to store missing value indicators
missing_indicators = pd.DataFrame()

# For each column in the DataFrame, create a corresponding indicator column
for column in df.columns:
    missing_indicators[column + '_missing'] = df[column].isna().astype(int)

# This allows you to see the correlation between features and missingness
df_with_indicators = pd.concat([df, missing_indicators], axis=1)

correlation_matrix = df_with_indicators.corr()

# Extract correlations of missing indicators with other features
missing_value_correlations = correlation_matrix[missing_indicators.columns].drop(missing_indicators.columns)

# Sort by absolute value to see the highest correlations first
sorted_correlations = missing_value_correlations.abs().unstack().sort_values(ascending=False)

# Filter out self-correlations (correlation of indicators with themselves)
non_self_correlations = sorted_correlations[sorted_correlations < 1]

# Print out the highest absolute correlations
print(non_self_correlations * 100)
```

```
C:\Users\Joey\AppData\Local\Temp\ipykernel_23452\2860011729.py:13: FutureWarning: The default value of numeric_
only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns
or specify the value of numeric_only to silence this warning.
  correlation_matrix = df_with_indicators.corr()
```

```
x39_missing  x10    0.848010
x23_missing  x31    0.829952
x49_missing  x47    0.828414
x15_missing  x16    0.788476
x26_missing  x1     0.764006
                      ...
x20_missing  x8     0.001085
x26_missing  x49    0.000849
x24_missing  x20    0.000721
x10_missing  x35    0.000264
x42_missing  x35    0.000216
Length: 2255, dtype: float64
```

In [ ]:
```
non_self_correlations.max() * 100
```

Out[ ]:
```
0.8480099590725956
```

In [ ]:
```
df.dropna(inplace = True)
df.shape
```

Out[ ]:
```
(158392, 51)
```

In [ ]:
```
df.describe().transpose()
```

Out[ ]:

| | count | mean | std | min | 25% | 50% | 75% | max |
|---|---|---|---|---|---|---|---|---|
| **x0** | 158392.0 | -0.000808 | 0.371064 | -1.592635 | -0.251246 | -0.001818 | 0.248622 | 1.600849 |
| **x1** | 158392.0 | 0.003705 | 6.340297 | -26.278302 | -4.259016 | 0.010023 | 4.286606 | 27.988178 |
| **x2** | 158392.0 | -1.148314 | 13.274738 | -59.394048 | -10.166609 | -1.342199 | 7.878130 | 63.545653 |
| **x3** | 158392.0 | -0.023012 | 8.066624 | -33.864827 | -5.453044 | -0.028470 | 5.448332 | 38.906025 |
| **x4** | 158392.0 | -0.000266 | 6.383306 | -28.467536 | -4.313987 | -0.001138 | 4.308644 | 26.247812 |
| **x5** | 158392.0 | 0.013282 | 7.672102 | -33.822988 | -5.152419 | 0.015135 | 5.191172 | 35.550110 |
| **x6** | 158392.0 | -1.669562 | 19.300472 | -86.354483 | -14.781485 | -1.951457 | 11.454209 | 92.390605 |
| **x7** | 158392.0 | -7.697877 | 30.541562 | -181.506976 | -27.315875 | -6.959275 | 12.215119 | 149.150634 |
| **x8** | 158392.0 | -0.028853 | 8.904048 | -37.691045 | -6.034094 | -0.016173 | 5.978646 | 39.049831 |
| **x9** | 158392.0 | 0.004320 | 6.354359 | -27.980659 | -4.260304 | 0.003098 | 4.303807 | 27.377842 |
| **x10** | 158392.0 | 0.000816 | 7.870963 | -36.306571 | -5.286455 | -0.019074 | 5.327598 | 37.945583 |
| **x11** | 158392.0 | 0.030692 | 8.767797 | -38.092869 | -5.902750 | 0.013579 | 5.933786 | 36.360443 |
| **x12** | 158392.0 | -1.337022 | 14.752763 | -64.197967 | -11.383333 | -1.627464 | 8.375380 | 73.279354 |
| **x13** | 158392.0 | 0.005699 | 8.952626 | -38.723514 | -6.030792 | -0.004343 | 6.039018 | 42.392177 |
| **x14** | 158392.0 | 0.008887 | 6.964429 | -30.905214 | -4.695374 | 0.003644 | 4.702776 | 32.546340 |
| **x15** | 158392.0 | 0.002436 | 3.271402 | -17.002359 | -2.207028 | 0.005473 | 2.212473 | 13.782559 |
| **x16** | 158392.0 | 0.006746 | 4.982869 | -26.042983 | -3.343254 | 0.012754 | 3.366107 | 21.961123 |
| **x17** | 158392.0 | 0.012607 | 7.570453 | -34.395898 | -5.070818 | 0.024699 | 5.102171 | 37.057048 |
| **x18** | 158392.0 | 0.014051 | 4.540760 | -20.198686 | -3.054185 | 0.017192 | 3.073832 | 19.652986 |
| **x19** | 158392.0 | 0.021573 | 7.594895 | -35.633396 | -5.105826 | 0.040295 | 5.158919 | 33.515550 |
| **x20** | 158392.0 | 0.298973 | 5.803957 | -26.677396 | -3.605254 | 0.432127 | 4.303770 | 27.814560 |
| **x21** | 158392.0 | -0.027341 | 9.410971 | -43.501854 | -6.360632 | -0.016830 | 6.318381 | 46.237503 |
| **x22** | 158392.0 | 0.007413 | 5.412217 | -23.644193 | -3.649892 | 0.009153 | 3.672444 | 24.863012 |
| **x23** | 158392.0 | 0.726195 | 14.908566 | -66.640341 | -9.260850 | 1.035878 | 11.031540 | 58.490500 |
| **x25** | 158392.0 | -0.001621 | 1.263860 | -6.364653 | -0.853516 | -0.004934 | 0.850890 | 5.314169 |
| **x26** | 158392.0 | -0.001013 | 0.843154 | -3.857484 | -0.566752 | -0.001314 | 0.567379 | 3.951652 |
| **x27** | 158392.0 | -0.003656 | 6.773700 | -32.003555 | -4.596859 | 0.035506 | 4.647103 | 28.645074 |
| **x28** | 158392.0 | 0.030159 | 14.437525 | -72.896705 | -9.700474 | 0.244454 | 9.934612 | 67.753845 |
| **x31** | 158392.0 | -0.007546 | 2.767239 | -12.289364 | -1.875986 | -0.000218 | 1.854836 | 11.247163 |
| **x33** | 158392.0 | -0.007019 | 1.747829 | -7.451454 | -1.184854 | -0.006598 | 1.179054 | 7.787120 |
| **x34** | 158392.0 | -0.001261 | 8.012550 | -36.116606 | -5.403326 | -0.015421 | 5.411490 | 34.841428 |
| **x35** | 158392.0 | 0.000049 | 2.379169 | -10.008149 | -1.610630 | -0.003761 | 1.602599 | 9.892426 |
| **x36** | 158392.0 | 0.006182 | 1.592854 | -6.866024 | -1.068702 | 0.004384 | 1.079242 | 6.999544 |
| **x38** | 158392.0 | 6.063752 | 16.886960 | -74.297559 | -5.246467 | 6.192058 | 17.424261 | 90.467981 |
| **x39** | 158392.0 | 0.003466 | 5.134009 | -22.101647 | -3.458830 | 0.017274 | 3.462758 | 21.545591 |
| **x40** | 158392.0 | -2.318750 | 17.040216 | -74.059196 | -13.952620 | -2.709284 | 8.972837 | 88.824477 |
| **x41** | 158392.0 | 6.706030 | 18.675642 | -82.167224 | -5.802178 | 6.847926 | 19.269855 | 100.050432 |
| **x42** | 158392.0 | -1.832959 | 5.110079 | -27.933750 | -5.159340 | -1.922935 | 1.452018 | 22.668041 |
| **x43** | 158392.0 | -0.002174 | 1.535282 | -6.876234 | -1.039992 | -0.004279 | 1.033870 | 6.680922 |
| **x44** | 158392.0 | -0.007254 | 4.163766 | -17.983487 | -2.814168 | -0.012278 | 2.781096 | 19.069759 |
| **x45** | 158392.0 | 0.000996 | 0.396604 | -1.753221 | -0.266369 | 0.001841 | 0.269194 | 1.669205 |
| **x46** | 158392.0 | -12.751993 | 36.608634 | -201.826828 | -36.432779 | -12.975088 | 11.445524 | 150.859415 |
| **x47** | 158392.0 | 0.028262 | 4.787974 | -21.086333 | -3.216974 | 0.036234 | 3.269134 | 20.836854 |
| **x48** | 158392.0 | 0.000160 | 1.935087 | -8.490155 | -1.320800 | -0.011800 | 1.318161 | 8.226552 |
| **x49** | 158392.0 | -0.672052 | 15.033134 | -65.791191 | -10.929046 | -0.569139 | 9.649839 | 66.877604 |
| **y** | 158392.0 | 0.401195 | 0.490142 | 0.000000 | 0.000000 | 0.000000 | 1.000000 | 1.000000 |

We have data in various ranges/scales. this will need to be normalized

In [ ]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 158392 entries, 0 to 159999
Data columns (total 51 columns):
 #   Column  Non-Null Count   Dtype
---  ------  --------------   -----
 0   x0      158392 non-null  float64
 1   x1      158392 non-null  float64
 2   x2      158392 non-null  float64
 3   x3      158392 non-null  float64
 4   x4      158392 non-null  float64
 5   x5      158392 non-null  float64
 6   x6      158392 non-null  float64
 7   x7      158392 non-null  float64
 8   x8      158392 non-null  float64
 9   x9      158392 non-null  float64
 10  x10     158392 non-null  float64
 11  x11     158392 non-null  float64
 12  x12     158392 non-null  float64
 13  x13     158392 non-null  float64
 14  x14     158392 non-null  float64
 15  x15     158392 non-null  float64
 16  x16     158392 non-null  float64
 17  x17     158392 non-null  float64
 18  x18     158392 non-null  float64
 19  x19     158392 non-null  float64
 20  x20     158392 non-null  float64
 21  x21     158392 non-null  float64
 22  x22     158392 non-null  float64
 23  x23     158392 non-null  float64
 24  x24     158392 non-null  object
 25  x25     158392 non-null  float64
 26  x26     158392 non-null  float64
 27  x27     158392 non-null  float64
 28  x28     158392 non-null  float64
 29  x29     158392 non-null  object
 30  x30     158392 non-null  object
 31  x31     158392 non-null  float64
 32  x32     158392 non-null  object
 33  x33     158392 non-null  float64
 34  x34     158392 non-null  float64
 35  x35     158392 non-null  float64
 36  x36     158392 non-null  float64
 37  x37     158392 non-null  object
 38  x38     158392 non-null  float64
 39  x39     158392 non-null  float64
 40  x40     158392 non-null  float64
 41  x41     158392 non-null  float64
 42  x42     158392 non-null  float64
 43  x43     158392 non-null  float64
 44  x44     158392 non-null  float64
 45  x45     158392 non-null  float64
 46  x46     158392 non-null  float64
 47  x47     158392 non-null  float64
 48  x48     158392 non-null  float64
 49  x49     158392 non-null  float64
 50  y       158392 non-null  int64
dtypes: float64(45), int64(1), object(5)
memory usage: 62.8+ MB
```

Data seems to have a few columns which are not numerical. (or they are but need to be processed)

# Data Standardization and Cleaning

x24 = country (asia, europe, america) with counts respectively 137596, 16378, 4418 - one hot encoding

x29 = months(july, jun, aug, may, sept, apr, oct, mar, nov, feb, dev, jan) - one hot encoding counts(45122,40900,29115,21708,10740,6699,2385,1221,331,139,23,9 )

x30 = day of week(monday-friday) - one hot encoding

x32 = percentage value - turning into float and leaving as is

x37 = money - taking away dollar sign and keeping as float

In [ ]:
```
# changing x29 to have standard names
df['x29'] = df['x29'].astype('category')
df['x29'] = df['x29'].cat.rename_categories({'Jun':'June','sept.':'Sept',
                                             'Dev':'Dec','January':'Jan'})
```

In [ ]:
```
# strip the $ and make into an float feature.
df['money'] = df['x37'].replace('[\$]','', regex=True).astype(float)

df.drop('x37',inplace=True, axis=1)
```

In [ ]:
```
df['decimal'] = df['x32'].replace('[\%]', '',regex=True).astype(float) / 100
df.drop('x32', axis=1, inplace=True)
```

In [ ]:
```
df = pd.get_dummies(df, columns=['x29','x24','x30'], drop_first=True).astype('int')
df.head()
```

Out[ ]:

| | x0 | x1 | x2 | x3 | x4 | x5 | x6 | x7 | x8 | x9 | ... | x29_May | x29_Nov | x29_Oct | x29_Sept | x24_asia | x24_euorpe | x30_monday | x30_thurday | x |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0 | -3 | 4 | 2 | -1 | 0 | 6 | -14 | -1 | -4 | ... | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | |
| **1** | 0 | 0 | 27 | 4 | 6 | -2 | 40 | -6 | 0 | 0 | ... | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| **2** | 0 | -1 | 12 | 6 | -5 | -11 | 17 | 11 | 5 | -2 | ... | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| **3** | 0 | 5 | -24 | 3 | 6 | 2 | -35 | -18 | 0 | -5 | ... | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| **4** | 0 | 0 | -11 | 1 | 2 | 0 | -16 | 27 | 1 | -4 | ... | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |

5 rows × 65 columns

In [ ]:
```
df['y'] = df['y'].astype('category')
```

# Data Preprocessing

scaling features we want to not scale hot encoded features, and also not scale

In [ ]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler

X = df.drop('y', axis=1)
y = df['y']
```

In [ ]:
```
col_to_scale =['x0', 'x1', 'x2', 'x3', 'x4', 'x5', 'x6', 'x7', 'x8', 'x9', 'x10',
            'x11', 'x12', 'x13', 'x14', 'x15', 'x16', 'x17', 'x18', 'x19', 'x20',
            'x21', 'x22', 'x23', 'x25', 'x26', 'x27', 'x28', 'x31', 'x33', 'x34',
            'x35', 'x36', 'x38', 'x39', 'x40', 'x41', 'x42', 'x43', 'x44', 'x45',
            'x46', 'x47', 'x48', 'x49', 'money', 'decimal']

scaler = StandardScaler()

scaled_data = scaler.fit_transform(df[col_to_scale])

X[col_to_scale] = scaled_data
```

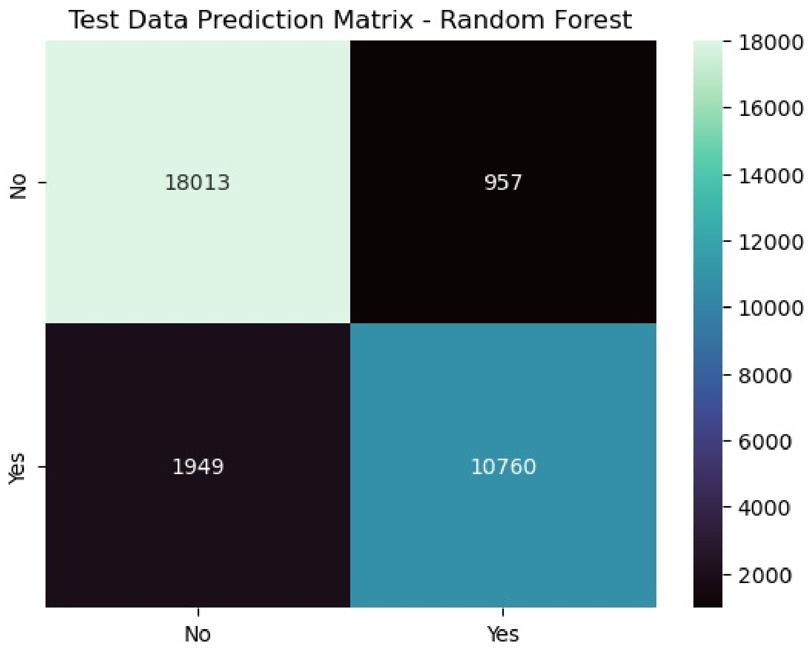
In [ ]:
```
from sklearn.model_selection import train_test_split

# Split the data into main training set and test set (80% - 20%)
X_train_main, X_test, y_train_main, y_test = train_test_split(
    X, y, test_size=0.2, random_state=12, stratify=y)

# Further split the main training set into training and validation sets (75% - 25% of main training)
X_train, X_validation, y_train, y_validation = train_test_split(
    X_train_main, y_train_main, test_size=0.25, random_state=12, stratify=y_train_main)
```

# Base Model - Random Forest

In [ ]:
```
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import confusion_matrix, classification_report

rf = RandomForestClassifier(class_weight='balanced')

# Fit the model on the training set
rf.fit(X_train, y_train)

# predict on validation set
y_validation_pred = rf.predict(X_validation)

# Evaluate predictions using the validation set
cm_validation = confusion_matrix(y_validation, y_validation_pred)
cr_validation = classification_report(y_validation, y_validation_pred)

print("Validation Confusion Matrix:")
print(cm_validation)
print("\nValidation Classification Report:")
print(cr_validation)


y_test_pred = rf.predict(X_test)

cm_test = confusion_matrix(y_test, y_test_pred)
cr_test = classification_report(y_test, y_test_pred)
```

```python
print("Test Confusion Matrix:")
print(cm_test)
print("\nTest Classification Report:")
print(cr_test)

# print out test metrics
sns.heatmap(cm_test, annot=True, fmt='.0f', cmap = 'mako')
plt.title('Test Data Prediction Matrix - Random Forest')
plt.xticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.yticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.show()
```

```
Validation Confusion Matrix:
[[18033   936]
 [ 1986 10724]]

Validation Classification Report:
              precision    recall  f1-score   support

           0       0.90      0.95      0.93     18969
           1       0.92      0.84      0.88     12710

    accuracy                           0.91     31679
   macro avg       0.91      0.90      0.90     31679
weighted avg       0.91      0.91      0.91     31679

Test Confusion Matrix:
[[18013   957]
 [ 1949 10760]]

Test Classification Report:
              precision    recall  f1-score   support

           0       0.90      0.95      0.93     18970
           1       0.92      0.85      0.88     12709

    accuracy                           0.91     31679
   macro avg       0.91      0.90      0.90     31679
weighted avg       0.91      0.91      0.91     31679
```




Model Predictions Cost us: $128,720

# XGBoost

In [ ]:
```python
import xgboost as xgb

# Create the DMatrix for train, validation, and test sets
dtrain = xgb.DMatrix(X_train, label = y_train)
dvalidation = xgb.DMatrix(X_validation, label = y_validation)
dtest = xgb.DMatrix(X_test, label = y_test)

evallist = [(dtrain, 'train'), (dvalidation, 'validation')]
```

## Param Search

In [ ]:
```
params = {
    'booster':'gbtree',
    'objective':'binary:logistic',
    'eta':0.1,
    'subsample':.5,
    'colsample_bytree':.5,
    'max_depth':3,
}

max_depth = [3,5,10,15,20,40]
sub_s = np.random.random(10)
cols = np.random.random(10)
md = np.random.randint(0,6,10)
for i in range(10):
    params['subsample'] = sub_s[i]
    params['colsample_bytree']=cols[i]
    params['max_depth'] = max_depth[md[i]]
    tmp = xgb.cv(
        params, dtrain, num_boost_round=2000,
        nfold = 5, metrics=(['logloss']),
        early_stopping_rounds=5,
        as_pandas=True,verbose_eval=False,show_stdv=True,seed=0,shuffle=False)
    print('____________DONE____________')
    print(params)
    print(tmp.loc[tmp.shape[0]-1:,:])
    print("==============================")
    tmp = 0
```

```
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.6933070768191619, 'colsample_b
ytree': 0.6279204295635943, 'max_depth': 5}
      train-logloss-mean  train-logloss-std  test-logloss-mean  \
1172            0.100261           0.000693           0.199277

      test-logloss-std
1172           0.00181
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.580548360415606, 'colsample_by
tree': 0.859240211480657, 'max_depth': 3}
      train-logloss-mean  train-logloss-std  test-logloss-mean  \
1921            0.183943           0.000856           0.233424

      test-logloss-std
1921          0.002292
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.675930885212629, 'colsample_by
tree': 0.06109841873546429, 'max_depth': 20}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
454            0.116175           0.004981           0.489914

     test-logloss-std
454          0.009597
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.45274285610781184, 'colsample_
bytree': 0.283589353932732, 'max_depth': 20}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
343             0.01393            0.00012           0.222857

     test-logloss-std
343          0.001459
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.9884180027352296, 'colsample_b
ytree': 0.47251993841361806, 'max_depth': 40}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
222            0.006406            0.00004           0.187276

     test-logloss-std
222          0.002746
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.9986339615338715, 'colsample_b
ytree': 0.7428389415716817, 'max_depth': 40}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
141            0.008816           0.000026           0.177299

     test-logloss-std
141          0.001832
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.3588629369997731, 'colsample_b
ytree': 0.9870155597890307, 'max_depth': 10}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
199            0.074017           0.001154           0.193058

     test-logloss-std
199          0.001039
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.007156569211485997, 'colsample
_bytree': 0.8175418589656883, 'max_depth': 20}
    train-logloss-mean  train-logloss-std  test-logloss-mean  test-logloss-std
81             0.39967           0.011066           0.412169          0.010581
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.8015913573609416, 'colsample_b
ytree': 0.6361358572992668, 'max_depth': 20}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
172            0.010911           0.000095           0.178394

     test-logloss-std
172          0.002111
==============================
____________DONE____________
{'booster': 'gbtree', 'objective': 'binary:logistic', 'eta': 0.1, 'subsample': 0.12082773328660013, 'colsample_
bytree': 0.07067883629885074, 'max_depth': 40}
     train-logloss-mean  train-logloss-std  test-logloss-mean  \
166            0.368466           0.007235           0.535744

     test-logloss-std
166           0.00605
==============================
```

## Cross Validation

## Cross Validation

```
In [ ]: num_round = 1000

        params = {'booster': 'gbtree',
                 'objective': 'binary:logistic',
                 'eta': 0.1, 'subsample': 0.6297428583724649,
                 'colsample_bytree': 0.9236039374528398, 'max_depth': 20}
```

```
In [ ]: xgb_cv_results = xgb.cv(params = params,dtrain = dtrain,
                                num_boost_round=1000, nfold=5,
                                verbose_eval=True, early_stopping_rounds=5)
```

```
[0]     train-logloss:0.62844+0.00058   test-logloss:0.63971+0.00081
[1]     train-logloss:0.57367+0.00096   test-logloss:0.59376+0.00116
[2]     train-logloss:0.52517+0.00110   test-logloss:0.55291+0.00114
[3]     train-logloss:0.48270+0.00121   test-logloss:0.51741+0.00137
[4]     train-logloss:0.44602+0.00149   test-logloss:0.48740+0.00184
[5]     train-logloss:0.41299+0.00094   test-logloss:0.46075+0.00158
[6]     train-logloss:0.38294+0.00077   test-logloss:0.43629+0.00129
[7]     train-logloss:0.35650+0.00067   test-logloss:0.41510+0.00128
[8]     train-logloss:0.33273+0.00057   test-logloss:0.39646+0.00175
[9]     train-logloss:0.31137+0.00043   test-logloss:0.37988+0.00209
[10]    train-logloss:0.29176+0.00054   test-logloss:0.36451+0.00187
[11]    train-logloss:0.27378+0.00036   test-logloss:0.35034+0.00201
[12]    train-logloss:0.25743+0.00029   test-logloss:0.33749+0.00248
[13]    train-logloss:0.24232+0.00032   test-logloss:0.32584+0.00247
[14]    train-logloss:0.22846+0.00046   test-logloss:0.31513+0.00260
[15]    train-logloss:0.21577+0.00039   test-logloss:0.30549+0.00258
[16]    train-logloss:0.20423+0.00031   test-logloss:0.29687+0.00269
[17]    train-logloss:0.19362+0.00044   test-logloss:0.28887+0.00276
[18]    train-logloss:0.18379+0.00036   test-logloss:0.28156+0.00254
[19]    train-logloss:0.17464+0.00034   test-logloss:0.27473+0.00268
[20]    train-logloss:0.16612+0.00049   test-logloss:0.26839+0.00309
[21]    train-logloss:0.15813+0.00044   test-logloss:0.26227+0.00301
[22]    train-logloss:0.15080+0.00049   test-logloss:0.25694+0.00308
[23]    train-logloss:0.14429+0.00062   test-logloss:0.25216+0.00335
[24]    train-logloss:0.13810+0.00053   test-logloss:0.24769+0.00337
[25]    train-logloss:0.13223+0.00055   test-logloss:0.24351+0.00339
[26]    train-logloss:0.12658+0.00055   test-logloss:0.23933+0.00338
[27]    train-logloss:0.12155+0.00023   test-logloss:0.23568+0.00320
[28]    train-logloss:0.11682+0.00030   test-logloss:0.23241+0.00325
[29]    train-logloss:0.11237+0.00029   test-logloss:0.22912+0.00314
[30]    train-logloss:0.10796+0.00038   test-logloss:0.22596+0.00326
[31]    train-logloss:0.10400+0.00043   test-logloss:0.22304+0.00350
[32]    train-logloss:0.10034+0.00039   test-logloss:0.22049+0.00352
[33]    train-logloss:0.09688+0.00064   test-logloss:0.21806+0.00372
[34]    train-logloss:0.09381+0.00047   test-logloss:0.21592+0.00365
[35]    train-logloss:0.09088+0.00046   test-logloss:0.21377+0.00367
[36]    train-logloss:0.08811+0.00052   test-logloss:0.21182+0.00368
[37]    train-logloss:0.08539+0.00059   test-logloss:0.21001+0.00372
[38]    train-logloss:0.08310+0.00067   test-logloss:0.20847+0.00386
[39]    train-logloss:0.08084+0.00075   test-logloss:0.20690+0.00377
[40]    train-logloss:0.07867+0.00052   test-logloss:0.20537+0.00382
[41]    train-logloss:0.07659+0.00071   test-logloss:0.20399+0.00396
[42]    train-logloss:0.07464+0.00051   test-logloss:0.20253+0.00367
[43]    train-logloss:0.07285+0.00051   test-logloss:0.20141+0.00364
[44]    train-logloss:0.07108+0.00032   test-logloss:0.20025+0.00355
[45]    train-logloss:0.06942+0.00039   test-logloss:0.19910+0.00359
[46]    train-logloss:0.06772+0.00033   test-logloss:0.19777+0.00372
[47]    train-logloss:0.06621+0.00031   test-logloss:0.19676+0.00368
[48]    train-logloss:0.06503+0.00033   test-logloss:0.19600+0.00355
[49]    train-logloss:0.06378+0.00050   test-logloss:0.19523+0.00343
[50]    train-logloss:0.06246+0.00043   test-logloss:0.19432+0.00341
[51]    train-logloss:0.06109+0.00026   test-logloss:0.19345+0.00351
[52]    train-logloss:0.05995+0.00023   test-logloss:0.19271+0.00359
[53]    train-logloss:0.05867+0.00032   test-logloss:0.19204+0.00344
[54]    train-logloss:0.05755+0.00031   test-logloss:0.19137+0.00348
[55]    train-logloss:0.05641+0.00055   test-logloss:0.19067+0.00331
[56]    train-logloss:0.05524+0.00067   test-logloss:0.19005+0.00344
[57]    train-logloss:0.05413+0.00057   test-logloss:0.18951+0.00361
[58]    train-logloss:0.05318+0.00057   test-logloss:0.18904+0.00387
[59]    train-logloss:0.05234+0.00081   test-logloss:0.18845+0.00392
[60]    train-logloss:0.05142+0.00073   test-logloss:0.18801+0.00386
[61]    train-logloss:0.05051+0.00067   test-logloss:0.18742+0.00389
[62]    train-logloss:0.04958+0.00058   test-logloss:0.18698+0.00372
[63]    train-logloss:0.04877+0.00045   test-logloss:0.18664+0.00363
[64]    train-logloss:0.04794+0.00044   test-logloss:0.18632+0.00349
[65]    train-logloss:0.04729+0.00044   test-logloss:0.18597+0.00348
[66]    train-logloss:0.04656+0.00046   test-logloss:0.18578+0.00346
[67]    train-logloss:0.04587+0.00060   test-logloss:0.18541+0.00345
[68]    train-logloss:0.04518+0.00063   test-logloss:0.18524+0.00347
[69]    train-logloss:0.04434+0.00059   test-logloss:0.18488+0.00342
[70]    train-logloss:0.04367+0.00055   test-logloss:0.18462+0.00337
[71]    train-logloss:0.04304+0.00050   test-logloss:0.18441+0.00334
[72]    train-logloss:0.04234+0.00044   test-logloss:0.18422+0.00337
[73]    train-logloss:0.04179+0.00039   test-logloss:0.18407+0.00337
[74]    train-logloss:0.04111+0.00049   test-logloss:0.18391+0.00345
```

```
[75]	train-logloss:0.04043+0.00046	test-logloss:0.18368+0.00358
[76]	train-logloss:0.03979+0.00033	test-logloss:0.18348+0.00355
[77]	train-logloss:0.03916+0.00041	test-logloss:0.18317+0.00346
[78]	train-logloss:0.03869+0.00037	test-logloss:0.18311+0.00348
[79]	train-logloss:0.03813+0.00033	test-logloss:0.18300+0.00357
[80]	train-logloss:0.03764+0.00038	test-logloss:0.18293+0.00362
[81]	train-logloss:0.03712+0.00030	test-logloss:0.18278+0.00373
[82]	train-logloss:0.03650+0.00023	test-logloss:0.18255+0.00376
[83]	train-logloss:0.03603+0.00023	test-logloss:0.18251+0.00375
[84]	train-logloss:0.03549+0.00029	test-logloss:0.18243+0.00387
[85]	train-logloss:0.03500+0.00026	test-logloss:0.18231+0.00395
[86]	train-logloss:0.03456+0.00027	test-logloss:0.18224+0.00397
[87]	train-logloss:0.03410+0.00022	test-logloss:0.18212+0.00399
[88]	train-logloss:0.03369+0.00026	test-logloss:0.18200+0.00387
[89]	train-logloss:0.03324+0.00024	test-logloss:0.18188+0.00386
[90]	train-logloss:0.03275+0.00026	test-logloss:0.18171+0.00386
[91]	train-logloss:0.03225+0.00030	test-logloss:0.18151+0.00389
[92]	train-logloss:0.03178+0.00030	test-logloss:0.18145+0.00405
[93]	train-logloss:0.03128+0.00032	test-logloss:0.18126+0.00412
[94]	train-logloss:0.03082+0.00030	test-logloss:0.18107+0.00407
[95]	train-logloss:0.03036+0.00031	test-logloss:0.18098+0.00393
[96]	train-logloss:0.02997+0.00029	test-logloss:0.18090+0.00392
[97]	train-logloss:0.02955+0.00025	test-logloss:0.18091+0.00384
[98]	train-logloss:0.02917+0.00023	test-logloss:0.18087+0.00386
[99]	train-logloss:0.02880+0.00023	test-logloss:0.18072+0.00380
[100]	train-logloss:0.02840+0.00027	test-logloss:0.18060+0.00373
[101]	train-logloss:0.02805+0.00028	test-logloss:0.18054+0.00381
[102]	train-logloss:0.02770+0.00029	test-logloss:0.18049+0.00375
[103]	train-logloss:0.02733+0.00024	test-logloss:0.18026+0.00366
[104]	train-logloss:0.02699+0.00020	test-logloss:0.18021+0.00375
[105]	train-logloss:0.02667+0.00014	test-logloss:0.18016+0.00379
[106]	train-logloss:0.02635+0.00013	test-logloss:0.18010+0.00382
[107]	train-logloss:0.02605+0.00017	test-logloss:0.18010+0.00378
[108]	train-logloss:0.02574+0.00018	test-logloss:0.18009+0.00373
[109]	train-logloss:0.02542+0.00025	test-logloss:0.17992+0.00361
[110]	train-logloss:0.02512+0.00024	test-logloss:0.17979+0.00363
[111]	train-logloss:0.02486+0.00022	test-logloss:0.17974+0.00370
[112]	train-logloss:0.02457+0.00025	test-logloss:0.17973+0.00373
[113]	train-logloss:0.02428+0.00026	test-logloss:0.17968+0.00372
[114]	train-logloss:0.02398+0.00025	test-logloss:0.17964+0.00373
[115]	train-logloss:0.02374+0.00026	test-logloss:0.17962+0.00376
[116]	train-logloss:0.02348+0.00026	test-logloss:0.17953+0.00371
[117]	train-logloss:0.02323+0.00031	test-logloss:0.17953+0.00364
[118]	train-logloss:0.02293+0.00028	test-logloss:0.17943+0.00373
[119]	train-logloss:0.02264+0.00026	test-logloss:0.17932+0.00383
[120]	train-logloss:0.02239+0.00025	test-logloss:0.17929+0.00378
[121]	train-logloss:0.02217+0.00028	test-logloss:0.17926+0.00378
[122]	train-logloss:0.02194+0.00026	test-logloss:0.17919+0.00375
[123]	train-logloss:0.02168+0.00026	test-logloss:0.17918+0.00379
[124]	train-logloss:0.02144+0.00024	test-logloss:0.17914+0.00384
[125]	train-logloss:0.02120+0.00024	test-logloss:0.17904+0.00385
[126]	train-logloss:0.02098+0.00024	test-logloss:0.17909+0.00385
[127]	train-logloss:0.02072+0.00022	test-logloss:0.17903+0.00383
[128]	train-logloss:0.02051+0.00024	test-logloss:0.17895+0.00376
[129]	train-logloss:0.02031+0.00025	test-logloss:0.17893+0.00373
[130]	train-logloss:0.02007+0.00025	test-logloss:0.17886+0.00378
[131]	train-logloss:0.01985+0.00027	test-logloss:0.17889+0.00378
[132]	train-logloss:0.01965+0.00024	test-logloss:0.17888+0.00381
[133]	train-logloss:0.01946+0.00026	test-logloss:0.17878+0.00389
[134]	train-logloss:0.01927+0.00026	test-logloss:0.17877+0.00378
[135]	train-logloss:0.01911+0.00025	test-logloss:0.17877+0.00378
[136]	train-logloss:0.01892+0.00024	test-logloss:0.17873+0.00381
[137]	train-logloss:0.01872+0.00025	test-logloss:0.17864+0.00377
[138]	train-logloss:0.01855+0.00022	test-logloss:0.17863+0.00376
[139]	train-logloss:0.01837+0.00024	test-logloss:0.17857+0.00380
[140]	train-logloss:0.01820+0.00022	test-logloss:0.17853+0.00379
[141]	train-logloss:0.01803+0.00020	test-logloss:0.17850+0.00382
[142]	train-logloss:0.01786+0.00021	test-logloss:0.17847+0.00380
[143]	train-logloss:0.01769+0.00021	test-logloss:0.17851+0.00379
[144]	train-logloss:0.01752+0.00022	test-logloss:0.17852+0.00377
[145]	train-logloss:0.01734+0.00020	test-logloss:0.17853+0.00380
[146]	train-logloss:0.01720+0.00019	test-logloss:0.17856+0.00382
[147]	train-logloss:0.01703+0.00019	test-logloss:0.17852+0.00380
```

In [ ]:

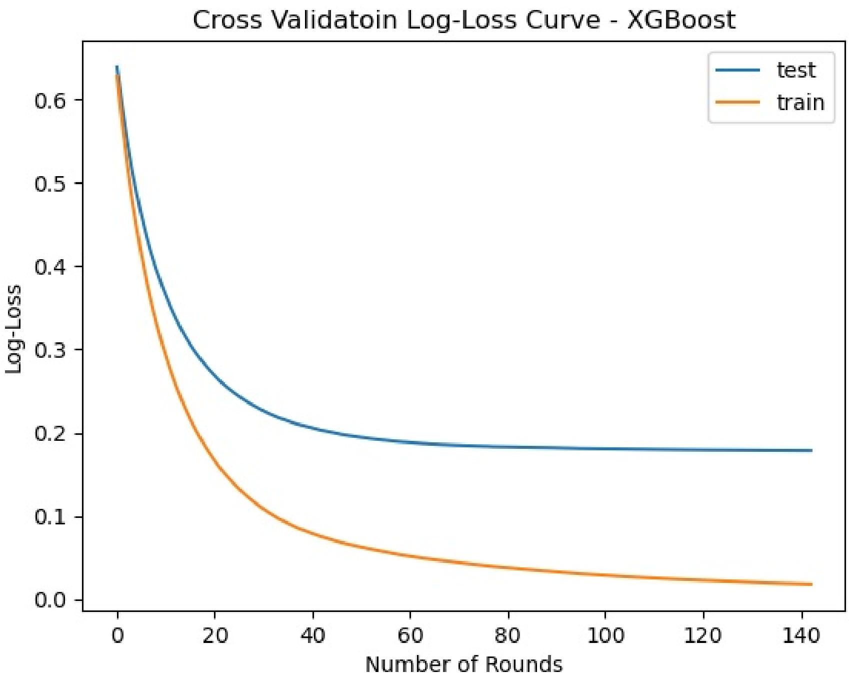
```
xgb_cv_results
```

Out[ ]:

| | train-logloss-mean | train-logloss-std | test-logloss-mean | test-logloss-std |
|---|---|---|---|---|
| 0 | 0.628445 | 0.000582 | 0.639706 | 0.000813 |
| 1 | 0.573671 | 0.000957 | 0.593762 | 0.001159 |
| 2 | 0.525169 | 0.001097 | 0.552911 | 0.001138 |
| 3 | 0.482704 | 0.001210 | 0.517407 | 0.001375 |
| 4 | 0.446016 | 0.001488 | 0.487401 | 0.001837 |
| ... | ... | ... | ... | ... |
| 138 | 0.018547 | 0.000225 | 0.178626 | 0.003756 |
| 139 | 0.018369 | 0.000241 | 0.178573 | 0.003801 |
| 140 | 0.018203 | 0.000221 | 0.178535 | 0.003794 |
| 141 | 0.018029 | 0.000195 | 0.178498 | 0.003819 |
| 142 | 0.017863 | 0.000213 | 0.178470 | 0.003798 |

143 rows × 4 columns

In [ ]:
```
plt.plot(xgb_cv_results['test-logloss-mean'], label='test')
plt.plot(xgb_cv_results['train-logloss-mean'], label = 'train')
plt.title('Cross Validatoin Log-Loss Curve - XGBoost')
plt.xlabel('Number of Rounds')
plt.ylabel('Log-Loss')
plt.legend()
plt.show()
```




## Training Model

In [ ]:
```
param = {'booster': 'gbtree',
        'objective': 'binary:logistic',
        'eta': 0.1, 'subsample': 0.6297428583724649,
        'colsample_bytree': 0.9236039374528398, 'max_depth': 20}

num_round =1000

evallist = [(dtrain,'train'), (dvalidation,'validation')]

xgb_model = xgb.train(param, dtrain,
                      num_round, evallist,
                      early_stopping_rounds=2)
```

```
c:\Users\Joey\anaconda3\envs\ML\lib\site-packages\xgboost\core.py:617: FutureWarning: Pass `evals` as keyword a
rgs.
  warnings.warn(msg, FutureWarning)
[0]	train-logloss:0.62821	validation-logloss:0.63926
[1]	train-logloss:0.57066	validation-logloss:0.59002
[2]	train-logloss:0.52315	validation-logloss:0.55145
[3]	train-logloss:0.48036	validation-logloss:0.51506
[4]	train-logloss:0.44276	validation-logloss:0.48370
[5]	train-logloss:0.41049	validation-logloss:0.45770
[6]	train-logloss:0.38150	validation-logloss:0.43468
[7]	train-logloss:0.35494	validation-logloss:0.41319
```

```
[8]	train-logloss:0.33111	validation-logloss:0.39426
[9]	train-logloss:0.30959	validation-logloss:0.37696
[10]	train-logloss:0.28944	validation-logloss:0.36067
[11]	train-logloss:0.27181	validation-logloss:0.34714
[12]	train-logloss:0.25506	validation-logloss:0.33358
[13]	train-logloss:0.24006	validation-logloss:0.32174
[14]	train-logloss:0.22654	validation-logloss:0.31174
[15]	train-logloss:0.21390	validation-logloss:0.30220
[16]	train-logloss:0.20242	validation-logloss:0.29350
[17]	train-logloss:0.19206	validation-logloss:0.28571
[18]	train-logloss:0.18215	validation-logloss:0.27841
[19]	train-logloss:0.17274	validation-logloss:0.27117
[20]	train-logloss:0.16426	validation-logloss:0.26477
[21]	train-logloss:0.15623	validation-logloss:0.25875
[22]	train-logloss:0.14897	validation-logloss:0.25344
[23]	train-logloss:0.14231	validation-logloss:0.24871
[24]	train-logloss:0.13603	validation-logloss:0.24414
[25]	train-logloss:0.13015	validation-logloss:0.24006
[26]	train-logloss:0.12467	validation-logloss:0.23624
[27]	train-logloss:0.11959	validation-logloss:0.23290
[28]	train-logloss:0.11530	validation-logloss:0.22984
[29]	train-logloss:0.11076	validation-logloss:0.22684
[30]	train-logloss:0.10641	validation-logloss:0.22358
[31]	train-logloss:0.10258	validation-logloss:0.22081
[32]	train-logloss:0.09890	validation-logloss:0.21842
[33]	train-logloss:0.09555	validation-logloss:0.21616
[34]	train-logloss:0.09259	validation-logloss:0.21391
[35]	train-logloss:0.08949	validation-logloss:0.21156
[36]	train-logloss:0.08686	validation-logloss:0.20929
[37]	train-logloss:0.08456	validation-logloss:0.20778
[38]	train-logloss:0.08182	validation-logloss:0.20563
[39]	train-logloss:0.08003	validation-logloss:0.20467
[40]	train-logloss:0.07742	validation-logloss:0.20274
[41]	train-logloss:0.07522	validation-logloss:0.20111
[42]	train-logloss:0.07337	validation-logloss:0.19976
[43]	train-logloss:0.07145	validation-logloss:0.19834
[44]	train-logloss:0.06970	validation-logloss:0.19710
[45]	train-logloss:0.06753	validation-logloss:0.19560
[46]	train-logloss:0.06547	validation-logloss:0.19428
[47]	train-logloss:0.06445	validation-logloss:0.19328
[48]	train-logloss:0.06301	validation-logloss:0.19225
[49]	train-logloss:0.06139	validation-logloss:0.19118
[50]	train-logloss:0.06043	validation-logloss:0.19036
[51]	train-logloss:0.05956	validation-logloss:0.18982
[52]	train-logloss:0.05854	validation-logloss:0.18914
[53]	train-logloss:0.05741	validation-logloss:0.18838
[54]	train-logloss:0.05620	validation-logloss:0.18751
[55]	train-logloss:0.05549	validation-logloss:0.18699
[56]	train-logloss:0.05432	validation-logloss:0.18624
[57]	train-logloss:0.05336	validation-logloss:0.18565
[58]	train-logloss:0.05236	validation-logloss:0.18493
[59]	train-logloss:0.05141	validation-logloss:0.18441
[60]	train-logloss:0.05083	validation-logloss:0.18422
[61]	train-logloss:0.05011	validation-logloss:0.18387
[62]	train-logloss:0.04919	validation-logloss:0.18367
[63]	train-logloss:0.04858	validation-logloss:0.18318
[64]	train-logloss:0.04783	validation-logloss:0.18297
[65]	train-logloss:0.04706	validation-logloss:0.18284
[66]	train-logloss:0.04598	validation-logloss:0.18234
[67]	train-logloss:0.04521	validation-logloss:0.18222
[68]	train-logloss:0.04455	validation-logloss:0.18211
[69]	train-logloss:0.04416	validation-logloss:0.18196
[70]	train-logloss:0.04336	validation-logloss:0.18156
[71]	train-logloss:0.04293	validation-logloss:0.18123
[72]	train-logloss:0.04250	validation-logloss:0.18109
[73]	train-logloss:0.04212	validation-logloss:0.18069
[74]	train-logloss:0.04149	validation-logloss:0.18067
[75]	train-logloss:0.04071	validation-logloss:0.18026
[76]	train-logloss:0.04008	validation-logloss:0.18016
[77]	train-logloss:0.03927	validation-logloss:0.17977
[78]	train-logloss:0.03856	validation-logloss:0.17931
[79]	train-logloss:0.03792	validation-logloss:0.17908
[80]	train-logloss:0.03738	validation-logloss:0.17891
[81]	train-logloss:0.03701	validation-logloss:0.17884
[82]	train-logloss:0.03647	validation-logloss:0.17893
[83]	train-logloss:0.03598	validation-logloss:0.17877
[84]	train-logloss:0.03570	validation-logloss:0.17876
[85]	train-logloss:0.03503	validation-logloss:0.17851
[86]	train-logloss:0.03459	validation-logloss:0.17851
[87]	train-logloss:0.03432	validation-logloss:0.17839
[88]	train-logloss:0.03364	validation-logloss:0.17791
[89]	train-logloss:0.03325	validation-logloss:0.17787
[90]	train-logloss:0.03303	validation-logloss:0.17776
[91]	train-logloss:0.03257	validation-logloss:0.17756
[92]	train-logloss:0.03216	validation-logloss:0.17757
[93]	train-logloss:0.03164	validation-logloss:0.17724
[94]	train-logloss:0.03123	validation-logloss:0.17721
[95]	train-logloss:0.03083	validation-logloss:0.17715
[96]	train-logloss:0.03037	validation-logloss:0.17720
```

# Validating Model

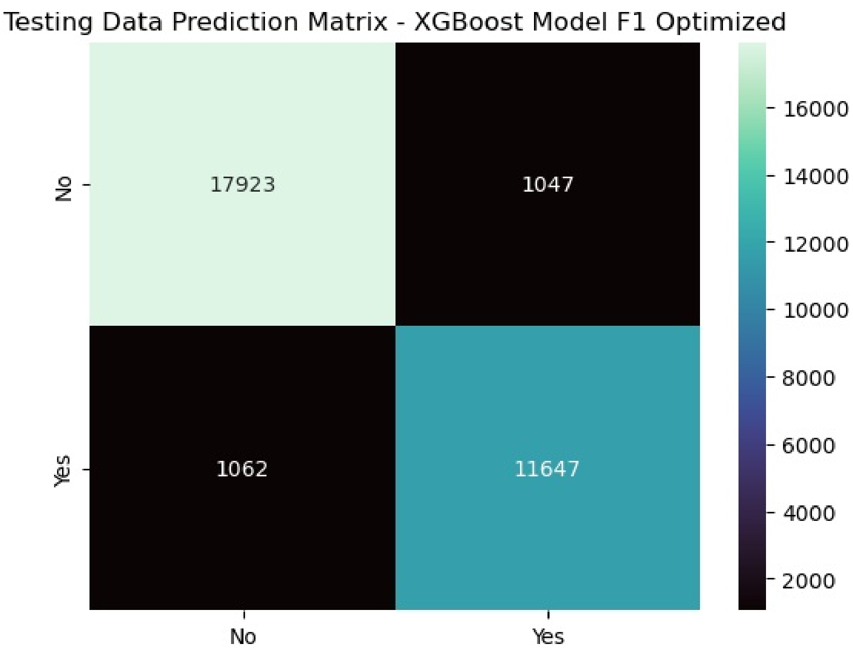
In [ ]:
```
import xgboost as xgb
import numpy as np
from sklearn.metrics import f1_score

# Make predictions on the test data
y_test_pred = xgb_model.predict(dtest)

best_threshold = 0.5
best_f1 = 0

thresholds = np.linspace(0, 1, 100)

for threshold in thresholds:
    # Convert probabilities to binary output based on current threshold
    y_pred_binary = (y_test_pred > threshold).astype(int)

    # Calculate the F1 score
    current_f1 = f1_score(y_test, y_pred_binary)

    # If the current F1 score is better than the best so far, update the best threshold
    if current_f1 > best_f1:
        best_f1 = current_f1
        best_threshold = threshold

# Print the best threshold and the corresponding F1 score
print(f"Best Threshold: {best_threshold}")
print(f"Best F1 Score: {best_f1}")

y_test_pred_binary = (y_test_pred > best_threshold).astype(int)
```

```
Best Threshold: 0.4444444444444445
Best F1 Score: 0.9169783096484666
```

# Tuned XGBoost Test Results

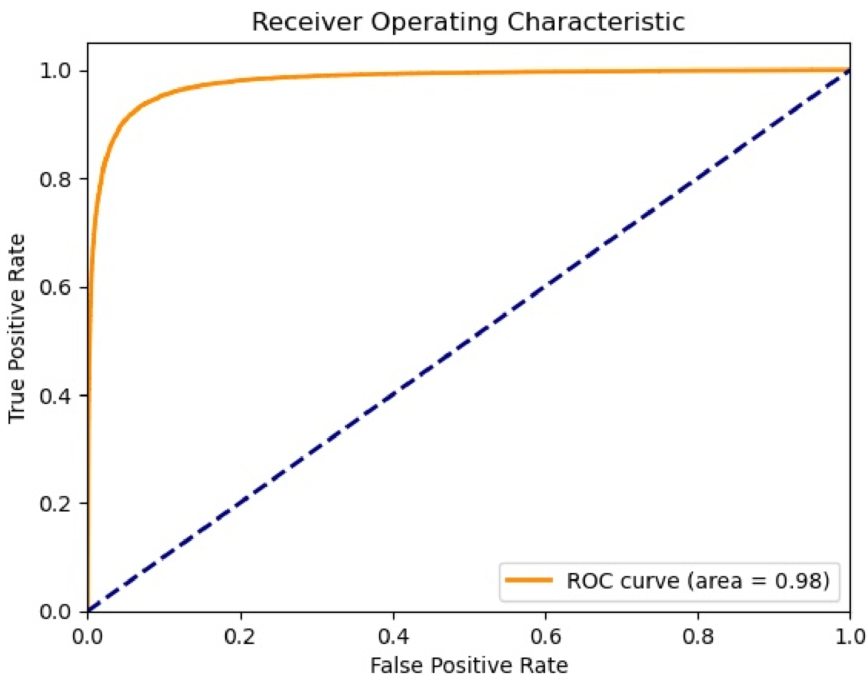
In [ ]:
```
from sklearn.metrics import confusion_matrix, classification_report

# Generate the confusion matrix
cm = confusion_matrix(y_test, y_test_pred_binary)

# Generate the classification report
cr = classification_report(y_test, y_test_pred_binary)

# Print the confusion matrix
print("Confusion Matrix:")
print(cm)

# Print the classification report
print("\nClassification Report:")
print(cr)

sns.heatmap(cm, annot=True, fmt='.0f', cmap = 'mako')
plt.title('Testing Data Prediction Matrix - XGBoost Model F1 Optimized')
plt.xticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.yticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.show()
```

```
Confusion Matrix:
[[17923  1047]
 [ 1062 11647]]

Classification Report:
              precision    recall  f1-score   support

           0       0.94      0.94      0.94     18970
           1       0.92      0.92      0.92     12709

    accuracy                           0.93     31679
   macro avg       0.93      0.93      0.93     31679
weighted avg       0.93      0.93      0.93     31679
```




In [ ]:

```
from sklearn.metrics import roc_curve, auc
# Compute ROC curve and ROC area
fpr, tpr, thresholds = roc_curve(y_test, y_test_pred)
roc_auc = auc(fpr, tpr)

# Plot the ROC curve
plt.figure()
plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' % roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic')
plt.legend(loc="lower right")
plt.show()
```

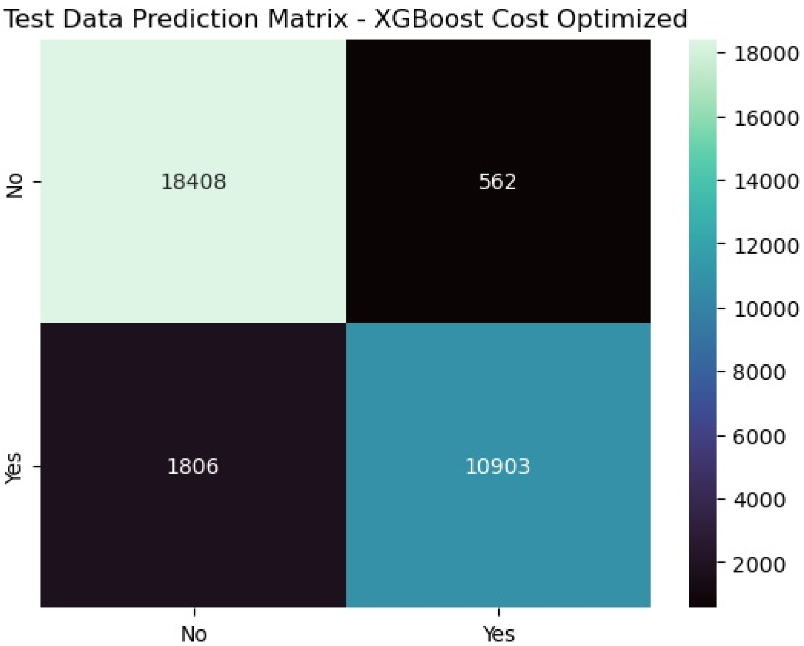



## Cost Optimized Threshold

In [ ]:

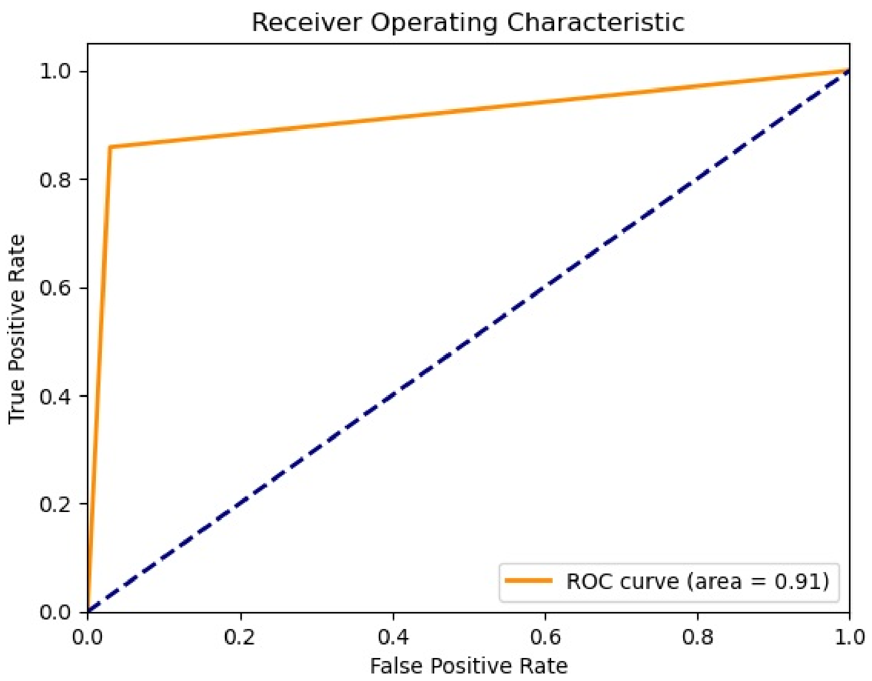
```python
import numpy as np
from sklearn.metrics import confusion_matrix

# Define costs
cost_fp = 100
cost_fn = 40

# Assume y_test_pred contains the predicted probabilities for the positive class
thresholds = np.linspace(0, 1, 1000)
min_cost = np.inf
best_threshold = None

for threshold in thresholds:
    # Convert probabilities to binary output based on the current threshold
    y_pred_binary = (y_test_pred > threshold).astype(int)

    # Calculate the confusion matrix for the current threshold
    tn, fp, fn, tp = confusion_matrix(y_test, y_pred_binary).ravel()

    # Calculate the total cost for the current threshold
    total_cost = (fp * cost_fp) + (fn * cost_fn)

    # Update the minimum cost and the best threshold
    if total_cost < min_cost:
        min_cost = total_cost
        best_threshold = threshold

# Use the best threshold to update the binary predictions
y_test_pred_binary = (y_test_pred > best_threshold).astype(int)

# Recalculate the confusion matrix and classification report using the best threshold
cm = confusion_matrix(y_test, y_test_pred_binary)
cr = classification_report(y_test, y_test_pred_binary)

# Print the best threshold, the new confusion matrix, and the classification report
print(f"Best Threshold: {best_threshold}")
print("Updated Confusion Matrix:")
print(cm)
print("\nUpdated Classification Report:")
print(cr)

sns.heatmap(cm, annot=True, fmt='.0f', cmap = 'mako')
plt.title('Test Data Prediction Matrix - XGBoost Cost Optimized')
plt.xticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.yticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.show()
```

```
Best Threshold: 0.6726726726726726
Updated Confusion Matrix:
[[18408   562]
 [ 1806 10903]]

Updated Classification Report:
              precision    recall  f1-score   support

           0       0.91      0.97      0.94     18970
           1       0.95      0.86      0.90     12709

    accuracy                           0.93     31679
   macro avg       0.93      0.91      0.92     31679
weighted avg       0.93      0.93      0.92     31679
```




In [ ]:

```
# Compute ROC curve and ROC area
fpr, tpr, thresholds = roc_curve(y_test, y_test_pred_binary)
roc_auc = auc(fpr, tpr)

# Plot the ROC curve
plt.figure()
plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' % roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic')
plt.legend(loc="lower right")
plt.show()
```




# Deep Neural Network

In [ ]:
```
import tensorflow as tf

df['y'] = df['y'].astype(int)
X = df.drop('y', axis=1)
y = df['y']
```

In [ ]:
```
col_to_scale =['x0', 'x1', 'x2', 'x3', 'x4', 'x5', 'x6', 'x7', 'x8', 'x9', 'x10',
            'x11', 'x12', 'x13', 'x14', 'x15', 'x16', 'x17', 'x18', 'x19', 'x20',
            'x21', 'x22', 'x23', 'x25', 'x26', 'x27', 'x28', 'x31', 'x33', 'x34',
            'x35', 'x36', 'x38', 'x39', 'x40', 'x41', 'x42', 'x43', 'x44', 'x45',
            'x46', 'x47', 'x48', 'x49', 'money', 'decimal']

scaled_data = scaler.fit_transform(df[col_to_scale])

X[col_to_scale] = scaled_data
```

In [ ]:
```
# Split the data into main training set and test set (80% - 20%)
X_train_main, X_test, y_train_main, y_test = train_test_split(
    X, y, test_size=0.2, random_state=12, stratify=y)

# Further split the main training set into training and validation sets (75% - 25% of main training)
X_train, X_validation, y_train, y_validation = train_test_split(
    X_train_main, y_train_main, test_size=0.25, random_state=12, stratify=y_train_main)
```

In [ ]:
```
X_train.shape
```

Out[ ]:
```
(95034, 64)
```

In [ ]:
```
dnn = tf.keras.Sequential()

dnn.add(tf.keras.Input(shape = (64,)))
dnn.add(tf.keras.layers.Dense(32, activation = 'relu'))
dnn.add(tf.keras.layers.Dense(64, activation = 'relu'))
dnn.add(tf.keras.layers.Dense(32, activation = 'relu'))
dnn.add(tf.keras.layers.Dense(1, activation = 'sigmoid'))

opt = tf.keras.optimizers.Adam(learning_rate=.001)
dnn.compile(loss= 'BinaryCrossentropy',metrics = ['accuracy'], optimizer=opt)
```

In [ ]:
```
from tensorflow.keras.callbacks import EarlyStopping

saftey = EarlyStopping(monitor = 'val_loss', patience = 10)
history = dnn.fit(X_train, y_train, epochs=1000,
                batch_size=100, callbacks=[saftey],
                validation_data=(X_validation,y_validation))
```

```
Epoch 1/1000
951/951 [==============================] - 2s 2ms/step - loss: 0.3965 - accuracy: 0.8172 - val_loss: 0.2913 - v
al_accuracy: 0.8775
Epoch 2/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.2501 - accuracy: 0.8978 - val_loss: 0.2329 - v
al_accuracy: 0.9052
Epoch 3/1000
```

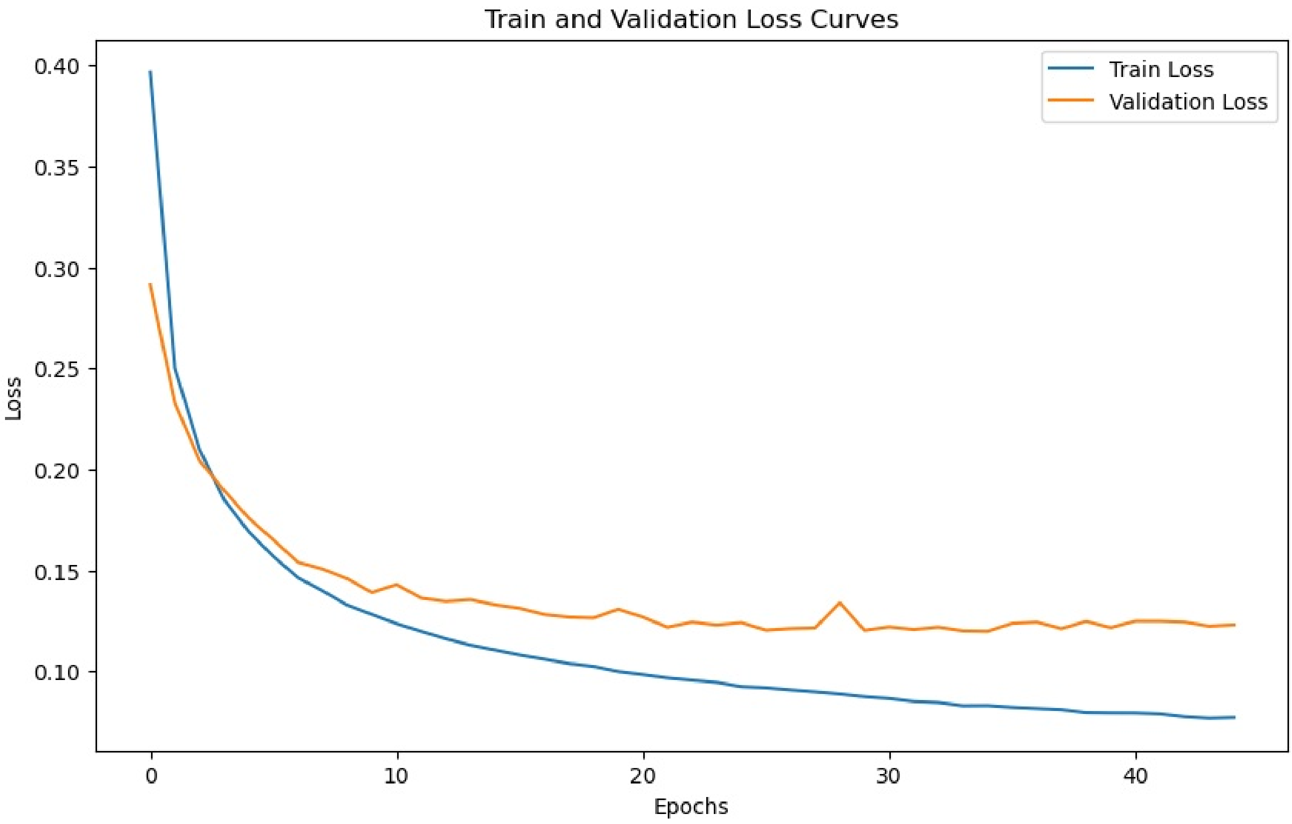
```
951/951 [==============================] - 1s 1ms/step - loss: 0.2099 - accuracy: 0.9176 - val_loss: 0.2043 - v
al_accuracy: 0.9203
Epoch 4/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1850 - accuracy: 0.9302 - val_loss: 0.1896 - v
al_accuracy: 0.9266
Epoch 5/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1691 - accuracy: 0.9367 - val_loss: 0.1759 - v
al_accuracy: 0.9338
Epoch 6/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1569 - accuracy: 0.9427 - val_loss: 0.1651 - v
al_accuracy: 0.9386
Epoch 7/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1464 - accuracy: 0.9461 - val_loss: 0.1540 - v
al_accuracy: 0.9438
Epoch 8/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1399 - accuracy: 0.9493 - val_loss: 0.1507 - v
al_accuracy: 0.9449
Epoch 9/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1328 - accuracy: 0.9529 - val_loss: 0.1459 - v
al_accuracy: 0.9466
Epoch 10/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1282 - accuracy: 0.9550 - val_loss: 0.1391 - v
al_accuracy: 0.9513
Epoch 11/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1237 - accuracy: 0.9570 - val_loss: 0.1430 - v
al_accuracy: 0.9495
Epoch 12/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1199 - accuracy: 0.9576 - val_loss: 0.1364 - v
al_accuracy: 0.9518
Epoch 13/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1162 - accuracy: 0.9600 - val_loss: 0.1347 - v
al_accuracy: 0.9532
Epoch 14/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1130 - accuracy: 0.9612 - val_loss: 0.1356 - v
al_accuracy: 0.9522
Epoch 15/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1106 - accuracy: 0.9624 - val_loss: 0.1330 - v
al_accuracy: 0.9537
Epoch 16/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1082 - accuracy: 0.9636 - val_loss: 0.1313 - v
al_accuracy: 0.9543
Epoch 17/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1061 - accuracy: 0.9643 - val_loss: 0.1282 - v
al_accuracy: 0.9564
Epoch 18/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1039 - accuracy: 0.9653 - val_loss: 0.1269 - v
al_accuracy: 0.9569
Epoch 19/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1025 - accuracy: 0.9661 - val_loss: 0.1266 - v
al_accuracy: 0.9558
Epoch 20/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.1000 - accuracy: 0.9662 - val_loss: 0.1308 - v
al_accuracy: 0.9552
Epoch 21/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0985 - accuracy: 0.9674 - val_loss: 0.1270 - v
al_accuracy: 0.9573
Epoch 22/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0968 - accuracy: 0.9678 - val_loss: 0.1219 - v
al_accuracy: 0.9600
Epoch 23/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0957 - accuracy: 0.9687 - val_loss: 0.1245 - v
al_accuracy: 0.9583
Epoch 24/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0946 - accuracy: 0.9686 - val_loss: 0.1230 - v
al_accuracy: 0.9590
Epoch 25/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0925 - accuracy: 0.9696 - val_loss: 0.1242 - v
al_accuracy: 0.9587
Epoch 26/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0919 - accuracy: 0.9698 - val_loss: 0.1205 - v
al_accuracy: 0.9597
Epoch 27/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0909 - accuracy: 0.9698 - val_loss: 0.1213 - v
al_accuracy: 0.9600
Epoch 28/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0900 - accuracy: 0.9708 - val_loss: 0.1216 - v
al_accuracy: 0.9605
Epoch 29/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0889 - accuracy: 0.9710 - val_loss: 0.1340 - v
al_accuracy: 0.9560
Epoch 30/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0876 - accuracy: 0.9714 - val_loss: 0.1204 - v
al_accuracy: 0.9603
Epoch 31/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0867 - accuracy: 0.9715 - val_loss: 0.1221 - v
al_accuracy: 0.9600
Epoch 32/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0852 - accuracy: 0.9721 - val_loss: 0.1208 - v
al_accuracy: 0.9598
```

```
Epoch 33/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0847 - accuracy: 0.9721 - val_loss: 0.1219 - v
al_accuracy: 0.9607
Epoch 34/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0830 - accuracy: 0.9727 - val_loss: 0.1201 - v
al_accuracy: 0.9614
Epoch 35/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0831 - accuracy: 0.9726 - val_loss: 0.1199 - v
al_accuracy: 0.9619
Epoch 36/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0823 - accuracy: 0.9733 - val_loss: 0.1238 - v
al_accuracy: 0.9618
Epoch 37/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0817 - accuracy: 0.9736 - val_loss: 0.1244 - v
al_accuracy: 0.9595
Epoch 38/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0811 - accuracy: 0.9731 - val_loss: 0.1212 - v
al_accuracy: 0.9611
Epoch 39/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0797 - accuracy: 0.9742 - val_loss: 0.1248 - v
al_accuracy: 0.9603
Epoch 40/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0795 - accuracy: 0.9744 - val_loss: 0.1217 - v
al_accuracy: 0.9616
Epoch 41/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0795 - accuracy: 0.9742 - val_loss: 0.1249 - v
al_accuracy: 0.9606
Epoch 42/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0790 - accuracy: 0.9745 - val_loss: 0.1249 - v
al_accuracy: 0.9598
Epoch 43/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0776 - accuracy: 0.9745 - val_loss: 0.1245 - v
al_accuracy: 0.9611
Epoch 44/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0769 - accuracy: 0.9750 - val_loss: 0.1224 - v
al_accuracy: 0.9613
Epoch 45/1000
951/951 [==============================] - 1s 1ms/step - loss: 0.0772 - accuracy: 0.9744 - val_loss: 0.1231 - v
al_accuracy: 0.9610
```

## CV Loss Curve

In [ ]:

```
plt.figure(figsize=(10, 6))
plt.plot(history.history['loss'], label='Train Loss')
plt.plot(history.history['val_loss'], label='Validation Loss')
plt.title('Train and Validation Loss Curves')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.legend()
plt.show()
```

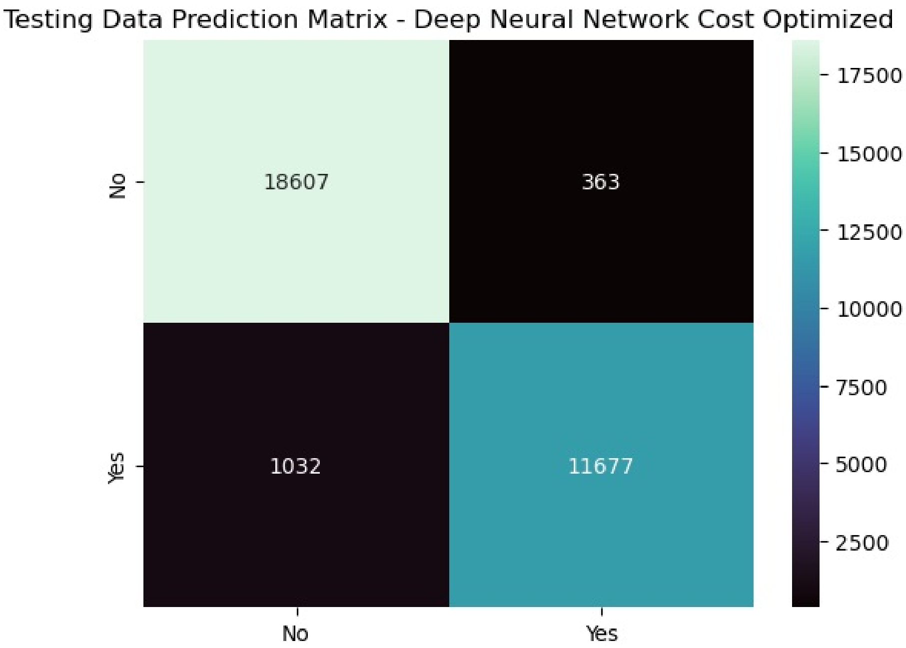


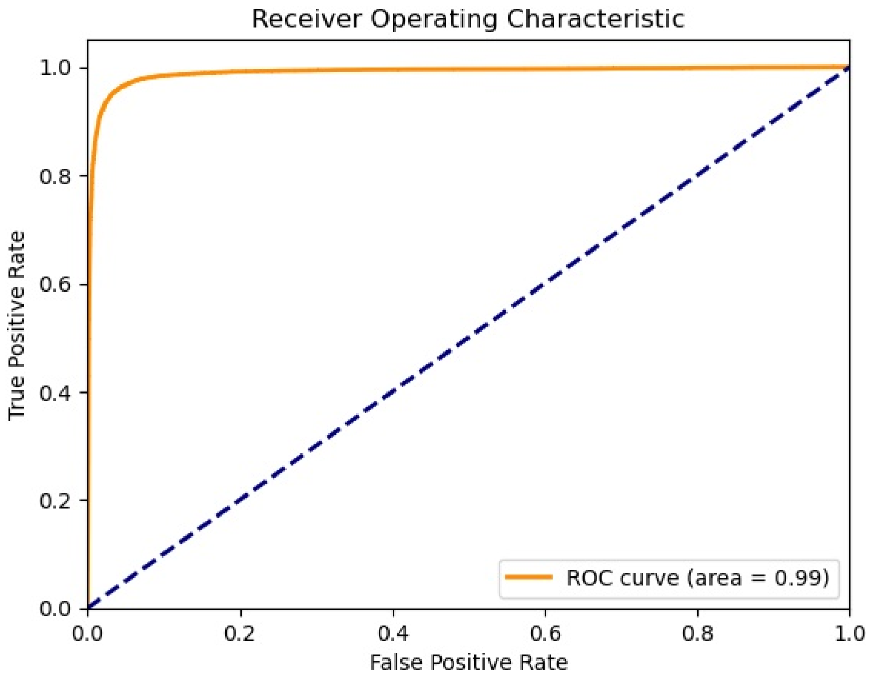

In [ ]:

```
# Define the cost of false positives and false negatives
```

```python
cost_fp = 100
cost_fn = 40

# Predict probabilities on the test set
y_pred_prob = dnn.predict(X_test).flatten()

# Initialize the list to store costs for each threshold
costs = []
thresholds = np.linspace(0, 1, 100)

# Loop over thresholds to calculate the total cost
for t in thresholds:
    y_pred = (y_pred_prob > t).astype(int)
    tn, fp, fn, tp = confusion_matrix(y_test, y_pred).ravel()
    total_cost = (fp * cost_fp) + (fn * cost_fn)
    costs.append(total_cost)

# Find the threshold that minimizes the total cost
min_cost_index = np.argmin(costs)
min_cost_thres = thresholds[min_cost_index]
print(f'Threshold that minimizes the total cost: {min_cost_thres}')

# Generate predictions using the threshold that minimizes the total cost
y_pred_min_cost = (y_pred_prob > min_cost_thres).astype(int)

# Compute the confusion matrix
cm = confusion_matrix(y_test, y_pred_min_cost)
print("Confusion Matrix:")
print(cm)

# Generate the classification report
cr = classification_report(y_test, y_pred_min_cost)
print("\nClassification Report:")
print(cr)

sns.heatmap(cm, annot=True, fmt='.0f', cmap = 'mako')
plt.title('Testing Data Prediction Matrix - Deep Neural Network Cost Optimized')
plt.xticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.yticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.show()



# Compute ROC curve and ROC area
fpr, tpr, _ = roc_curve(y_test, y_pred_prob)
roc_auc = auc(fpr, tpr)

# Plot the ROC curve
plt.figure()
plt.plot(fpr, tpr, color='darkorange', lw=2, label='ROC curve (area = %0.2f)' % roc_auc)
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic')
plt.legend(loc="lower right")
plt.show()
```

```
990/990 [==============================] - 1s 626us/step
Threshold that minimizes the total cost: 0.7373737373737375
Confusion Matrix:
[[18607   363]
 [ 1032 11677]]

Classification Report:
              precision    recall  f1-score   support

           0       0.95      0.98      0.96     18970
           1       0.97      0.92      0.94     12709

    accuracy                           0.96     31679
   macro avg       0.96      0.95      0.95     31679
weighted avg       0.96      0.96      0.96     31679
```




# Entire Prediction Results - Cross Val Predict

In [ ]:
```
from sklearn.model_selection import cross_val_predict
```

In [ ]:
```
import tensorflow as tf
from sklearn.model_selection import StratifiedKFold
from sklearn.metrics import confusion_matrix, classification_report
import numpy as np

cost_fp = 100
cost_fn = 40

kfold = StratifiedKFold(n_splits=5, shuffle=True)

best_threshold = []
```

```python
all_true_labels = []
all_pred_labels = []

for train, test in kfold.split(X, y):
    dnn = tf.keras.Sequential([
        tf.keras.Input(shape=(64,)),
        tf.keras.layers.Dense(32, activation='relu'),
        tf.keras.layers.Dense(64, activation='relu'),
        tf.keras.layers.Dense(32, activation='relu'),
        tf.keras.layers.Dense(1, activation='sigmoid')
    ])

    dnn.compile(loss='binary_crossentropy', metrics=['accuracy'], optimizer='adam')

    X_np = X.values
    y_np = y.values

    # Fit the model
    dnn.fit(X_np[train], y_np[train], epochs=600, batch_size=100, verbose=2)

    # Predict probabilities on the validation set
    y_pred_prob = dnn.predict(X_np[test]).flatten()

    # Initialize the list to store costs for each threshold
    costs = []
    thresholds = np.linspace(0, 1, 100)

    # Loop over thresholds to calculate the total cost
    for t in thresholds:
        y_pred = (y_pred_prob > t).astype(int)
        tn, fp, fn, tp = confusion_matrix(y_np[test], y_pred).ravel()
        total_cost = (fp * cost_fp) + (fn * cost_fn)
        costs.append(total_cost)

    # Find the threshold that minimizes the total cost for the fold
    min_cost_index = np.argmin(costs)
    min_cost_thres = thresholds[min_cost_index]
    best_threshold.append(min_cost_thres)
    y_pred = (y_pred_prob > min_cost_thres).astype(int)
    all_true_labels.extend(y_np[test])
    all_pred_labels.extend(y_pred)

conf_matrix = confusion_matrix(all_true_labels,all_pred_labels)
class_report = classification_report(all_true_labels,all_pred_labels)

# Aggregate the best thresholds (e.g., by averaging)
final_best_threshold = np.mean(best_threshold)
print(f'Final Best Threshold: {final_best_threshold}')

print(conf_matrix)
print(class_report)
```

```
Epoch 1/600
1268/1268 - 2s - loss: 0.3645 - accuracy: 0.8345 - 2s/epoch - 1ms/step
Epoch 2/600
1268/1268 - 1s - loss: 0.2324 - accuracy: 0.9062 - 1s/epoch - 984us/step
Epoch 3/600
1268/1268 - 1s - loss: 0.1888 - accuracy: 0.9282 - 1s/epoch - 962us/step
Epoch 4/600
1268/1268 - 1s - loss: 0.1625 - accuracy: 0.9398 - 1s/epoch - 982us/step
Epoch 5/600
1268/1268 - 1s - loss: 0.1470 - accuracy: 0.9470 - 1s/epoch - 964us/step
Epoch 6/600
1268/1268 - 1s - loss: 0.1365 - accuracy: 0.9516 - 1s/epoch - 960us/step
Epoch 7/600
1268/1268 - 1s - loss: 0.1296 - accuracy: 0.9543 - 1s/epoch - 978us/step
Epoch 8/600
1268/1268 - 1s - loss: 0.1234 - accuracy: 0.9574 - 1s/epoch - 961us/step
Epoch 9/600
1268/1268 - 1s - loss: 0.1192 - accuracy: 0.9590 - 1s/epoch - 980us/step
Epoch 10/600
1268/1268 - 1s - loss: 0.1157 - accuracy: 0.9602 - 1s/epoch - 984us/step
Epoch 11/600
1268/1268 - 1s - loss: 0.1120 - accuracy: 0.9621 - 1s/epoch - 971us/step
Epoch 12/600
1268/1268 - 1s - loss: 0.1097 - accuracy: 0.9629 - 1s/epoch - 965us/step
Epoch 13/600
1268/1268 - 1s - loss: 0.1078 - accuracy: 0.9638 - 1s/epoch - 982us/step
Epoch 14/600
1268/1268 - 1s - loss: 0.1055 - accuracy: 0.9645 - 1s/epoch - 967us/step
Epoch 15/600
1268/1268 - 1s - loss: 0.1031 - accuracy: 0.9655 - 1s/epoch - 985us/step
Epoch 16/600
1268/1268 - 1s - loss: 0.1019 - accuracy: 0.9660 - 1s/epoch - 972us/step
Epoch 17/600
1268/1268 - 1s - loss: 0.1002 - accuracy: 0.9668 - 1s/epoch - 961us/step
Epoch 18/600
1268/1268 - 1s - loss: 0.0988 - accuracy: 0.9673 - 1s/epoch - 960us/step
Epoch 19/600
```

```
1268/1268 - 1s - loss: 0.0982 - accuracy: 0.9675 - 1s/epoch - 978us/step
Epoch 20/600
1268/1268 - 1s - loss: 0.0959 - accuracy: 0.9685 - 1s/epoch - 967us/step
Epoch 21/600
1268/1268 - 1s - loss: 0.0951 - accuracy: 0.9687 - 1s/epoch - 971us/step
Epoch 22/600
1268/1268 - 1s - loss: 0.0941 - accuracy: 0.9691 - 1s/epoch - 984us/step
Epoch 23/600
1268/1268 - 1s - loss: 0.0932 - accuracy: 0.9692 - 1s/epoch - 971us/step
Epoch 24/600
1268/1268 - 1s - loss: 0.0922 - accuracy: 0.9696 - 1s/epoch - 988us/step
Epoch 25/600
1268/1268 - 1s - loss: 0.0914 - accuracy: 0.9701 - 1s/epoch - 984us/step
Epoch 26/600
1268/1268 - 1s - loss: 0.0901 - accuracy: 0.9705 - 1s/epoch - 981us/step
Epoch 27/600
1268/1268 - 1s - loss: 0.0895 - accuracy: 0.9710 - 1s/epoch - 965us/step
Epoch 28/600
1268/1268 - 1s - loss: 0.0886 - accuracy: 0.9713 - 1s/epoch - 963us/step
Epoch 29/600
1268/1268 - 1s - loss: 0.0878 - accuracy: 0.9714 - 1s/epoch - 981us/step
Epoch 30/600
1268/1268 - 1s - loss: 0.0868 - accuracy: 0.9716 - 1s/epoch - 980us/step
Epoch 31/600
1268/1268 - 1s - loss: 0.0864 - accuracy: 0.9718 - 1s/epoch - 959us/step
Epoch 32/600
1268/1268 - 1s - loss: 0.0860 - accuracy: 0.9722 - 1s/epoch - 962us/step
Epoch 33/600
1268/1268 - 1s - loss: 0.0852 - accuracy: 0.9722 - 1s/epoch - 983us/step
Epoch 34/600
1268/1268 - 1s - loss: 0.0842 - accuracy: 0.9725 - 1s/epoch - 982us/step
Epoch 35/600
1268/1268 - 1s - loss: 0.0838 - accuracy: 0.9731 - 1s/epoch - 966us/step
Epoch 36/600
1268/1268 - 1s - loss: 0.0830 - accuracy: 0.9732 - 1s/epoch - 958us/step
Epoch 37/600
1268/1268 - 1s - loss: 0.0825 - accuracy: 0.9731 - 1s/epoch - 980us/step
Epoch 38/600
1268/1268 - 1s - loss: 0.0817 - accuracy: 0.9733 - 1s/epoch - 966us/step
Epoch 39/600
1268/1268 - 1s - loss: 0.0810 - accuracy: 0.9739 - 1s/epoch - 985us/step
Epoch 40/600
1268/1268 - 1s - loss: 0.0805 - accuracy: 0.9737 - 1s/epoch - 983us/step
Epoch 41/600
1268/1268 - 1s - loss: 0.0798 - accuracy: 0.9740 - 1s/epoch - 961us/step
Epoch 42/600
1268/1268 - 1s - loss: 0.0794 - accuracy: 0.9741 - 1s/epoch - 982us/step
Epoch 43/600
1268/1268 - 1s - loss: 0.0793 - accuracy: 0.9743 - 1s/epoch - 962us/step
Epoch 44/600
1268/1268 - 1s - loss: 0.0782 - accuracy: 0.9751 - 1s/epoch - 967us/step
Epoch 45/600
1268/1268 - 1s - loss: 0.0780 - accuracy: 0.9752 - 1s/epoch - 985us/step
Epoch 46/600
1268/1268 - 1s - loss: 0.0776 - accuracy: 0.9751 - 1s/epoch - 958us/step
Epoch 47/600
1268/1268 - 1s - loss: 0.0769 - accuracy: 0.9749 - 1s/epoch - 962us/step
Epoch 48/600
1268/1268 - 1s - loss: 0.0767 - accuracy: 0.9753 - 1s/epoch - 982us/step
Epoch 49/600
1268/1268 - 1s - loss: 0.0764 - accuracy: 0.9752 - 1s/epoch - 981us/step
Epoch 50/600
1268/1268 - 1s - loss: 0.0756 - accuracy: 0.9752 - 1s/epoch - 966us/step
Epoch 51/600
1268/1268 - 1s - loss: 0.0755 - accuracy: 0.9759 - 1s/epoch - 978us/step
Epoch 52/600
1268/1268 - 1s - loss: 0.0752 - accuracy: 0.9754 - 1s/epoch - 964us/step
Epoch 53/600
1268/1268 - 1s - loss: 0.0748 - accuracy: 0.9759 - 1s/epoch - 980us/step
Epoch 54/600
1268/1268 - 1s - loss: 0.0742 - accuracy: 0.9758 - 1s/epoch - 961us/step
Epoch 55/600
1268/1268 - 1s - loss: 0.0737 - accuracy: 0.9764 - 1s/epoch - 1ms/step
Epoch 56/600
1268/1268 - 1s - loss: 0.0736 - accuracy: 0.9760 - 1s/epoch - 990us/step
Epoch 57/600
1268/1268 - 1s - loss: 0.0730 - accuracy: 0.9766 - 1s/epoch - 987us/step
Epoch 58/600
1268/1268 - 1s - loss: 0.0723 - accuracy: 0.9767 - 1s/epoch - 965us/step
Epoch 59/600
1268/1268 - 1s - loss: 0.0726 - accuracy: 0.9765 - 1s/epoch - 971us/step
Epoch 60/600
1268/1268 - 1s - loss: 0.0723 - accuracy: 0.9765 - 1s/epoch - 995us/step
Epoch 61/600
1268/1268 - 1s - loss: 0.0720 - accuracy: 0.9768 - 1s/epoch - 960us/step
Epoch 62/600
1268/1268 - 1s - loss: 0.0718 - accuracy: 0.9765 - 1s/epoch - 979us/step
Epoch 63/600
1268/1268 - 1s - loss: 0.0709 - accuracy: 0.9772 - 1s/epoch - 965us/step
```

```
Epoch 64/600
1268/1268 - 1s - loss: 0.0712 - accuracy: 0.9770 - 1s/epoch - 985us/step
Epoch 65/600
1268/1268 - 1s - loss: 0.0703 - accuracy: 0.9773 - 1s/epoch - 972us/step
Epoch 66/600
1268/1268 - 1s - loss: 0.0706 - accuracy: 0.9772 - 1s/epoch - 962us/step
Epoch 67/600
1268/1268 - 1s - loss: 0.0700 - accuracy: 0.9774 - 1s/epoch - 977us/step
Epoch 68/600
1268/1268 - 1s - loss: 0.0695 - accuracy: 0.9775 - 1s/epoch - 951us/step
Epoch 69/600
1268/1268 - 1s - loss: 0.0701 - accuracy: 0.9773 - 1s/epoch - 978us/step
Epoch 70/600
1268/1268 - 1s - loss: 0.0694 - accuracy: 0.9778 - 1s/epoch - 966us/step
Epoch 71/600
1268/1268 - 1s - loss: 0.0687 - accuracy: 0.9780 - 1s/epoch - 958us/step
Epoch 72/600
1268/1268 - 1s - loss: 0.0689 - accuracy: 0.9776 - 1s/epoch - 981us/step
Epoch 73/600
1268/1268 - 1s - loss: 0.0686 - accuracy: 0.9780 - 1s/epoch - 980us/step
Epoch 74/600
1268/1268 - 1s - loss: 0.0678 - accuracy: 0.9784 - 1s/epoch - 962us/step
Epoch 75/600
1268/1268 - 1s - loss: 0.0682 - accuracy: 0.9783 - 1s/epoch - 964us/step
Epoch 76/600
1268/1268 - 1s - loss: 0.0677 - accuracy: 0.9785 - 1s/epoch - 963us/step
Epoch 77/600
1268/1268 - 1s - loss: 0.0675 - accuracy: 0.9779 - 1s/epoch - 973us/step
Epoch 78/600
1268/1268 - 1s - loss: 0.0678 - accuracy: 0.9782 - 1s/epoch - 968us/step
Epoch 79/600
1268/1268 - 1s - loss: 0.0671 - accuracy: 0.9785 - 1s/epoch - 980us/step
Epoch 80/600
1268/1268 - 1s - loss: 0.0668 - accuracy: 0.9785 - 1s/epoch - 964us/step
Epoch 81/600
1268/1268 - 1s - loss: 0.0670 - accuracy: 0.9782 - 1s/epoch - 976us/step
Epoch 82/600
1268/1268 - 1s - loss: 0.0660 - accuracy: 0.9788 - 1s/epoch - 972us/step
Epoch 83/600
1268/1268 - 1s - loss: 0.0660 - accuracy: 0.9786 - 1s/epoch - 974us/step
Epoch 84/600
1268/1268 - 1s - loss: 0.0661 - accuracy: 0.9786 - 1s/epoch - 965us/step
Epoch 85/600
1268/1268 - 1s - loss: 0.0657 - accuracy: 0.9790 - 1s/epoch - 978us/step
Epoch 86/600
1268/1268 - 1s - loss: 0.0655 - accuracy: 0.9787 - 1s/epoch - 965us/step
Epoch 87/600
1268/1268 - 1s - loss: 0.0650 - accuracy: 0.9791 - 1s/epoch - 982us/step
Epoch 88/600
1268/1268 - 1s - loss: 0.0650 - accuracy: 0.9788 - 1s/epoch - 970us/step
Epoch 89/600
1268/1268 - 1s - loss: 0.0647 - accuracy: 0.9787 - 1s/epoch - 980us/step
Epoch 90/600
1268/1268 - 1s - loss: 0.0648 - accuracy: 0.9792 - 1s/epoch - 964us/step
Epoch 91/600
1268/1268 - 1s - loss: 0.0648 - accuracy: 0.9791 - 1s/epoch - 984us/step
Epoch 92/600
1268/1268 - 1s - loss: 0.0644 - accuracy: 0.9792 - 1s/epoch - 965us/step
Epoch 93/600
1268/1268 - 1s - loss: 0.0641 - accuracy: 0.9794 - 1s/epoch - 961us/step
Epoch 94/600
1268/1268 - 1s - loss: 0.0637 - accuracy: 0.9794 - 1s/epoch - 987us/step
Epoch 95/600
1268/1268 - 1s - loss: 0.0636 - accuracy: 0.9795 - 1s/epoch - 960us/step
Epoch 96/600
1268/1268 - 1s - loss: 0.0634 - accuracy: 0.9793 - 1s/epoch - 976us/step
Epoch 97/600
1268/1268 - 1s - loss: 0.0632 - accuracy: 0.9794 - 1s/epoch - 957us/step
Epoch 98/600
1268/1268 - 1s - loss: 0.0630 - accuracy: 0.9791 - 1s/epoch - 976us/step
Epoch 99/600
1268/1268 - 1s - loss: 0.0628 - accuracy: 0.9793 - 1s/epoch - 962us/step
Epoch 100/600
1268/1268 - 1s - loss: 0.0632 - accuracy: 0.9794 - 1s/epoch - 976us/step
Epoch 101/600
1268/1268 - 1s - loss: 0.0621 - accuracy: 0.9798 - 1s/epoch - 959us/step
Epoch 102/600
1268/1268 - 1s - loss: 0.0624 - accuracy: 0.9798 - 1s/epoch - 962us/step
Epoch 103/600
1268/1268 - 1s - loss: 0.0622 - accuracy: 0.9799 - 1s/epoch - 985us/step
Epoch 104/600
1268/1268 - 1s - loss: 0.0621 - accuracy: 0.9798 - 1s/epoch - 959us/step
Epoch 105/600
1268/1268 - 1s - loss: 0.0619 - accuracy: 0.9797 - 1s/epoch - 973us/step
Epoch 106/600
1268/1268 - 1s - loss: 0.0620 - accuracy: 0.9800 - 1s/epoch - 982us/step
Epoch 107/600
1268/1268 - 1s - loss: 0.0612 - accuracy: 0.9801 - 1s/epoch - 961us/step
Epoch 108/600
```

```
1268/1268 - 1s - loss: 0.0616 - accuracy: 0.9801 - 1s/epoch - 977us/step
Epoch 109/600
1268/1268 - 1s - loss: 0.0613 - accuracy: 0.9799 - 1s/epoch - 1ms/step
Epoch 110/600
1268/1268 - 1s - loss: 0.0609 - accuracy: 0.9805 - 1s/epoch - 973us/step
Epoch 111/600
1268/1268 - 1s - loss: 0.0611 - accuracy: 0.9802 - 1s/epoch - 979us/step
Epoch 112/600
1268/1268 - 1s - loss: 0.0604 - accuracy: 0.9802 - 1s/epoch - 984us/step
Epoch 113/600
1268/1268 - 1s - loss: 0.0601 - accuracy: 0.9803 - 1s/epoch - 963us/step
Epoch 114/600
1268/1268 - 1s - loss: 0.0605 - accuracy: 0.9805 - 1s/epoch - 967us/step
Epoch 115/600
1268/1268 - 1s - loss: 0.0603 - accuracy: 0.9802 - 1s/epoch - 956us/step
Epoch 116/600
1268/1268 - 1s - loss: 0.0603 - accuracy: 0.9803 - 1s/epoch - 973us/step
Epoch 117/600
1268/1268 - 1s - loss: 0.0599 - accuracy: 0.9808 - 1s/epoch - 959us/step
Epoch 118/600
1268/1268 - 1s - loss: 0.0596 - accuracy: 0.9807 - 1s/epoch - 975us/step
Epoch 119/600
1268/1268 - 1s - loss: 0.0599 - accuracy: 0.9803 - 1s/epoch - 960us/step
Epoch 120/600
1268/1268 - 1s - loss: 0.0596 - accuracy: 0.9806 - 1s/epoch - 980us/step
Epoch 121/600
1268/1268 - 1s - loss: 0.0592 - accuracy: 0.9807 - 1s/epoch - 964us/step
Epoch 122/600
1268/1268 - 1s - loss: 0.0598 - accuracy: 0.9808 - 1s/epoch - 977us/step
Epoch 123/600
1268/1268 - 1s - loss: 0.0589 - accuracy: 0.9807 - 1s/epoch - 963us/step
Epoch 124/600
1268/1268 - 1s - loss: 0.0585 - accuracy: 0.9811 - 1s/epoch - 978us/step
Epoch 125/600
1268/1268 - 1s - loss: 0.0593 - accuracy: 0.9807 - 1s/epoch - 958us/step
Epoch 126/600
1268/1268 - 1s - loss: 0.0589 - accuracy: 0.9809 - 1s/epoch - 975us/step
Epoch 127/600
1268/1268 - 1s - loss: 0.0584 - accuracy: 0.9809 - 1s/epoch - 958us/step
Epoch 128/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9809 - 1s/epoch - 976us/step
Epoch 129/600
1268/1268 - 1s - loss: 0.0587 - accuracy: 0.9808 - 1s/epoch - 953us/step
Epoch 130/600
1268/1268 - 1s - loss: 0.0580 - accuracy: 0.9811 - 1s/epoch - 960us/step
Epoch 131/600
1268/1268 - 1s - loss: 0.0582 - accuracy: 0.9810 - 1s/epoch - 979us/step
Epoch 132/600
1268/1268 - 1s - loss: 0.0583 - accuracy: 0.9811 - 1s/epoch - 976us/step
Epoch 133/600
1268/1268 - 1s - loss: 0.0577 - accuracy: 0.9811 - 1s/epoch - 958us/step
Epoch 134/600
1268/1268 - 1s - loss: 0.0577 - accuracy: 0.9813 - 1s/epoch - 974us/step
Epoch 135/600
1268/1268 - 1s - loss: 0.0574 - accuracy: 0.9814 - 1s/epoch - 963us/step
Epoch 136/600
1268/1268 - 1s - loss: 0.0569 - accuracy: 0.9813 - 1s/epoch - 982us/step
Epoch 137/600
1268/1268 - 1s - loss: 0.0577 - accuracy: 0.9813 - 1s/epoch - 962us/step
Epoch 138/600
1268/1268 - 1s - loss: 0.0577 - accuracy: 0.9809 - 1s/epoch - 974us/step
Epoch 139/600
1268/1268 - 1s - loss: 0.0570 - accuracy: 0.9813 - 1s/epoch - 958us/step
Epoch 140/600
1268/1268 - 1s - loss: 0.0572 - accuracy: 0.9813 - 1s/epoch - 960us/step
Epoch 141/600
1268/1268 - 1s - loss: 0.0567 - accuracy: 0.9812 - 1s/epoch - 983us/step
Epoch 142/600
1268/1268 - 1s - loss: 0.0571 - accuracy: 0.9815 - 1s/epoch - 957us/step
Epoch 143/600
1268/1268 - 1s - loss: 0.0567 - accuracy: 0.9814 - 1s/epoch - 975us/step
Epoch 144/600
1268/1268 - 1s - loss: 0.0572 - accuracy: 0.9812 - 1s/epoch - 974us/step
Epoch 145/600
1268/1268 - 1s - loss: 0.0565 - accuracy: 0.9815 - 1s/epoch - 982us/step
Epoch 146/600
1268/1268 - 1s - loss: 0.0568 - accuracy: 0.9814 - 1s/epoch - 959us/step
Epoch 147/600
1268/1268 - 1s - loss: 0.0560 - accuracy: 0.9817 - 1s/epoch - 982us/step
Epoch 148/600
1268/1268 - 1s - loss: 0.0561 - accuracy: 0.9814 - 1s/epoch - 960us/step
Epoch 149/600
1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9813 - 1s/epoch - 959us/step
Epoch 150/600
1268/1268 - 1s - loss: 0.0559 - accuracy: 0.9816 - 1s/epoch - 979us/step
Epoch 151/600
1268/1268 - 1s - loss: 0.0561 - accuracy: 0.9817 - 1s/epoch - 977us/step
Epoch 152/600
1268/1268 - 1s - loss: 0.0554 - accuracy: 0.9819 - 1s/epoch - 959us/step
```

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Epoch 153/600
1268/1268 - 1s - loss: 0.0556 - accuracy: 0.9819 - 1s/epoch - 992us/step
Epoch 154/600
1268/1268 - 1s - loss: 0.0557 - accuracy: 0.9818 - 1s/epoch - 961us/step
Epoch 155/600
1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9815 - 1s/epoch - 979us/step
Epoch 156/600
1268/1268 - 1s - loss: 0.0552 - accuracy: 0.9818 - 1s/epoch - 961us/step
Epoch 157/600
1268/1268 - 1s - loss: 0.0549 - accuracy: 0.9817 - 1s/epoch - 978us/step
Epoch 158/600
1268/1268 - 1s - loss: 0.0556 - accuracy: 0.9819 - 1s/epoch - 974us/step
Epoch 159/600
1268/1268 - 1s - loss: 0.0551 - accuracy: 0.9817 - 1s/epoch - 980us/step
Epoch 160/600
1268/1268 - 1s - loss: 0.0554 - accuracy: 0.9818 - 1s/epoch - 965us/step
Epoch 161/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9819 - 1s/epoch - 986us/step
Epoch 162/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9822 - 1s/epoch - 963us/step
Epoch 163/600
1268/1268 - 1s - loss: 0.0549 - accuracy: 0.9819 - 1s/epoch - 981us/step
Epoch 164/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9822 - 1s/epoch - 963us/step
Epoch 165/600
1268/1268 - 1s - loss: 0.0548 - accuracy: 0.9819 - 1s/epoch - 959us/step
Epoch 166/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9819 - 1s/epoch - 987us/step
Epoch 167/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9817 - 1s/epoch - 974us/step
Epoch 168/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9823 - 1s/epoch - 966us/step
Epoch 169/600
1268/1268 - 1s - loss: 0.0539 - accuracy: 0.9823 - 1s/epoch - 997us/step
Epoch 170/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9821 - 1s/epoch - 970us/step
Epoch 171/600
1268/1268 - 1s - loss: 0.0537 - accuracy: 0.9824 - 1s/epoch - 978us/step
Epoch 172/600
1268/1268 - 1s - loss: 0.0540 - accuracy: 0.9824 - 1s/epoch - 963us/step
Epoch 173/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9822 - 1s/epoch - 973us/step
Epoch 174/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9821 - 1s/epoch - 963us/step
Epoch 175/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9818 - 1s/epoch - 979us/step
Epoch 176/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9819 - 1s/epoch - 963us/step
Epoch 177/600
1268/1268 - 1s - loss: 0.0535 - accuracy: 0.9822 - 1s/epoch - 960us/step
Epoch 178/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9826 - 1s/epoch - 979us/step
Epoch 179/600
1268/1268 - 1s - loss: 0.0537 - accuracy: 0.9824 - 1s/epoch - 979us/step
Epoch 180/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9824 - 1s/epoch - 962us/step
Epoch 181/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9824 - 1s/epoch - 973us/step
Epoch 182/600
1268/1268 - 1s - loss: 0.0531 - accuracy: 0.9823 - 1s/epoch - 959us/step
Epoch 183/600
1268/1268 - 1s - loss: 0.0534 - accuracy: 0.9822 - 1s/epoch - 980us/step
Epoch 184/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9825 - 1s/epoch - 962us/step
Epoch 185/600
1268/1268 - 1s - loss: 0.0531 - accuracy: 0.9827 - 1s/epoch - 983us/step
Epoch 186/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9822 - 1s/epoch - 963us/step
Epoch 187/600
1268/1268 - 1s - loss: 0.0522 - accuracy: 0.9830 - 1s/epoch - 980us/step
Epoch 188/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9824 - 1s/epoch - 966us/step
Epoch 189/600
1268/1268 - 1s - loss: 0.0525 - accuracy: 0.9826 - 1s/epoch - 964us/step
Epoch 190/600
1268/1268 - 1s - loss: 0.0524 - accuracy: 0.9826 - 1s/epoch - 991us/step
Epoch 191/600
1268/1268 - 1s - loss: 0.0521 - accuracy: 0.9827 - 1s/epoch - 980us/step
Epoch 192/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9822 - 1s/epoch - 961us/step
Epoch 193/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9826 - 1s/epoch - 980us/step
Epoch 194/600
1268/1268 - 1s - loss: 0.0523 - accuracy: 0.9828 - 1s/epoch - 962us/step
Epoch 195/600
1268/1268 - 1s - loss: 0.0521 - accuracy: 0.9829 - 1s/epoch - 984us/step
Epoch 196/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9828 - 1s/epoch - 1ms/step
Epoch 197/600
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1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9826 - 1s/epoch - 960us/step
Epoch 198/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9830 - 1s/epoch - 978us/step
Epoch 199/600
1268/1268 - 1s - loss: 0.0514 - accuracy: 0.9831 - 1s/epoch - 987us/step
Epoch 200/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9828 - 1s/epoch - 961us/step
Epoch 201/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9827 - 1s/epoch - 962us/step
Epoch 202/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9832 - 1s/epoch - 974us/step
Epoch 203/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9829 - 1s/epoch - 981us/step
Epoch 204/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9829 - 1s/epoch - 965us/step
Epoch 205/600
1268/1268 - 1s - loss: 0.0512 - accuracy: 0.9831 - 1s/epoch - 961us/step
Epoch 206/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9827 - 1s/epoch - 984us/step
Epoch 207/600
1268/1268 - 1s - loss: 0.0512 - accuracy: 0.9834 - 1s/epoch - 990us/step
Epoch 208/600
1268/1268 - 1s - loss: 0.0514 - accuracy: 0.9830 - 1s/epoch - 959us/step
Epoch 209/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9833 - 1s/epoch - 977us/step
Epoch 210/600
1268/1268 - 1s - loss: 0.0513 - accuracy: 0.9832 - 1s/epoch - 957us/step
Epoch 211/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9831 - 1s/epoch - 970us/step
Epoch 212/600
1268/1268 - 1s - loss: 0.0510 - accuracy: 0.9830 - 1s/epoch - 968us/step
Epoch 213/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9831 - 1s/epoch - 982us/step
Epoch 214/600
1268/1268 - 1s - loss: 0.0510 - accuracy: 0.9830 - 1s/epoch - 962us/step
Epoch 215/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9832 - 1s/epoch - 958us/step
Epoch 216/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9827 - 1s/epoch - 976us/step
Epoch 217/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9835 - 1s/epoch - 975us/step
Epoch 218/600
1268/1268 - 1s - loss: 0.0505 - accuracy: 0.9830 - 1s/epoch - 982us/step
Epoch 219/600
1268/1268 - 1s - loss: 0.0504 - accuracy: 0.9830 - 1s/epoch - 965us/step
Epoch 220/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9832 - 1s/epoch - 980us/step
Epoch 221/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9835 - 1s/epoch - 965us/step
Epoch 222/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9835 - 1s/epoch - 980us/step
Epoch 223/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9834 - 1s/epoch - 963us/step
Epoch 224/600
1268/1268 - 1s - loss: 0.0505 - accuracy: 0.9830 - 1s/epoch - 985us/step
Epoch 225/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9833 - 1s/epoch - 965us/step
Epoch 226/600
1268/1268 - 1s - loss: 0.0499 - accuracy: 0.9834 - 1s/epoch - 981us/step
Epoch 227/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9833 - 1s/epoch - 960us/step
Epoch 228/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9839 - 1s/epoch - 981us/step
Epoch 229/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9835 - 1s/epoch - 957us/step
Epoch 230/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9836 - 1s/epoch - 967us/step
Epoch 231/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9835 - 1s/epoch - 965us/step
Epoch 232/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9833 - 1s/epoch - 990us/step
Epoch 233/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9832 - 1s/epoch - 960us/step
Epoch 234/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9834 - 1s/epoch - 979us/step
Epoch 235/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9839 - 1s/epoch - 961us/step
Epoch 236/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9838 - 1s/epoch - 979us/step
Epoch 237/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9837 - 1s/epoch - 956us/step
Epoch 238/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9835 - 1s/epoch - 980us/step
Epoch 239/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9834 - 1s/epoch - 963us/step
Epoch 240/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9838 - 1s/epoch - 978us/step
Epoch 241/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9842 - 1s/epoch - 957us/step
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Epoch 242/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9840 - 1s/epoch - 968us/step
Epoch 243/600
1268/1268 - 1s - loss: 0.0488 - accuracy: 0.9841 - 1s/epoch - 972us/step
Epoch 244/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9837 - 1s/epoch - 972us/step
Epoch 245/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9840 - 1s/epoch - 961us/step
Epoch 246/600
1268/1268 - 1s - loss: 0.0485 - accuracy: 0.9837 - 1s/epoch - 978us/step
Epoch 247/600
1268/1268 - 1s - loss: 0.0488 - accuracy: 0.9831 - 1s/epoch - 972us/step
Epoch 248/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9839 - 1s/epoch - 980us/step
Epoch 249/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9839 - 1s/epoch - 957us/step
Epoch 250/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9838 - 1s/epoch - 977us/step
Epoch 251/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9841 - 1s/epoch - 962us/step
Epoch 252/600
1268/1268 - 1s - loss: 0.0484 - accuracy: 0.9841 - 1s/epoch - 976us/step
Epoch 253/600
1268/1268 - 1s - loss: 0.0485 - accuracy: 0.9837 - 1s/epoch - 959us/step
Epoch 254/600
1268/1268 - 1s - loss: 0.0485 - accuracy: 0.9836 - 1s/epoch - 978us/step
Epoch 255/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9839 - 1s/epoch - 963us/step
Epoch 256/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9842 - 1s/epoch - 991us/step
Epoch 257/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9837 - 1s/epoch - 961us/step
Epoch 258/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9842 - 1s/epoch - 990us/step
Epoch 259/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9839 - 1s/epoch - 958us/step
Epoch 260/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9841 - 1s/epoch - 980us/step
Epoch 261/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9840 - 1s/epoch - 963us/step
Epoch 262/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9840 - 1s/epoch - 978us/step
Epoch 263/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9838 - 1s/epoch - 964us/step
Epoch 264/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9839 - 1s/epoch - 979us/step
Epoch 265/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9841 - 1s/epoch - 961us/step
Epoch 266/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9840 - 1s/epoch - 976us/step
Epoch 267/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9841 - 1s/epoch - 959us/step
Epoch 268/600
1268/1268 - 1s - loss: 0.0473 - accuracy: 0.9841 - 1s/epoch - 971us/step
Epoch 269/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9838 - 1s/epoch - 957us/step
Epoch 270/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9842 - 1s/epoch - 975us/step
Epoch 271/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9841 - 1s/epoch - 966us/step
Epoch 272/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9839 - 1s/epoch - 974us/step
Epoch 273/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9844 - 1s/epoch - 961us/step
Epoch 274/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9844 - 1s/epoch - 977us/step
Epoch 275/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9842 - 1s/epoch - 963us/step
Epoch 276/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9840 - 1s/epoch - 977us/step
Epoch 277/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9843 - 1s/epoch - 960us/step
Epoch 278/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9844 - 1s/epoch - 984us/step
Epoch 279/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9840 - 1s/epoch - 961us/step
Epoch 280/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9844 - 1s/epoch - 986us/step
Epoch 281/600
1268/1268 - 1s - loss: 0.0468 - accuracy: 0.9845 - 1s/epoch - 959us/step
Epoch 282/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9839 - 1s/epoch - 976us/step
Epoch 283/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9845 - 1s/epoch - 961us/step
Epoch 284/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9845 - 1s/epoch - 974us/step
Epoch 285/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9845 - 1s/epoch - 963us/step
Epoch 286/600
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1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9847 - 1s/epoch - 980us/step
Epoch 287/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9844 - 1s/epoch - 963us/step
Epoch 288/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9841 - 1s/epoch - 967us/step
Epoch 289/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9847 - 1s/epoch - 982us/step
Epoch 290/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9845 - 1s/epoch - 958us/step
Epoch 291/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9845 - 1s/epoch - 981us/step
Epoch 292/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9848 - 1s/epoch - 961us/step
Epoch 293/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9844 - 1s/epoch - 977us/step
Epoch 294/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9846 - 1s/epoch - 962us/step
Epoch 295/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9846 - 1s/epoch - 978us/step
Epoch 296/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9846 - 1s/epoch - 963us/step
Epoch 297/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9841 - 1s/epoch - 976us/step
Epoch 298/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9846 - 1s/epoch - 960us/step
Epoch 299/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9846 - 1s/epoch - 954us/step
Epoch 300/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9848 - 1s/epoch - 976us/step
Epoch 301/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9848 - 1s/epoch - 974us/step
Epoch 302/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9849 - 1s/epoch - 957us/step
Epoch 303/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9849 - 1s/epoch - 982us/step
Epoch 304/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9845 - 1s/epoch - 969us/step
Epoch 305/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9850 - 1s/epoch - 991us/step
Epoch 306/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9847 - 1s/epoch - 961us/step
Epoch 307/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9846 - 1s/epoch - 991us/step
Epoch 308/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9849 - 1s/epoch - 971us/step
Epoch 309/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9844 - 1s/epoch - 977us/step
Epoch 310/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9847 - 1s/epoch - 961us/step
Epoch 311/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9845 - 1s/epoch - 977us/step
Epoch 312/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9843 - 1s/epoch - 972us/step
Epoch 313/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9847 - 1s/epoch - 985us/step
Epoch 314/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9854 - 1s/epoch - 961us/step
Epoch 315/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9843 - 1s/epoch - 1ms/step
Epoch 316/600
1268/1268 - 1s - loss: 0.0460 - accuracy: 0.9845 - 1s/epoch - 959us/step
Epoch 317/600
1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9847 - 1s/epoch - 992us/step
Epoch 318/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9848 - 1s/epoch - 960us/step
Epoch 319/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9848 - 1s/epoch - 969us/step
Epoch 320/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9848 - 1s/epoch - 961us/step
Epoch 321/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9846 - 1s/epoch - 983us/step
Epoch 322/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9847 - 1s/epoch - 962us/step
Epoch 323/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9849 - 1s/epoch - 980us/step
Epoch 324/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9850 - 1s/epoch - 961us/step
Epoch 325/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9846 - 1s/epoch - 984us/step
Epoch 326/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9847 - 1s/epoch - 961us/step
Epoch 327/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9853 - 1s/epoch - 975us/step
Epoch 328/600
1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9847 - 1s/epoch - 963us/step
Epoch 329/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9847 - 1s/epoch - 976us/step
Epoch 330/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9847 - 1s/epoch - 959us/step
```

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Epoch 331/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9850 - 1s/epoch - 979us/step
Epoch 332/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9849 - 1s/epoch - 959us/step
Epoch 333/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9849 - 1s/epoch - 985us/step
Epoch 334/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9850 - 1s/epoch - 965us/step
Epoch 335/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9850 - 1s/epoch - 975us/step
Epoch 336/600
1268/1268 - 1s - loss: 0.0448 - accuracy: 0.9847 - 1s/epoch - 969us/step
Epoch 337/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9850 - 1s/epoch - 976us/step
Epoch 338/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9849 - 1s/epoch - 964us/step
Epoch 339/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9851 - 1s/epoch - 979us/step
Epoch 340/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9850 - 1s/epoch - 958us/step
Epoch 341/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9853 - 1s/epoch - 970us/step
Epoch 342/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9849 - 1s/epoch - 986us/step
Epoch 343/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 344/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9849 - 1s/epoch - 992us/step
Epoch 345/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 346/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9849 - 1s/epoch - 974us/step
Epoch 347/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9852 - 1s/epoch - 982us/step
Epoch 348/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9847 - 1s/epoch - 962us/step
Epoch 349/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9851 - 1s/epoch - 990us/step
Epoch 350/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9852 - 1s/epoch - 959us/step
Epoch 351/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9851 - 1s/epoch - 982us/step
Epoch 352/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9856 - 1s/epoch - 962us/step
Epoch 353/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9855 - 1s/epoch - 984us/step
Epoch 354/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9847 - 1s/epoch - 972us/step
Epoch 355/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9850 - 1s/epoch - 992us/step
Epoch 356/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9848 - 1s/epoch - 964us/step
Epoch 357/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9853 - 1s/epoch - 977us/step
Epoch 358/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 359/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9849 - 1s/epoch - 980us/step
Epoch 360/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9856 - 1s/epoch - 964us/step
Epoch 361/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9850 - 1s/epoch - 984us/step
Epoch 362/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9855 - 1s/epoch - 965us/step
Epoch 363/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9858 - 1s/epoch - 978us/step
Epoch 364/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9851 - 1s/epoch - 963us/step
Epoch 365/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9852 - 1s/epoch - 978us/step
Epoch 366/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9853 - 1s/epoch - 965us/step
Epoch 367/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9852 - 1s/epoch - 972us/step
Epoch 368/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9853 - 1s/epoch - 954us/step
Epoch 369/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9854 - 1s/epoch - 981us/step
Epoch 370/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9855 - 1s/epoch - 955us/step
Epoch 371/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9852 - 1s/epoch - 978us/step
Epoch 372/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9853 - 1s/epoch - 966us/step
Epoch 373/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9854 - 1s/epoch - 977us/step
Epoch 374/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9851 - 1s/epoch - 967us/step
Epoch 375/600
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1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9854 - 1s/epoch - 972us/step
Epoch 376/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9854 - 1s/epoch - 962us/step
Epoch 377/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9856 - 1s/epoch - 980us/step
Epoch 378/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9855 - 1s/epoch - 962us/step
Epoch 379/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9853 - 1s/epoch - 972us/step
Epoch 380/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9854 - 1s/epoch - 959us/step
Epoch 381/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9854 - 1s/epoch - 978us/step
Epoch 382/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9858 - 1s/epoch - 951us/step
Epoch 383/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9854 - 1s/epoch - 978us/step
Epoch 384/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9853 - 1s/epoch - 961us/step
Epoch 385/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9856 - 1s/epoch - 964us/step
Epoch 386/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9851 - 1s/epoch - 974us/step
Epoch 387/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9854 - 1s/epoch - 961us/step
Epoch 388/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9856 - 1s/epoch - 982us/step
Epoch 389/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9854 - 1s/epoch - 959us/step
Epoch 390/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9854 - 1s/epoch - 978us/step
Epoch 391/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9858 - 1s/epoch - 960us/step
Epoch 392/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9851 - 1s/epoch - 978us/step
Epoch 393/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9858 - 1s/epoch - 959us/step
Epoch 394/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9854 - 1s/epoch - 956us/step
Epoch 395/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9859 - 1s/epoch - 973us/step
Epoch 396/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9858 - 1s/epoch - 971us/step
Epoch 397/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9855 - 1s/epoch - 953us/step
Epoch 398/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9853 - 1s/epoch - 969us/step
Epoch 399/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9856 - 1s/epoch - 959us/step
Epoch 400/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9853 - 1s/epoch - 980us/step
Epoch 401/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9857 - 1s/epoch - 967us/step
Epoch 402/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9855 - 1s/epoch - 980us/step
Epoch 403/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9857 - 1s/epoch - 971us/step
Epoch 404/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9857 - 1s/epoch - 984us/step
Epoch 405/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9858 - 1s/epoch - 964us/step
Epoch 406/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9860 - 1s/epoch - 979us/step
Epoch 407/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9857 - 1s/epoch - 961us/step
Epoch 408/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9856 - 1s/epoch - 979us/step
Epoch 409/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9860 - 1s/epoch - 966us/step
Epoch 410/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9857 - 1s/epoch - 985us/step
Epoch 411/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9857 - 1s/epoch - 961us/step
Epoch 412/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9856 - 1s/epoch - 972us/step
Epoch 413/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9858 - 1s/epoch - 961us/step
Epoch 414/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9857 - 1s/epoch - 982us/step
Epoch 415/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9856 - 1s/epoch - 959us/step
Epoch 416/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9857 - 1s/epoch - 976us/step
Epoch 417/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9860 - 1s/epoch - 961us/step
Epoch 418/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9860 - 1s/epoch - 985us/step
Epoch 419/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9859 - 1s/epoch - 955us/step
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Epoch 420/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9853 - 1s/epoch - 982us/step
Epoch 421/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9863 - 1s/epoch - 961us/step
Epoch 422/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9854 - 1s/epoch - 979us/step
Epoch 423/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9862 - 1s/epoch - 956us/step
Epoch 424/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9855 - 1s/epoch - 979us/step
Epoch 425/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9861 - 1s/epoch - 958us/step
Epoch 426/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9856 - 1s/epoch - 982us/step
Epoch 427/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9863 - 1s/epoch - 961us/step
Epoch 428/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9860 - 1s/epoch - 980us/step
Epoch 429/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9860 - 1s/epoch - 960us/step
Epoch 430/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9859 - 1s/epoch - 973us/step
Epoch 431/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9862 - 1s/epoch - 964us/step
Epoch 432/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9861 - 1s/epoch - 975us/step
Epoch 433/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9859 - 1s/epoch - 958us/step
Epoch 434/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9861 - 1s/epoch - 984us/step
Epoch 435/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9854 - 1s/epoch - 963us/step
Epoch 436/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9860 - 1s/epoch - 981us/step
Epoch 437/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9856 - 1s/epoch - 966us/step
Epoch 438/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9860 - 1s/epoch - 979us/step
Epoch 439/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9861 - 1s/epoch - 961us/step
Epoch 440/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9859 - 1s/epoch - 978us/step
Epoch 441/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9859 - 1s/epoch - 963us/step
Epoch 442/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9858 - 1s/epoch - 983us/step
Epoch 443/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9860 - 1s/epoch - 964us/step
Epoch 444/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9862 - 1s/epoch - 985us/step
Epoch 445/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9854 - 1s/epoch - 960us/step
Epoch 446/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9861 - 1s/epoch - 978us/step
Epoch 447/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9861 - 1s/epoch - 965us/step
Epoch 448/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 449/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9858 - 1s/epoch - 965us/step
Epoch 450/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9860 - 1s/epoch - 967us/step
Epoch 451/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9860 - 1s/epoch - 988us/step
Epoch 452/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9864 - 1s/epoch - 981us/step
Epoch 453/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9858 - 1s/epoch - 961us/step
Epoch 454/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9862 - 1s/epoch - 980us/step
Epoch 455/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9863 - 1s/epoch - 963us/step
Epoch 456/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9858 - 1s/epoch - 978us/step
Epoch 457/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9862 - 1s/epoch - 958us/step
Epoch 458/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9863 - 1s/epoch - 980us/step
Epoch 459/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9859 - 1s/epoch - 958us/step
Epoch 460/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9863 - 1s/epoch - 972us/step
Epoch 461/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9861 - 1s/epoch - 973us/step
Epoch 462/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9865 - 1s/epoch - 974us/step
Epoch 463/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9862 - 1s/epoch - 961us/step
Epoch 464/600
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1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9860 - 1s/epoch - 986us/step
Epoch 465/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9859 - 1s/epoch - 955us/step
Epoch 466/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9863 - 1s/epoch - 976us/step
Epoch 467/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9864 - 1s/epoch - 965us/step
Epoch 468/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9859 - 1s/epoch - 981us/step
Epoch 469/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9862 - 1s/epoch - 960us/step
Epoch 470/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9860 - 1s/epoch - 956us/step
Epoch 471/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9862 - 1s/epoch - 973us/step
Epoch 472/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9863 - 1s/epoch - 978us/step
Epoch 473/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9867 - 1s/epoch - 956us/step
Epoch 474/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9863 - 1s/epoch - 980us/step
Epoch 475/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9859 - 1s/epoch - 963us/step
Epoch 476/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9862 - 1s/epoch - 975us/step
Epoch 477/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9860 - 1s/epoch - 958us/step
Epoch 478/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9865 - 1s/epoch - 976us/step
Epoch 479/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9865 - 1s/epoch - 954us/step
Epoch 480/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9863 - 1s/epoch - 968us/step
Epoch 481/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9862 - 1s/epoch - 959us/step
Epoch 482/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9863 - 1s/epoch - 980us/step
Epoch 483/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9864 - 1s/epoch - 964us/step
Epoch 484/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9867 - 1s/epoch - 973us/step
Epoch 485/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9865 - 1s/epoch - 959us/step
Epoch 486/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9860 - 1s/epoch - 979us/step
Epoch 487/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9864 - 1s/epoch - 960us/step
Epoch 488/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 978us/step
Epoch 489/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9868 - 1s/epoch - 961us/step
Epoch 490/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9863 - 1s/epoch - 982us/step
Epoch 491/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9862 - 1s/epoch - 963us/step
Epoch 492/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9867 - 1s/epoch - 984us/step
Epoch 493/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9864 - 1s/epoch - 964us/step
Epoch 494/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9861 - 1s/epoch - 982us/step
Epoch 495/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9864 - 1s/epoch - 963us/step
Epoch 496/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9862 - 1s/epoch - 984us/step
Epoch 497/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9863 - 1s/epoch - 964us/step
Epoch 498/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9862 - 1s/epoch - 993us/step
Epoch 499/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9864 - 1s/epoch - 964us/step
Epoch 500/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9865 - 1s/epoch - 987us/step
Epoch 501/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9865 - 1s/epoch - 971us/step
Epoch 502/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9864 - 1s/epoch - 980us/step
Epoch 503/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9866 - 1s/epoch - 961us/step
Epoch 504/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9867 - 1s/epoch - 982us/step
Epoch 505/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9864 - 1s/epoch - 963us/step
Epoch 506/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9868 - 1s/epoch - 986us/step
Epoch 507/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9867 - 1s/epoch - 971us/step
Epoch 508/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9866 - 1s/epoch - 981us/step
```

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Epoch 509/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9866 - 1s/epoch - 964us/step
Epoch 510/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9866 - 1s/epoch - 981us/step
Epoch 511/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9862 - 1s/epoch - 962us/step
Epoch 512/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9869 - 1s/epoch - 979us/step
Epoch 513/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9864 - 1s/epoch - 961us/step
Epoch 514/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9858 - 1s/epoch - 981us/step
Epoch 515/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9867 - 1s/epoch - 960us/step
Epoch 516/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9863 - 1s/epoch - 985us/step
Epoch 517/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9862 - 1s/epoch - 960us/step
Epoch 518/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9870 - 1s/epoch - 983us/step
Epoch 519/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9863 - 1s/epoch - 964us/step
Epoch 520/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9866 - 1s/epoch - 982us/step
Epoch 521/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9867 - 1s/epoch - 958us/step
Epoch 522/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9866 - 1s/epoch - 978us/step
Epoch 523/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9860 - 1s/epoch - 959us/step
Epoch 524/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9866 - 1s/epoch - 982us/step
Epoch 525/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 959us/step
Epoch 526/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9865 - 1s/epoch - 978us/step
Epoch 527/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9866 - 1s/epoch - 966us/step
Epoch 528/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9869 - 1s/epoch - 982us/step
Epoch 529/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9867 - 1s/epoch - 962us/step
Epoch 530/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9863 - 1s/epoch - 985us/step
Epoch 531/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9867 - 1s/epoch - 962us/step
Epoch 532/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9865 - 1s/epoch - 987us/step
Epoch 533/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9871 - 1s/epoch - 967us/step
Epoch 534/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9863 - 1s/epoch - 983us/step
Epoch 535/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9865 - 1s/epoch - 960us/step
Epoch 536/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9865 - 1s/epoch - 986us/step
Epoch 537/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9871 - 1s/epoch - 963us/step
Epoch 538/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9867 - 1s/epoch - 980us/step
Epoch 539/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9866 - 1s/epoch - 960us/step
Epoch 540/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9866 - 1s/epoch - 986us/step
Epoch 541/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9870 - 1s/epoch - 961us/step
Epoch 542/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9865 - 1s/epoch - 984us/step
Epoch 543/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9867 - 1s/epoch - 963us/step
Epoch 544/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9872 - 1s/epoch - 984us/step
Epoch 545/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9867 - 1s/epoch - 963us/step
Epoch 546/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9869 - 1s/epoch - 984us/step
Epoch 547/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9866 - 1s/epoch - 959us/step
Epoch 548/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9864 - 1s/epoch - 979us/step
Epoch 549/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9868 - 1s/epoch - 980us/step
Epoch 550/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9869 - 1s/epoch - 984us/step
Epoch 551/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9868 - 1s/epoch - 960us/step
Epoch 552/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 980us/step
Epoch 553/600
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1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9870 - 1s/epoch - 961us/step
Epoch 554/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9867 - 1s/epoch - 971us/step
Epoch 555/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9869 - 1s/epoch - 968us/step
Epoch 556/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9864 - 1s/epoch - 985us/step
Epoch 557/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9872 - 1s/epoch - 962us/step
Epoch 558/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 973us/step
Epoch 559/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9866 - 1s/epoch - 962us/step
Epoch 560/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9865 - 1s/epoch - 982us/step
Epoch 561/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9868 - 1s/epoch - 962us/step
Epoch 562/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9871 - 1s/epoch - 982us/step
Epoch 563/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9866 - 1s/epoch - 963us/step
Epoch 564/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9870 - 1s/epoch - 985us/step
Epoch 565/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9869 - 1s/epoch - 965us/step
Epoch 566/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 972us/step
Epoch 567/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9870 - 1s/epoch - 959us/step
Epoch 568/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9866 - 1s/epoch - 979us/step
Epoch 569/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 570/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9872 - 1s/epoch - 988us/step
Epoch 571/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 970us/step
Epoch 572/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9868 - 1s/epoch - 984us/step
Epoch 573/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9873 - 1s/epoch - 968us/step
Epoch 574/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9872 - 1s/epoch - 981us/step
Epoch 575/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9867 - 1s/epoch - 964us/step
Epoch 576/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9872 - 1s/epoch - 981us/step
Epoch 577/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9868 - 1s/epoch - 967us/step
Epoch 578/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 985us/step
Epoch 579/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9865 - 1s/epoch - 961us/step
Epoch 580/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9870 - 1s/epoch - 981us/step
Epoch 581/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9868 - 1s/epoch - 964us/step
Epoch 582/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9868 - 1s/epoch - 987us/step
Epoch 583/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9873 - 1s/epoch - 960us/step
Epoch 584/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 963us/step
Epoch 585/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 984us/step
Epoch 586/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9873 - 1s/epoch - 984us/step
Epoch 587/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9870 - 1s/epoch - 963us/step
Epoch 588/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9870 - 1s/epoch - 975us/step
Epoch 589/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9871 - 1s/epoch - 963us/step
Epoch 590/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9867 - 1s/epoch - 979us/step
Epoch 591/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 965us/step
Epoch 592/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9868 - 1s/epoch - 984us/step
Epoch 593/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9868 - 1s/epoch - 962us/step
Epoch 594/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9873 - 1s/epoch - 981us/step
Epoch 595/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9870 - 1s/epoch - 963us/step
Epoch 596/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9872 - 1s/epoch - 983us/step
Epoch 597/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9870 - 1s/epoch - 971us/step
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Epoch 598/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9875 - 1s/epoch - 997us/step
Epoch 599/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 964us/step
Epoch 600/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9872 - 1s/epoch - 982us/step
990/990 [==============================] - 1s 660us/step
Epoch 1/600
1268/1268 - 2s - loss: 0.3680 - accuracy: 0.8315 - 2s/epoch - 1ms/step
Epoch 2/600
1268/1268 - 1s - loss: 0.2239 - accuracy: 0.9107 - 1s/epoch - 969us/step
Epoch 3/600
1268/1268 - 1s - loss: 0.1842 - accuracy: 0.9295 - 1s/epoch - 969us/step
Epoch 4/600
1268/1268 - 1s - loss: 0.1631 - accuracy: 0.9390 - 1s/epoch - 983us/step
Epoch 5/600
1268/1268 - 1s - loss: 0.1496 - accuracy: 0.9451 - 1s/epoch - 968us/step
Epoch 6/600
1268/1268 - 1s - loss: 0.1402 - accuracy: 0.9502 - 1s/epoch - 978us/step
Epoch 7/600
1268/1268 - 1s - loss: 0.1327 - accuracy: 0.9537 - 1s/epoch - 968us/step
Epoch 8/600
1268/1268 - 1s - loss: 0.1280 - accuracy: 0.9555 - 1s/epoch - 966us/step
Epoch 9/600
1268/1268 - 1s - loss: 0.1218 - accuracy: 0.9578 - 1s/epoch - 979us/step
Epoch 10/600
1268/1268 - 1s - loss: 0.1179 - accuracy: 0.9595 - 1s/epoch - 987us/step
Epoch 11/600
1268/1268 - 1s - loss: 0.1151 - accuracy: 0.9612 - 1s/epoch - 967us/step
Epoch 12/600
1268/1268 - 1s - loss: 0.1115 - accuracy: 0.9620 - 1s/epoch - 981us/step
Epoch 13/600
1268/1268 - 1s - loss: 0.1087 - accuracy: 0.9636 - 1s/epoch - 966us/step
Epoch 14/600
1268/1268 - 1s - loss: 0.1058 - accuracy: 0.9645 - 1s/epoch - 985us/step
Epoch 15/600
1268/1268 - 1s - loss: 0.1038 - accuracy: 0.9661 - 1s/epoch - 968us/step
Epoch 16/600
1268/1268 - 1s - loss: 0.1016 - accuracy: 0.9667 - 1s/epoch - 982us/step
Epoch 17/600
1268/1268 - 1s - loss: 0.0998 - accuracy: 0.9673 - 1s/epoch - 967us/step
Epoch 18/600
1268/1268 - 1s - loss: 0.0985 - accuracy: 0.9676 - 1s/epoch - 982us/step
Epoch 19/600
1268/1268 - 1s - loss: 0.0969 - accuracy: 0.9687 - 1s/epoch - 966us/step
Epoch 20/600
1268/1268 - 1s - loss: 0.0952 - accuracy: 0.9688 - 1s/epoch - 986us/step
Epoch 21/600
1268/1268 - 1s - loss: 0.0948 - accuracy: 0.9690 - 1s/epoch - 965us/step
Epoch 22/600
1268/1268 - 1s - loss: 0.0926 - accuracy: 0.9701 - 1s/epoch - 985us/step
Epoch 23/600
1268/1268 - 1s - loss: 0.0918 - accuracy: 0.9702 - 1s/epoch - 968us/step
Epoch 24/600
1268/1268 - 1s - loss: 0.0904 - accuracy: 0.9711 - 1s/epoch - 987us/step
Epoch 25/600
1268/1268 - 1s - loss: 0.0903 - accuracy: 0.9710 - 1s/epoch - 968us/step
Epoch 26/600
1268/1268 - 1s - loss: 0.0887 - accuracy: 0.9712 - 1s/epoch - 982us/step
Epoch 27/600
1268/1268 - 1s - loss: 0.0875 - accuracy: 0.9720 - 1s/epoch - 971us/step
Epoch 28/600
1268/1268 - 1s - loss: 0.0877 - accuracy: 0.9719 - 1s/epoch - 984us/step
Epoch 29/600
1268/1268 - 1s - loss: 0.0861 - accuracy: 0.9726 - 1s/epoch - 971us/step
Epoch 30/600
1268/1268 - 1s - loss: 0.0861 - accuracy: 0.9723 - 1s/epoch - 983us/step
Epoch 31/600
1268/1268 - 1s - loss: 0.0851 - accuracy: 0.9728 - 1s/epoch - 971us/step
Epoch 32/600
1268/1268 - 1s - loss: 0.0843 - accuracy: 0.9731 - 1s/epoch - 989us/step
Epoch 33/600
1268/1268 - 1s - loss: 0.0839 - accuracy: 0.9737 - 1s/epoch - 968us/step
Epoch 34/600
1268/1268 - 1s - loss: 0.0829 - accuracy: 0.9740 - 1s/epoch - 976us/step
Epoch 35/600
1268/1268 - 1s - loss: 0.0822 - accuracy: 0.9739 - 1s/epoch - 969us/step
Epoch 36/600
1268/1268 - 1s - loss: 0.0817 - accuracy: 0.9739 - 1s/epoch - 985us/step
Epoch 37/600
1268/1268 - 1s - loss: 0.0808 - accuracy: 0.9745 - 1s/epoch - 968us/step
Epoch 38/600
1268/1268 - 1s - loss: 0.0807 - accuracy: 0.9743 - 1s/epoch - 985us/step
Epoch 39/600
1268/1268 - 1s - loss: 0.0797 - accuracy: 0.9749 - 1s/epoch - 965us/step
Epoch 40/600
1268/1268 - 1s - loss: 0.0797 - accuracy: 0.9748 - 1s/epoch - 983us/step
Epoch 41/600
1268/1268 - 1s - loss: 0.0793 - accuracy: 0.9750 - 1s/epoch - 967us/step
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Epoch 42/600
1268/1268 - 1s - loss: 0.0785 - accuracy: 0.9751 - 1s/epoch - 984us/step
Epoch 43/600
1268/1268 - 1s - loss: 0.0779 - accuracy: 0.9756 - 1s/epoch - 972us/step
Epoch 44/600
1268/1268 - 1s - loss: 0.0776 - accuracy: 0.9756 - 1s/epoch - 982us/step
Epoch 45/600
1268/1268 - 1s - loss: 0.0775 - accuracy: 0.9753 - 1s/epoch - 982us/step
Epoch 46/600
1268/1268 - 1s - loss: 0.0770 - accuracy: 0.9760 - 1s/epoch - 987us/step
Epoch 47/600
1268/1268 - 1s - loss: 0.0762 - accuracy: 0.9762 - 1s/epoch - 968us/step
Epoch 48/600
1268/1268 - 1s - loss: 0.0757 - accuracy: 0.9761 - 1s/epoch - 984us/step
Epoch 49/600
1268/1268 - 1s - loss: 0.0754 - accuracy: 0.9762 - 1s/epoch - 969us/step
Epoch 50/600
1268/1268 - 1s - loss: 0.0748 - accuracy: 0.9766 - 1s/epoch - 979us/step
Epoch 51/600
1268/1268 - 1s - loss: 0.0745 - accuracy: 0.9763 - 1s/epoch - 971us/step
Epoch 52/600
1268/1268 - 1s - loss: 0.0739 - accuracy: 0.9768 - 1s/epoch - 995us/step
Epoch 53/600
1268/1268 - 1s - loss: 0.0742 - accuracy: 0.9763 - 1s/epoch - 970us/step
Epoch 54/600
1268/1268 - 1s - loss: 0.0737 - accuracy: 0.9767 - 1s/epoch - 996us/step
Epoch 55/600
1268/1268 - 1s - loss: 0.0732 - accuracy: 0.9768 - 1s/epoch - 967us/step
Epoch 56/600
1268/1268 - 1s - loss: 0.0723 - accuracy: 0.9774 - 1s/epoch - 983us/step
Epoch 57/600
1268/1268 - 1s - loss: 0.0721 - accuracy: 0.9772 - 1s/epoch - 969us/step
Epoch 58/600
1268/1268 - 1s - loss: 0.0723 - accuracy: 0.9771 - 1s/epoch - 990us/step
Epoch 59/600
1268/1268 - 1s - loss: 0.0717 - accuracy: 0.9774 - 1s/epoch - 974us/step
Epoch 60/600
1268/1268 - 1s - loss: 0.0715 - accuracy: 0.9772 - 1s/epoch - 987us/step
Epoch 61/600
1268/1268 - 1s - loss: 0.0714 - accuracy: 0.9775 - 1s/epoch - 968us/step
Epoch 62/600
1268/1268 - 1s - loss: 0.0703 - accuracy: 0.9776 - 1s/epoch - 981us/step
Epoch 63/600
1268/1268 - 1s - loss: 0.0704 - accuracy: 0.9777 - 1s/epoch - 973us/step
Epoch 64/600
1268/1268 - 1s - loss: 0.0697 - accuracy: 0.9781 - 1s/epoch - 990us/step
Epoch 65/600
1268/1268 - 1s - loss: 0.0701 - accuracy: 0.9775 - 1s/epoch - 968us/step
Epoch 66/600
1268/1268 - 1s - loss: 0.0695 - accuracy: 0.9775 - 1s/epoch - 984us/step
Epoch 67/600
1268/1268 - 1s - loss: 0.0688 - accuracy: 0.9787 - 1s/epoch - 968us/step
Epoch 68/600
1268/1268 - 1s - loss: 0.0684 - accuracy: 0.9784 - 1s/epoch - 989us/step
Epoch 69/600
1268/1268 - 1s - loss: 0.0683 - accuracy: 0.9784 - 1s/epoch - 971us/step
Epoch 70/600
1268/1268 - 1s - loss: 0.0679 - accuracy: 0.9785 - 1s/epoch - 968us/step
Epoch 71/600
1268/1268 - 1s - loss: 0.0678 - accuracy: 0.9786 - 1s/epoch - 984us/step
Epoch 72/600
1268/1268 - 1s - loss: 0.0676 - accuracy: 0.9788 - 1s/epoch - 985us/step
Epoch 73/600
1268/1268 - 1s - loss: 0.0675 - accuracy: 0.9786 - 1s/epoch - 968us/step
Epoch 74/600
1268/1268 - 1s - loss: 0.0671 - accuracy: 0.9789 - 1s/epoch - 966us/step
Epoch 75/600
1268/1268 - 1s - loss: 0.0671 - accuracy: 0.9786 - 1s/epoch - 992us/step
Epoch 76/600
1268/1268 - 1s - loss: 0.0665 - accuracy: 0.9788 - 1s/epoch - 987us/step
Epoch 77/600
1268/1268 - 1s - loss: 0.0663 - accuracy: 0.9788 - 1s/epoch - 967us/step
Epoch 78/600
1268/1268 - 1s - loss: 0.0658 - accuracy: 0.9787 - 1s/epoch - 984us/step
Epoch 79/600
1268/1268 - 1s - loss: 0.0663 - accuracy: 0.9793 - 1s/epoch - 984us/step
Epoch 80/600
1268/1268 - 1s - loss: 0.0654 - accuracy: 0.9790 - 1s/epoch - 967us/step
Epoch 81/600
1268/1268 - 1s - loss: 0.0649 - accuracy: 0.9798 - 1s/epoch - 989us/step
Epoch 82/600
1268/1268 - 1s - loss: 0.0646 - accuracy: 0.9792 - 1s/epoch - 982us/step
Epoch 83/600
1268/1268 - 1s - loss: 0.0649 - accuracy: 0.9792 - 1s/epoch - 969us/step
Epoch 84/600
1268/1268 - 1s - loss: 0.0644 - accuracy: 0.9794 - 1s/epoch - 972us/step
Epoch 85/600
1268/1268 - 1s - loss: 0.0639 - accuracy: 0.9796 - 1s/epoch - 984us/step
Epoch 86/600
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1268/1268 - 1s - loss: 0.0638 - accuracy: 0.9798 - 1s/epoch - 981us/step
Epoch 87/600
1268/1268 - 1s - loss: 0.0642 - accuracy: 0.9793 - 1s/epoch - 968us/step
Epoch 88/600
1268/1268 - 1s - loss: 0.0633 - accuracy: 0.9795 - 1s/epoch - 988us/step
Epoch 89/600
1268/1268 - 1s - loss: 0.0630 - accuracy: 0.9802 - 1s/epoch - 968us/step
Epoch 90/600
1268/1268 - 1s - loss: 0.0639 - accuracy: 0.9794 - 1s/epoch - 985us/step
Epoch 91/600
1268/1268 - 1s - loss: 0.0626 - accuracy: 0.9803 - 1s/epoch - 970us/step
Epoch 92/600
1268/1268 - 1s - loss: 0.0627 - accuracy: 0.9800 - 1s/epoch - 969us/step
Epoch 93/600
1268/1268 - 1s - loss: 0.0623 - accuracy: 0.9802 - 1s/epoch - 990us/step
Epoch 94/600
1268/1268 - 1s - loss: 0.0624 - accuracy: 0.9801 - 1s/epoch - 995us/step
Epoch 95/600
1268/1268 - 1s - loss: 0.0620 - accuracy: 0.9805 - 1s/epoch - 965us/step
Epoch 96/600
1268/1268 - 1s - loss: 0.0620 - accuracy: 0.9797 - 1s/epoch - 983us/step
Epoch 97/600
1268/1268 - 1s - loss: 0.0621 - accuracy: 0.9802 - 1s/epoch - 967us/step
Epoch 98/600
1268/1268 - 1s - loss: 0.0615 - accuracy: 0.9805 - 1s/epoch - 980us/step
Epoch 99/600
1268/1268 - 1s - loss: 0.0619 - accuracy: 0.9803 - 1s/epoch - 965us/step
Epoch 100/600
1268/1268 - 1s - loss: 0.0609 - accuracy: 0.9808 - 1s/epoch - 980us/step
Epoch 101/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9804 - 1s/epoch - 967us/step
Epoch 102/600
1268/1268 - 1s - loss: 0.0606 - accuracy: 0.9810 - 1s/epoch - 985us/step
Epoch 103/600
1268/1268 - 1s - loss: 0.0606 - accuracy: 0.9806 - 1s/epoch - 976us/step
Epoch 104/600
1268/1268 - 1s - loss: 0.0605 - accuracy: 0.9805 - 1s/epoch - 964us/step
Epoch 105/600
1268/1268 - 1s - loss: 0.0607 - accuracy: 0.9808 - 1s/epoch - 974us/step
Epoch 106/600
1268/1268 - 1s - loss: 0.0600 - accuracy: 0.9808 - 1s/epoch - 969us/step
Epoch 107/600
1268/1268 - 1s - loss: 0.0599 - accuracy: 0.9808 - 1s/epoch - 984us/step
Epoch 108/600
1268/1268 - 1s - loss: 0.0596 - accuracy: 0.9815 - 1s/epoch - 962us/step
Epoch 109/600
1268/1268 - 1s - loss: 0.0598 - accuracy: 0.9810 - 1s/epoch - 980us/step
Epoch 110/600
1268/1268 - 1s - loss: 0.0596 - accuracy: 0.9811 - 1s/epoch - 966us/step
Epoch 111/600
1268/1268 - 1s - loss: 0.0590 - accuracy: 0.9812 - 1s/epoch - 980us/step
Epoch 112/600
1268/1268 - 1s - loss: 0.0598 - accuracy: 0.9811 - 1s/epoch - 962us/step
Epoch 113/600
1268/1268 - 1s - loss: 0.0583 - accuracy: 0.9815 - 1s/epoch - 983us/step
Epoch 114/600
1268/1268 - 1s - loss: 0.0587 - accuracy: 0.9815 - 1s/epoch - 964us/step
Epoch 115/600
1268/1268 - 1s - loss: 0.0588 - accuracy: 0.9812 - 1s/epoch - 985us/step
Epoch 116/600
1268/1268 - 1s - loss: 0.0584 - accuracy: 0.9814 - 1s/epoch - 964us/step
Epoch 117/600
1268/1268 - 1s - loss: 0.0583 - accuracy: 0.9813 - 1s/epoch - 966us/step
Epoch 118/600
1268/1268 - 1s - loss: 0.0577 - accuracy: 0.9818 - 1s/epoch - 982us/step
Epoch 119/600
1268/1268 - 1s - loss: 0.0583 - accuracy: 0.9813 - 1s/epoch - 984us/step
Epoch 120/600
1268/1268 - 1s - loss: 0.0575 - accuracy: 0.9815 - 1s/epoch - 963us/step
Epoch 121/600
1268/1268 - 1s - loss: 0.0580 - accuracy: 0.9815 - 1s/epoch - 987us/step
Epoch 122/600
1268/1268 - 1s - loss: 0.0569 - accuracy: 0.9819 - 1s/epoch - 964us/step
Epoch 123/600
1268/1268 - 1s - loss: 0.0575 - accuracy: 0.9816 - 1s/epoch - 967us/step
Epoch 124/600
1268/1268 - 1s - loss: 0.0571 - accuracy: 0.9816 - 1s/epoch - 989us/step
Epoch 125/600
1268/1268 - 1s - loss: 0.0564 - accuracy: 0.9823 - 1s/epoch - 976us/step
Epoch 126/600
1268/1268 - 1s - loss: 0.0566 - accuracy: 0.9819 - 1s/epoch - 988us/step
Epoch 127/600
1268/1268 - 1s - loss: 0.0569 - accuracy: 0.9814 - 1s/epoch - 969us/step
Epoch 128/600
1268/1268 - 1s - loss: 0.0564 - accuracy: 0.9819 - 1s/epoch - 974us/step
Epoch 129/600
1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9823 - 1s/epoch - 988us/step
Epoch 130/600
1268/1268 - 1s - loss: 0.0570 - accuracy: 0.9815 - 1s/epoch - 993us/step
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Epoch 131/600
1268/1268 - 1s - loss: 0.0560 - accuracy: 0.9822 - 1s/epoch - 969us/step
Epoch 132/600
1268/1268 - 1s - loss: 0.0564 - accuracy: 0.9821 - 1s/epoch - 993us/step
Epoch 133/600
1268/1268 - 1s - loss: 0.0561 - accuracy: 0.9819 - 1s/epoch - 969us/step
Epoch 134/600
1268/1268 - 1s - loss: 0.0557 - accuracy: 0.9821 - 1s/epoch - 983us/step
Epoch 135/600
1268/1268 - 1s - loss: 0.0555 - accuracy: 0.9824 - 1s/epoch - 970us/step
Epoch 136/600
1268/1268 - 1s - loss: 0.0555 - accuracy: 0.9821 - 1s/epoch - 969us/step
Epoch 137/600
1268/1268 - 1s - loss: 0.0552 - accuracy: 0.9827 - 1s/epoch - 988us/step
Epoch 138/600
1268/1268 - 1s - loss: 0.0555 - accuracy: 0.9824 - 1s/epoch - 987us/step
Epoch 139/600
1268/1268 - 1s - loss: 0.0548 - accuracy: 0.9826 - 1s/epoch - 968us/step
Epoch 140/600
1268/1268 - 1s - loss: 0.0551 - accuracy: 0.9826 - 1s/epoch - 989us/step
Epoch 141/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9826 - 1s/epoch - 975us/step
Epoch 142/600
1268/1268 - 1s - loss: 0.0551 - accuracy: 0.9827 - 1s/epoch - 996us/step
Epoch 143/600
1268/1268 - 1s - loss: 0.0545 - accuracy: 0.9827 - 1s/epoch - 984us/step
Epoch 144/600
1268/1268 - 1s - loss: 0.0549 - accuracy: 0.9827 - 1s/epoch - 992us/step
Epoch 145/600
1268/1268 - 1s - loss: 0.0546 - accuracy: 0.9825 - 1s/epoch - 976us/step
Epoch 146/600
1268/1268 - 1s - loss: 0.0543 - accuracy: 0.9823 - 1s/epoch - 970us/step
Epoch 147/600
1268/1268 - 1s - loss: 0.0540 - accuracy: 0.9830 - 1s/epoch - 993us/step
Epoch 148/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9829 - 1s/epoch - 988us/step
Epoch 149/600
1268/1268 - 1s - loss: 0.0540 - accuracy: 0.9826 - 1s/epoch - 972us/step
Epoch 150/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9827 - 1s/epoch - 993us/step
Epoch 151/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9832 - 1s/epoch - 972us/step
Epoch 152/600
1268/1268 - 1s - loss: 0.0536 - accuracy: 0.9827 - 1s/epoch - 972us/step
Epoch 153/600
1268/1268 - 1s - loss: 0.0534 - accuracy: 0.9829 - 1s/epoch - 991us/step
Epoch 154/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9832 - 1s/epoch - 989us/step
Epoch 155/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9829 - 1s/epoch - 969us/step
Epoch 156/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9827 - 1s/epoch - 990us/step
Epoch 157/600
1268/1268 - 1s - loss: 0.0531 - accuracy: 0.9833 - 1s/epoch - 972us/step
Epoch 158/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9827 - 1s/epoch - 969us/step
Epoch 159/600
1268/1268 - 1s - loss: 0.0528 - accuracy: 0.9829 - 1s/epoch - 992us/step
Epoch 160/600
1268/1268 - 1s - loss: 0.0527 - accuracy: 0.9829 - 1s/epoch - 991us/step
Epoch 161/600
1268/1268 - 1s - loss: 0.0527 - accuracy: 0.9832 - 1s/epoch - 969us/step
Epoch 162/600
1268/1268 - 1s - loss: 0.0521 - accuracy: 0.9833 - 1s/epoch - 991us/step
Epoch 163/600
1268/1268 - 1s - loss: 0.0523 - accuracy: 0.9828 - 1s/epoch - 976us/step
Epoch 164/600
1268/1268 - 1s - loss: 0.0524 - accuracy: 0.9830 - 1s/epoch - 991us/step
Epoch 165/600
1268/1268 - 1s - loss: 0.0522 - accuracy: 0.9831 - 1s/epoch - 969us/step
Epoch 166/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9835 - 1s/epoch - 990us/step
Epoch 167/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9832 - 1s/epoch - 968us/step
Epoch 168/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9835 - 1s/epoch - 983us/step
Epoch 169/600
1268/1268 - 1s - loss: 0.0522 - accuracy: 0.9833 - 1s/epoch - 972us/step
Epoch 170/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9834 - 1s/epoch - 986us/step
Epoch 171/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 172/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9834 - 1s/epoch - 983us/step
Epoch 173/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9836 - 1s/epoch - 980us/step
Epoch 174/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9836 - 1s/epoch - 995us/step
Epoch 175/600
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1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9833 - 1s/epoch - 974us/step
Epoch 176/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9840 - 1s/epoch - 989us/step
Epoch 177/600
1268/1268 - 1s - loss: 0.0509 - accuracy: 0.9836 - 1s/epoch - 968us/step
Epoch 178/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9835 - 1s/epoch - 984us/step
Epoch 179/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9832 - 1s/epoch - 972us/step
Epoch 180/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9839 - 1s/epoch - 989us/step
Epoch 181/600
1268/1268 - 1s - loss: 0.0507 - accuracy: 0.9837 - 1s/epoch - 971us/step
Epoch 182/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9836 - 1s/epoch - 972us/step
Epoch 183/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9833 - 1s/epoch - 987us/step
Epoch 184/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9837 - 1s/epoch - 969us/step
Epoch 185/600
1268/1268 - 1s - loss: 0.0505 - accuracy: 0.9834 - 1s/epoch - 978us/step
Epoch 186/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9839 - 1s/epoch - 980us/step
Epoch 187/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9838 - 1s/epoch - 972us/step
Epoch 188/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9840 - 1s/epoch - 994us/step
Epoch 189/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9836 - 1s/epoch - 971us/step
Epoch 190/600
1268/1268 - 1s - loss: 0.0497 - accuracy: 0.9842 - 1s/epoch - 989us/step
Epoch 191/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9841 - 1s/epoch - 978us/step
Epoch 192/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9839 - 1s/epoch - 993us/step
Epoch 193/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9838 - 1s/epoch - 972us/step
Epoch 194/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9838 - 1s/epoch - 990us/step
Epoch 195/600
1268/1268 - 1s - loss: 0.0496 - accuracy: 0.9842 - 1s/epoch - 968us/step
Epoch 196/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9841 - 1s/epoch - 991us/step
Epoch 197/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9840 - 1s/epoch - 971us/step
Epoch 198/600
1268/1268 - 1s - loss: 0.0491 - accuracy: 0.9839 - 1s/epoch - 987us/step
Epoch 199/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9837 - 1s/epoch - 967us/step
Epoch 200/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9842 - 1s/epoch - 990us/step
Epoch 201/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9842 - 1s/epoch - 974us/step
Epoch 202/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9841 - 1s/epoch - 991us/step
Epoch 203/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9842 - 1s/epoch - 971us/step
Epoch 204/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9843 - 1s/epoch - 991us/step
Epoch 205/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9843 - 1s/epoch - 972us/step
Epoch 206/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9844 - 1s/epoch - 994us/step
Epoch 207/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9841 - 1s/epoch - 972us/step
Epoch 208/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9846 - 1s/epoch - 993us/step
Epoch 209/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9847 - 1s/epoch - 974us/step
Epoch 210/600
1268/1268 - 1s - loss: 0.0488 - accuracy: 0.9842 - 1s/epoch - 988us/step
Epoch 211/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9843 - 1s/epoch - 971us/step
Epoch 212/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9844 - 1s/epoch - 967us/step
Epoch 213/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9846 - 1s/epoch - 987us/step
Epoch 214/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9848 - 1s/epoch - 993us/step
Epoch 215/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9842 - 1s/epoch - 969us/step
Epoch 216/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9845 - 1s/epoch - 988us/step
Epoch 217/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9845 - 1s/epoch - 976us/step
Epoch 218/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9847 - 1s/epoch - 993us/step
Epoch 219/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9843 - 1s/epoch - 970us/step
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Epoch 220/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9846 - 1s/epoch - 973us/step
Epoch 221/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9844 - 1s/epoch - 989us/step
Epoch 222/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9845 - 1s/epoch - 975us/step
Epoch 223/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9844 - 1s/epoch - 987us/step
Epoch 224/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9846 - 1s/epoch - 971us/step
Epoch 225/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9849 - 1s/epoch - 984us/step
Epoch 226/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9847 - 1s/epoch - 971us/step
Epoch 227/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 228/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9850 - 1s/epoch - 971us/step
Epoch 229/600
1268/1268 - 1s - loss: 0.0468 - accuracy: 0.9847 - 1s/epoch - 994us/step
Epoch 230/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9843 - 1s/epoch - 971us/step
Epoch 231/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9849 - 1s/epoch - 988us/step
Epoch 232/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9848 - 1s/epoch - 973us/step
Epoch 233/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9849 - 1s/epoch - 969us/step
Epoch 234/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9852 - 1s/epoch - 989us/step
Epoch 235/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9843 - 1s/epoch - 993us/step
Epoch 236/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9851 - 1s/epoch - 973us/step
Epoch 237/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9852 - 1s/epoch - 992us/step
Epoch 238/600
1268/1268 - 1s - loss: 0.0468 - accuracy: 0.9850 - 1s/epoch - 978us/step
Epoch 239/600
1268/1268 - 1s - loss: 0.0468 - accuracy: 0.9850 - 1s/epoch - 996us/step
Epoch 240/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9846 - 1s/epoch - 973us/step
Epoch 241/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9852 - 1s/epoch - 970us/step
Epoch 242/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9847 - 1s/epoch - 979us/step
Epoch 243/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9845 - 1s/epoch - 988us/step
Epoch 244/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9852 - 1s/epoch - 978us/step
Epoch 245/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9848 - 1s/epoch - 988us/step
Epoch 246/600
1268/1268 - 1s - loss: 0.0460 - accuracy: 0.9851 - 1s/epoch - 972us/step
Epoch 247/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9850 - 1s/epoch - 991us/step
Epoch 248/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9849 - 1s/epoch - 974us/step
Epoch 249/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9849 - 1s/epoch - 995us/step
Epoch 250/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9854 - 1s/epoch - 968us/step
Epoch 251/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9849 - 1s/epoch - 988us/step
Epoch 252/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9850 - 1s/epoch - 974us/step
Epoch 253/600
1268/1268 - 1s - loss: 0.0460 - accuracy: 0.9851 - 1s/epoch - 991us/step
Epoch 254/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9854 - 1s/epoch - 972us/step
Epoch 255/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9852 - 1s/epoch - 989us/step
Epoch 256/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9853 - 1s/epoch - 966us/step
Epoch 257/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9853 - 1s/epoch - 986us/step
Epoch 258/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9850 - 1s/epoch - 969us/step
Epoch 259/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9851 - 1s/epoch - 987us/step
Epoch 260/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9854 - 1s/epoch - 963us/step
Epoch 261/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9853 - 1s/epoch - 988us/step
Epoch 262/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9854 - 1s/epoch - 971us/step
Epoch 263/600
1268/1268 - 1s - loss: 0.0448 - accuracy: 0.9852 - 1s/epoch - 985us/step
Epoch 264/600
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1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9853 - 1s/epoch - 966us/step
Epoch 265/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9855 - 1s/epoch - 965us/step
Epoch 266/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9849 - 1s/epoch - 990us/step
Epoch 267/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9852 - 1s/epoch - 989us/step
Epoch 268/600
1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9849 - 1s/epoch - 972us/step
Epoch 269/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9855 - 1s/epoch - 989us/step
Epoch 270/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9856 - 1s/epoch - 980us/step
Epoch 271/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9853 - 1s/epoch - 985us/step
Epoch 272/600
1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9851 - 1s/epoch - 967us/step
Epoch 273/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9854 - 1s/epoch - 989us/step
Epoch 274/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9851 - 1s/epoch - 973us/step
Epoch 275/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9855 - 1s/epoch - 991us/step
Epoch 276/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9853 - 1s/epoch - 974us/step
Epoch 277/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9857 - 1s/epoch - 994us/step
Epoch 278/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9853 - 1s/epoch - 977us/step
Epoch 279/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9855 - 1s/epoch - 989us/step
Epoch 280/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9857 - 1s/epoch - 971us/step
Epoch 281/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9860 - 1s/epoch - 987us/step
Epoch 282/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9849 - 1s/epoch - 970us/step
Epoch 283/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9856 - 1s/epoch - 991us/step
Epoch 284/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9855 - 1s/epoch - 971us/step
Epoch 285/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9857 - 1s/epoch - 993us/step
Epoch 286/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9858 - 1s/epoch - 975us/step
Epoch 287/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9855 - 1s/epoch - 995us/step
Epoch 288/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9856 - 1s/epoch - 983us/step
Epoch 289/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9851 - 1s/epoch - 973us/step
Epoch 290/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9859 - 1s/epoch - 992us/step
Epoch 291/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9855 - 1s/epoch - 993us/step
Epoch 292/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9859 - 1s/epoch - 969us/step
Epoch 293/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9855 - 1s/epoch - 994us/step
Epoch 294/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9857 - 1s/epoch - 972us/step
Epoch 295/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9860 - 1s/epoch - 993us/step
Epoch 296/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9859 - 1s/epoch - 972us/step
Epoch 297/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9857 - 1s/epoch - 988us/step
Epoch 298/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9858 - 1s/epoch - 979us/step
Epoch 299/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9858 - 1s/epoch - 999us/step
Epoch 300/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9863 - 1s/epoch - 975us/step
Epoch 301/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9857 - 1s/epoch - 995us/step
Epoch 302/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9860 - 1s/epoch - 973us/step
Epoch 303/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9861 - 1s/epoch - 980us/step
Epoch 304/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9858 - 1s/epoch - 972us/step
Epoch 305/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9858 - 1s/epoch - 997us/step
Epoch 306/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9860 - 1s/epoch - 971us/step
Epoch 307/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 977us/step
Epoch 308/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9861 - 1s/epoch - 995us/step
```

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Epoch 309/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9856 - 1s/epoch - 995us/step
Epoch 310/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9863 - 1s/epoch - 973us/step
Epoch 311/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9862 - 1s/epoch - 988us/step
Epoch 312/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9856 - 1s/epoch - 971us/step
Epoch 313/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9861 - 1s/epoch - 995us/step
Epoch 314/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9855 - 1s/epoch - 969us/step
Epoch 315/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9859 - 1s/epoch - 991us/step
Epoch 316/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9858 - 1s/epoch - 975us/step
Epoch 317/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9863 - 1s/epoch - 993us/step
Epoch 318/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9862 - 1s/epoch - 983us/step
Epoch 319/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9856 - 1s/epoch - 969us/step
Epoch 320/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9867 - 1s/epoch - 987us/step
Epoch 321/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9857 - 1s/epoch - 993us/step
Epoch 322/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9861 - 1s/epoch - 976us/step
Epoch 323/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9864 - 1s/epoch - 990us/step
Epoch 324/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9859 - 1s/epoch - 981us/step
Epoch 325/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9862 - 1s/epoch - 991us/step
Epoch 326/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 327/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9861 - 1s/epoch - 989us/step
Epoch 328/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9864 - 1s/epoch - 974us/step
Epoch 329/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9862 - 1s/epoch - 992us/step
Epoch 330/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9864 - 1s/epoch - 974us/step
Epoch 331/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9860 - 1s/epoch - 993us/step
Epoch 332/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9866 - 1s/epoch - 966us/step
Epoch 333/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9854 - 1s/epoch - 990us/step
Epoch 334/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9861 - 1s/epoch - 979us/step
Epoch 335/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9861 - 1s/epoch - 990us/step
Epoch 336/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9862 - 1s/epoch - 975us/step
Epoch 337/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9860 - 1s/epoch - 995us/step
Epoch 338/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9861 - 1s/epoch - 968us/step
Epoch 339/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9865 - 1s/epoch - 984us/step
Epoch 340/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9862 - 1s/epoch - 972us/step
Epoch 341/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9866 - 1s/epoch - 995us/step
Epoch 342/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9859 - 1s/epoch - 977us/step
Epoch 343/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 344/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9864 - 1s/epoch - 970us/step
Epoch 345/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9865 - 1s/epoch - 969us/step
Epoch 346/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9861 - 1s/epoch - 996us/step
Epoch 347/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9859 - 1s/epoch - 992us/step
Epoch 348/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9864 - 1s/epoch - 971us/step
Epoch 349/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9866 - 1s/epoch - 992us/step
Epoch 350/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9863 - 1s/epoch - 973us/step
Epoch 351/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9863 - 1s/epoch - 986us/step
Epoch 352/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9862 - 1s/epoch - 968us/step
Epoch 353/600
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1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9870 - 1s/epoch - 995us/step
Epoch 354/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9869 - 1s/epoch - 976us/step
Epoch 355/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9863 - 1s/epoch - 990us/step
Epoch 356/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9868 - 1s/epoch - 971us/step
Epoch 357/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9863 - 1s/epoch - 986us/step
Epoch 358/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9864 - 1s/epoch - 972us/step
Epoch 359/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9860 - 1s/epoch - 987us/step
Epoch 360/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9866 - 1s/epoch - 976us/step
Epoch 361/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9865 - 1s/epoch - 993us/step
Epoch 362/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 973us/step
Epoch 363/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9866 - 1s/epoch - 994us/step
Epoch 364/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9862 - 1s/epoch - 971us/step
Epoch 365/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9865 - 1s/epoch - 996us/step
Epoch 366/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9866 - 1s/epoch - 974us/step
Epoch 367/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9866 - 1s/epoch - 991us/step
Epoch 368/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9864 - 1s/epoch - 975us/step
Epoch 369/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9866 - 1s/epoch - 993us/step
Epoch 370/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9866 - 1s/epoch - 970us/step
Epoch 371/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9866 - 1s/epoch - 999us/step
Epoch 372/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9865 - 1s/epoch - 976us/step
Epoch 373/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9866 - 1s/epoch - 994us/step
Epoch 374/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9868 - 1s/epoch - 978us/step
Epoch 375/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9866 - 1s/epoch - 994us/step
Epoch 376/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9866 - 1s/epoch - 971us/step
Epoch 377/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9868 - 1s/epoch - 994us/step
Epoch 378/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9867 - 1s/epoch - 973us/step
Epoch 379/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 989us/step
Epoch 380/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9868 - 1s/epoch - 977us/step
Epoch 381/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9869 - 1s/epoch - 970us/step
Epoch 382/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9865 - 1s/epoch - 997us/step
Epoch 383/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9865 - 1s/epoch - 975us/step
Epoch 384/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9865 - 1s/epoch - 993us/step
Epoch 385/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9869 - 1s/epoch - 977us/step
Epoch 386/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9862 - 1s/epoch - 985us/step
Epoch 387/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9866 - 1s/epoch - 971us/step
Epoch 388/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9867 - 1s/epoch - 991us/step
Epoch 389/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9869 - 1s/epoch - 986us/step
Epoch 390/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9869 - 1s/epoch - 975us/step
Epoch 391/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9868 - 1s/epoch - 978us/step
Epoch 392/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9869 - 1s/epoch - 971us/step
Epoch 393/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9866 - 1s/epoch - 972us/step
Epoch 394/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9868 - 1s/epoch - 993us/step
Epoch 395/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9871 - 1s/epoch - 990us/step
Epoch 396/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9869 - 1s/epoch - 970us/step
Epoch 397/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9870 - 1s/epoch - 973us/step
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Epoch 398/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9871 - 1s/epoch - 991us/step
Epoch 399/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9868 - 1s/epoch - 977us/step
Epoch 400/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9868 - 1s/epoch - 992us/step
Epoch 401/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9867 - 1s/epoch - 989us/step
Epoch 402/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9868 - 1s/epoch - 970us/step
Epoch 403/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9872 - 1s/epoch - 975us/step
Epoch 404/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9869 - 1s/epoch - 976us/step
Epoch 405/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9873 - 1s/epoch - 970us/step
Epoch 406/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9867 - 1s/epoch - 989us/step
Epoch 407/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9870 - 1s/epoch - 989us/step
Epoch 408/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9870 - 1s/epoch - 965us/step
Epoch 409/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9867 - 1s/epoch - 969us/step
Epoch 410/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9869 - 1s/epoch - 987us/step
Epoch 411/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9869 - 1s/epoch - 973us/step
Epoch 412/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9864 - 1s/epoch - 989us/step
Epoch 413/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9869 - 1s/epoch - 970us/step
Epoch 414/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9871 - 1s/epoch - 991us/step
Epoch 415/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9868 - 1s/epoch - 990us/step
Epoch 416/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9870 - 1s/epoch - 973us/step
Epoch 417/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9869 - 1s/epoch - 971us/step
Epoch 418/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9869 - 1s/epoch - 990us/step
Epoch 419/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9872 - 1s/epoch - 968us/step
Epoch 420/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9870 - 1s/epoch - 987us/step
Epoch 421/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9867 - 1s/epoch - 991us/step
Epoch 422/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9869 - 1s/epoch - 972us/step
Epoch 423/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9873 - 1s/epoch - 969us/step
Epoch 424/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9868 - 1s/epoch - 987us/step
Epoch 425/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9866 - 1s/epoch - 993us/step
Epoch 426/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9872 - 1s/epoch - 971us/step
Epoch 427/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 972us/step
Epoch 428/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9870 - 1s/epoch - 988us/step
Epoch 429/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 969us/step
Epoch 430/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9870 - 1s/epoch - 991us/step
Epoch 431/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9874 - 1s/epoch - 981us/step
Epoch 432/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9870 - 1s/epoch - 983us/step
Epoch 433/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9870 - 1s/epoch - 999us/step
Epoch 434/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9872 - 1s/epoch - 974us/step
Epoch 435/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9867 - 1s/epoch - 990us/step
Epoch 436/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 971us/step
Epoch 437/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9871 - 1s/epoch - 969us/step
Epoch 438/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9870 - 1s/epoch - 991us/step
Epoch 439/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9872 - 1s/epoch - 987us/step
Epoch 440/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9873 - 1s/epoch - 970us/step
Epoch 441/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9870 - 1s/epoch - 969us/step
Epoch 442/600
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1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9874 - 1s/epoch - 989us/step
Epoch 443/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9874 - 1s/epoch - 991us/step
Epoch 444/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 972us/step
Epoch 445/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9871 - 1s/epoch - 987us/step
Epoch 446/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9870 - 1s/epoch - 973us/step
Epoch 447/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9872 - 1s/epoch - 973us/step
Epoch 448/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9872 - 1s/epoch - 991us/step
Epoch 449/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9873 - 1s/epoch - 989us/step
Epoch 450/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9873 - 1s/epoch - 971us/step
Epoch 451/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9871 - 1s/epoch - 987us/step
Epoch 452/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9870 - 1s/epoch - 974us/step
Epoch 453/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9869 - 1s/epoch - 991us/step
Epoch 454/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9872 - 1s/epoch - 972us/step
Epoch 455/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9872 - 1s/epoch - 993us/step
Epoch 456/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 972us/step
Epoch 457/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9872 - 1s/epoch - 991us/step
Epoch 458/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9873 - 1s/epoch - 969us/step
Epoch 459/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9875 - 1s/epoch - 975us/step
Epoch 460/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9873 - 1s/epoch - 970us/step
Epoch 461/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9872 - 1s/epoch - 992us/step
Epoch 462/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9877 - 1s/epoch - 974us/step
Epoch 463/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9873 - 1s/epoch - 997us/step
Epoch 464/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9873 - 1s/epoch - 976us/step
Epoch 465/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9875 - 1s/epoch - 973us/step
Epoch 466/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9876 - 1s/epoch - 997us/step
Epoch 467/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9869 - 1s/epoch - 991us/step
Epoch 468/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9873 - 1s/epoch - 972us/step
Epoch 469/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9874 - 1s/epoch - 990us/step
Epoch 470/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 471/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 472/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9872 - 1s/epoch - 983us/step
Epoch 473/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9880 - 1s/epoch - 981us/step
Epoch 474/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 475/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9874 - 1s/epoch - 984us/step
Epoch 476/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9874 - 1s/epoch - 974us/step
Epoch 477/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 478/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9879 - 1s/epoch - 978us/step
Epoch 479/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9875 - 1s/epoch - 997us/step
Epoch 480/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9876 - 1s/epoch - 972us/step
Epoch 481/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9876 - 1s/epoch - 997us/step
Epoch 482/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9876 - 1s/epoch - 974us/step
Epoch 483/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9879 - 1s/epoch - 970us/step
Epoch 484/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9873 - 1s/epoch - 991us/step
Epoch 485/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9876 - 1s/epoch - 993us/step
Epoch 486/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9877 - 1s/epoch - 977us/step
```

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Epoch 487/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 488/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9877 - 1s/epoch - 969us/step
Epoch 489/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9878 - 1s/epoch - 986us/step
Epoch 490/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9871 - 1s/epoch - 974us/step
Epoch 491/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9875 - 1s/epoch - 993us/step
Epoch 492/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9875 - 1s/epoch - 974us/step
Epoch 493/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9881 - 1s/epoch - 991us/step
Epoch 494/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9878 - 1s/epoch - 969us/step
Epoch 495/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9879 - 1s/epoch - 971us/step
Epoch 496/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9878 - 1s/epoch - 993us/step
Epoch 497/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9880 - 1s/epoch - 991us/step
Epoch 498/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9875 - 1s/epoch - 969us/step
Epoch 499/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9879 - 1s/epoch - 970us/step
Epoch 500/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9877 - 1s/epoch - 990us/step
Epoch 501/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9870 - 1s/epoch - 991us/step
Epoch 502/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9879 - 1s/epoch - 971us/step
Epoch 503/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9877 - 1s/epoch - 993us/step
Epoch 504/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9880 - 1s/epoch - 973us/step
Epoch 505/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9873 - 1s/epoch - 989us/step
Epoch 506/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9876 - 1s/epoch - 970us/step
Epoch 507/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9880 - 1s/epoch - 993us/step
Epoch 508/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9878 - 1s/epoch - 971us/step
Epoch 509/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9879 - 1s/epoch - 991us/step
Epoch 510/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9877 - 1s/epoch - 977us/step
Epoch 511/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9874 - 1s/epoch - 978us/step
Epoch 512/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9875 - 1s/epoch - 993us/step
Epoch 513/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9878 - 1s/epoch - 979us/step
Epoch 514/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9874 - 1s/epoch - 972us/step
Epoch 515/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9882 - 1s/epoch - 988us/step
Epoch 516/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9878 - 1s/epoch - 974us/step
Epoch 517/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9881 - 1s/epoch - 988us/step
Epoch 518/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9875 - 1s/epoch - 966us/step
Epoch 519/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9876 - 1s/epoch - 970us/step
Epoch 520/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9877 - 1s/epoch - 993us/step
Epoch 521/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9878 - 1s/epoch - 997us/step
Epoch 522/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9879 - 1s/epoch - 969us/step
Epoch 523/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9875 - 1s/epoch - 986us/step
Epoch 524/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9880 - 1s/epoch - 971us/step
Epoch 525/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9876 - 1s/epoch - 993us/step
Epoch 526/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9879 - 1s/epoch - 972us/step
Epoch 527/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9878 - 1s/epoch - 999us/step
Epoch 528/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9876 - 1s/epoch - 969us/step
Epoch 529/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9874 - 1s/epoch - 992us/step
Epoch 530/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9880 - 1s/epoch - 984us/step
Epoch 531/600
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1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9882 - 1s/epoch - 989us/step
Epoch 532/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9880 - 1s/epoch - 970us/step
Epoch 533/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9878 - 1s/epoch - 987us/step
Epoch 534/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9881 - 1s/epoch - 974us/step
Epoch 535/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9876 - 1s/epoch - 997us/step
Epoch 536/600
1268/1268 - 1s - loss: 0.0356 - accuracy: 0.9880 - 1s/epoch - 974us/step
Epoch 537/600
1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9879 - 1s/epoch - 992us/step
Epoch 538/600
1268/1268 - 1s - loss: 0.0356 - accuracy: 0.9876 - 1s/epoch - 973us/step
Epoch 539/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9877 - 1s/epoch - 991us/step
Epoch 540/600
1268/1268 - 1s - loss: 0.0356 - accuracy: 0.9881 - 1s/epoch - 971us/step
Epoch 541/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9882 - 1s/epoch - 986us/step
Epoch 542/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9876 - 1s/epoch - 971us/step
Epoch 543/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9877 - 1s/epoch - 967us/step
Epoch 544/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9878 - 1s/epoch - 993us/step
Epoch 545/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9883 - 1s/epoch - 981us/step
Epoch 546/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9881 - 1s/epoch - 971us/step
Epoch 547/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9878 - 1s/epoch - 994us/step
Epoch 548/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9883 - 1s/epoch - 972us/step
Epoch 549/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9875 - 1s/epoch - 991us/step
Epoch 550/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9879 - 1s/epoch - 972us/step
Epoch 551/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9879 - 1s/epoch - 990us/step
Epoch 552/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9881 - 1s/epoch - 974us/step
Epoch 553/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9881 - 1s/epoch - 990us/step
Epoch 554/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9883 - 1s/epoch - 974us/step
Epoch 555/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9879 - 1s/epoch - 993us/step
Epoch 556/600
1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9879 - 1s/epoch - 970us/step
Epoch 557/600
1268/1268 - 1s - loss: 0.0349 - accuracy: 0.9881 - 1s/epoch - 973us/step
Epoch 558/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9880 - 1s/epoch - 988us/step
Epoch 559/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9880 - 1s/epoch - 970us/step
Epoch 560/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9880 - 1s/epoch - 984us/step
Epoch 561/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9880 - 1s/epoch - 971us/step
Epoch 562/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9879 - 1s/epoch - 995us/step
Epoch 563/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9881 - 1s/epoch - 971us/step
Epoch 564/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9879 - 1s/epoch - 986us/step
Epoch 565/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9879 - 1s/epoch - 970us/step
Epoch 566/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9879 - 1s/epoch - 994us/step
Epoch 567/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9881 - 1s/epoch - 972us/step
Epoch 568/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9881 - 1s/epoch - 995us/step
Epoch 569/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9883 - 1s/epoch - 973us/step
Epoch 570/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9882 - 1s/epoch - 991us/step
Epoch 571/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9879 - 1s/epoch - 969us/step
Epoch 572/600
1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9878 - 1s/epoch - 980us/step
Epoch 573/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9880 - 1s/epoch - 971us/step
Epoch 574/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9878 - 1s/epoch - 971us/step
Epoch 575/600
1268/1268 - 1s - loss: 0.0347 - accuracy: 0.9882 - 1s/epoch - 993us/step
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Epoch 576/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9881 - 1s/epoch - 997us/step
Epoch 577/600
1268/1268 - 1s - loss: 0.0346 - accuracy: 0.9886 - 1s/epoch - 974us/step
Epoch 578/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 579/600
1268/1268 - 1s - loss: 0.0347 - accuracy: 0.9882 - 1s/epoch - 973us/step
Epoch 580/600
1268/1268 - 1s - loss: 0.0346 - accuracy: 0.9886 - 1s/epoch - 971us/step
Epoch 581/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9883 - 1s/epoch - 990us/step
Epoch 582/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9881 - 1s/epoch - 973us/step
Epoch 583/600
1268/1268 - 1s - loss: 0.0348 - accuracy: 0.9881 - 1s/epoch - 990us/step
Epoch 584/600
1268/1268 - 1s - loss: 0.0344 - accuracy: 0.9884 - 1s/epoch - 993us/step
Epoch 585/600
1268/1268 - 1s - loss: 0.0348 - accuracy: 0.9881 - 1s/epoch - 991us/step
Epoch 586/600
1268/1268 - 1s - loss: 0.0344 - accuracy: 0.9885 - 1s/epoch - 974us/step
Epoch 587/600
1268/1268 - 1s - loss: 0.0349 - accuracy: 0.9879 - 1s/epoch - 993us/step
Epoch 588/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9880 - 1s/epoch - 971us/step
Epoch 589/600
1268/1268 - 1s - loss: 0.0345 - accuracy: 0.9883 - 1s/epoch - 976us/step
Epoch 590/600
1268/1268 - 1s - loss: 0.0345 - accuracy: 0.9882 - 1s/epoch - 986us/step
Epoch 591/600
1268/1268 - 1s - loss: 0.0348 - accuracy: 0.9882 - 1s/epoch - 994us/step
Epoch 592/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9879 - 1s/epoch - 971us/step
Epoch 593/600
1268/1268 - 1s - loss: 0.0343 - accuracy: 0.9882 - 1s/epoch - 992us/step
Epoch 594/600
1268/1268 - 1s - loss: 0.0344 - accuracy: 0.9884 - 1s/epoch - 976us/step
Epoch 595/600
1268/1268 - 1s - loss: 0.0347 - accuracy: 0.9882 - 1s/epoch - 984us/step
Epoch 596/600
1268/1268 - 1s - loss: 0.0349 - accuracy: 0.9884 - 1s/epoch - 986us/step
Epoch 597/600
1268/1268 - 1s - loss: 0.0341 - accuracy: 0.9883 - 1s/epoch - 988us/step
Epoch 598/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9880 - 1s/epoch - 971us/step
Epoch 599/600
1268/1268 - 1s - loss: 0.0347 - accuracy: 0.9882 - 1s/epoch - 989us/step
Epoch 600/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9878 - 1s/epoch - 973us/step
990/990 [==============================] - 1s 667us/step
Epoch 1/600
1268/1268 - 2s - loss: 0.3698 - accuracy: 0.8299 - 2s/epoch - 1ms/step
Epoch 2/600
1268/1268 - 1s - loss: 0.2342 - accuracy: 0.9061 - 1s/epoch - 967us/step
Epoch 3/600
1268/1268 - 1s - loss: 0.1943 - accuracy: 0.9242 - 1s/epoch - 1ms/step
Epoch 4/600
1268/1268 - 1s - loss: 0.1719 - accuracy: 0.9358 - 1s/epoch - 969us/step
Epoch 5/600
1268/1268 - 1s - loss: 0.1563 - accuracy: 0.9425 - 1s/epoch - 986us/step
Epoch 6/600
1268/1268 - 1s - loss: 0.1455 - accuracy: 0.9477 - 1s/epoch - 969us/step
Epoch 7/600
1268/1268 - 1s - loss: 0.1372 - accuracy: 0.9514 - 1s/epoch - 976us/step
Epoch 8/600
1268/1268 - 1s - loss: 0.1303 - accuracy: 0.9551 - 1s/epoch - 991us/step
Epoch 9/600
1268/1268 - 1s - loss: 0.1259 - accuracy: 0.9567 - 1s/epoch - 971us/step
Epoch 10/600
1268/1268 - 1s - loss: 0.1205 - accuracy: 0.9592 - 1s/epoch - 977us/step
Epoch 11/600
1268/1268 - 1s - loss: 0.1174 - accuracy: 0.9602 - 1s/epoch - 972us/step
Epoch 12/600
1268/1268 - 1s - loss: 0.1140 - accuracy: 0.9617 - 1s/epoch - 988us/step
Epoch 13/600
1268/1268 - 1s - loss: 0.1112 - accuracy: 0.9630 - 1s/epoch - 991us/step
Epoch 14/600
1268/1268 - 1s - loss: 0.1096 - accuracy: 0.9637 - 1s/epoch - 970us/step
Epoch 15/600
1268/1268 - 1s - loss: 0.1072 - accuracy: 0.9645 - 1s/epoch - 988us/step
Epoch 16/600
1268/1268 - 1s - loss: 0.1048 - accuracy: 0.9657 - 1s/epoch - 970us/step
Epoch 17/600
1268/1268 - 1s - loss: 0.1032 - accuracy: 0.9660 - 1s/epoch - 986us/step
Epoch 18/600
1268/1268 - 1s - loss: 0.1016 - accuracy: 0.9668 - 1s/epoch - 965us/step
Epoch 19/600
1268/1268 - 1s - loss: 0.1007 - accuracy: 0.9668 - 1s/epoch - 991us/step
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Epoch 20/600
1268/1268 - 1s - loss: 0.0985 - accuracy: 0.9674 - 1s/epoch - 967us/step
Epoch 21/600
1268/1268 - 1s - loss: 0.0973 - accuracy: 0.9684 - 1s/epoch - 992us/step
Epoch 22/600
1268/1268 - 1s - loss: 0.0958 - accuracy: 0.9691 - 1s/epoch - 974us/step
Epoch 23/600
1268/1268 - 1s - loss: 0.0948 - accuracy: 0.9692 - 1s/epoch - 986us/step
Epoch 24/600
1268/1268 - 1s - loss: 0.0938 - accuracy: 0.9699 - 1s/epoch - 972us/step
Epoch 25/600
1268/1268 - 1s - loss: 0.0922 - accuracy: 0.9701 - 1s/epoch - 998us/step
Epoch 26/600
1268/1268 - 1s - loss: 0.0921 - accuracy: 0.9701 - 1s/epoch - 972us/step
Epoch 27/600
1268/1268 - 1s - loss: 0.0911 - accuracy: 0.9703 - 1s/epoch - 993us/step
Epoch 28/600
1268/1268 - 1s - loss: 0.0903 - accuracy: 0.9707 - 1s/epoch - 970us/step
Epoch 29/600
1268/1268 - 1s - loss: 0.0890 - accuracy: 0.9713 - 1s/epoch - 987us/step
Epoch 30/600
1268/1268 - 1s - loss: 0.0883 - accuracy: 0.9718 - 1s/epoch - 967us/step
Epoch 31/600
1268/1268 - 1s - loss: 0.0880 - accuracy: 0.9713 - 1s/epoch - 988us/step
Epoch 32/600
1268/1268 - 1s - loss: 0.0867 - accuracy: 0.9722 - 1s/epoch - 973us/step
Epoch 33/600
1268/1268 - 1s - loss: 0.0859 - accuracy: 0.9726 - 1s/epoch - 990us/step
Epoch 34/600
1268/1268 - 1s - loss: 0.0856 - accuracy: 0.9728 - 1s/epoch - 969us/step
Epoch 35/600
1268/1268 - 1s - loss: 0.0845 - accuracy: 0.9733 - 1s/epoch - 987us/step
Epoch 36/600
1268/1268 - 1s - loss: 0.0847 - accuracy: 0.9731 - 1s/epoch - 965us/step
Epoch 37/600
1268/1268 - 1s - loss: 0.0839 - accuracy: 0.9734 - 1s/epoch - 999us/step
Epoch 38/600
1268/1268 - 1s - loss: 0.0829 - accuracy: 0.9737 - 1s/epoch - 967us/step
Epoch 39/600
1268/1268 - 1s - loss: 0.0825 - accuracy: 0.9735 - 1s/epoch - 988us/step
Epoch 40/600
1268/1268 - 1s - loss: 0.0813 - accuracy: 0.9742 - 1s/epoch - 965us/step
Epoch 41/600
1268/1268 - 1s - loss: 0.0811 - accuracy: 0.9745 - 1s/epoch - 983us/step
Epoch 42/600
1268/1268 - 1s - loss: 0.0805 - accuracy: 0.9746 - 1s/epoch - 972us/step
Epoch 43/600
1268/1268 - 1s - loss: 0.0798 - accuracy: 0.9746 - 1s/epoch - 991us/step
Epoch 44/600
1268/1268 - 1s - loss: 0.0798 - accuracy: 0.9747 - 1s/epoch - 969us/step
Epoch 45/600
1268/1268 - 1s - loss: 0.0793 - accuracy: 0.9753 - 1s/epoch - 986us/step
Epoch 46/600
1268/1268 - 1s - loss: 0.0785 - accuracy: 0.9750 - 1s/epoch - 967us/step
Epoch 47/600
1268/1268 - 1s - loss: 0.0784 - accuracy: 0.9751 - 1s/epoch - 987us/step
Epoch 48/600
1268/1268 - 1s - loss: 0.0774 - accuracy: 0.9753 - 1s/epoch - 969us/step
Epoch 49/600
1268/1268 - 1s - loss: 0.0767 - accuracy: 0.9756 - 1s/epoch - 989us/step
Epoch 50/600
1268/1268 - 1s - loss: 0.0774 - accuracy: 0.9753 - 1s/epoch - 970us/step
Epoch 51/600
1268/1268 - 1s - loss: 0.0765 - accuracy: 0.9761 - 1s/epoch - 986us/step
Epoch 52/600
1268/1268 - 1s - loss: 0.0762 - accuracy: 0.9762 - 1s/epoch - 962us/step
Epoch 53/600
1268/1268 - 1s - loss: 0.0761 - accuracy: 0.9761 - 1s/epoch - 997us/step
Epoch 54/600
1268/1268 - 1s - loss: 0.0755 - accuracy: 0.9761 - 1s/epoch - 967us/step
Epoch 55/600
1268/1268 - 1s - loss: 0.0749 - accuracy: 0.9764 - 1s/epoch - 981us/step
Epoch 56/600
1268/1268 - 1s - loss: 0.0743 - accuracy: 0.9763 - 1s/epoch - 965us/step
Epoch 57/600
1268/1268 - 1s - loss: 0.0745 - accuracy: 0.9757 - 1s/epoch - 986us/step
Epoch 58/600
1268/1268 - 1s - loss: 0.0743 - accuracy: 0.9762 - 1s/epoch - 969us/step
Epoch 59/600
1268/1268 - 1s - loss: 0.0735 - accuracy: 0.9769 - 1s/epoch - 986us/step
Epoch 60/600
1268/1268 - 1s - loss: 0.0729 - accuracy: 0.9773 - 1s/epoch - 968us/step
Epoch 61/600
1268/1268 - 1s - loss: 0.0732 - accuracy: 0.9767 - 1s/epoch - 982us/step
Epoch 62/600
1268/1268 - 1s - loss: 0.0732 - accuracy: 0.9769 - 1s/epoch - 963us/step
Epoch 63/600
1268/1268 - 1s - loss: 0.0724 - accuracy: 0.9773 - 1s/epoch - 987us/step
Epoch 64/600
```

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1268/1268 - 1s - loss: 0.0724 - accuracy: 0.9771 - 1s/epoch - 967us/step
Epoch 65/600
1268/1268 - 1s - loss: 0.0715 - accuracy: 0.9774 - 1s/epoch - 987us/step
Epoch 66/600
1268/1268 - 1s - loss: 0.0719 - accuracy: 0.9775 - 1s/epoch - 964us/step
Epoch 67/600
1268/1268 - 1s - loss: 0.0713 - accuracy: 0.9775 - 1s/epoch - 980us/step
Epoch 68/600
1268/1268 - 1s - loss: 0.0711 - accuracy: 0.9779 - 1s/epoch - 963us/step
Epoch 69/600
1268/1268 - 1s - loss: 0.0709 - accuracy: 0.9774 - 1s/epoch - 982us/step
Epoch 70/600
1268/1268 - 1s - loss: 0.0704 - accuracy: 0.9774 - 1s/epoch - 969us/step
Epoch 71/600
1268/1268 - 1s - loss: 0.0698 - accuracy: 0.9783 - 1s/epoch - 989us/step
Epoch 72/600
1268/1268 - 1s - loss: 0.0697 - accuracy: 0.9777 - 1s/epoch - 984us/step
Epoch 73/600
1268/1268 - 1s - loss: 0.0692 - accuracy: 0.9782 - 1s/epoch - 989us/step
Epoch 74/600
1268/1268 - 1s - loss: 0.0692 - accuracy: 0.9781 - 1s/epoch - 974us/step
Epoch 75/600
1268/1268 - 1s - loss: 0.0691 - accuracy: 0.9784 - 1s/epoch - 991us/step
Epoch 76/600
1268/1268 - 1s - loss: 0.0689 - accuracy: 0.9780 - 1s/epoch - 967us/step
Epoch 77/600
1268/1268 - 1s - loss: 0.0685 - accuracy: 0.9784 - 1s/epoch - 982us/step
Epoch 78/600
1268/1268 - 1s - loss: 0.0685 - accuracy: 0.9787 - 1s/epoch - 965us/step
Epoch 79/600
1268/1268 - 1s - loss: 0.0674 - accuracy: 0.9787 - 1s/epoch - 992us/step
Epoch 80/600
1268/1268 - 1s - loss: 0.0677 - accuracy: 0.9785 - 1s/epoch - 969us/step
Epoch 81/600
1268/1268 - 1s - loss: 0.0673 - accuracy: 0.9786 - 1s/epoch - 981us/step
Epoch 82/600
1268/1268 - 1s - loss: 0.0674 - accuracy: 0.9783 - 1s/epoch - 962us/step
Epoch 83/600
1268/1268 - 1s - loss: 0.0666 - accuracy: 0.9789 - 1s/epoch - 990us/step
Epoch 84/600
1268/1268 - 1s - loss: 0.0666 - accuracy: 0.9788 - 1s/epoch - 967us/step
Epoch 85/600
1268/1268 - 1s - loss: 0.0666 - accuracy: 0.9787 - 1s/epoch - 991us/step
Epoch 86/600
1268/1268 - 1s - loss: 0.0664 - accuracy: 0.9787 - 1s/epoch - 967us/step
Epoch 87/600
1268/1268 - 1s - loss: 0.0666 - accuracy: 0.9788 - 1s/epoch - 987us/step
Epoch 88/600
1268/1268 - 1s - loss: 0.0660 - accuracy: 0.9793 - 1s/epoch - 963us/step
Epoch 89/600
1268/1268 - 1s - loss: 0.0656 - accuracy: 0.9791 - 1s/epoch - 987us/step
Epoch 90/600
1268/1268 - 1s - loss: 0.0656 - accuracy: 0.9791 - 1s/epoch - 964us/step
Epoch 91/600
1268/1268 - 1s - loss: 0.0658 - accuracy: 0.9789 - 1s/epoch - 990us/step
Epoch 92/600
1268/1268 - 1s - loss: 0.0650 - accuracy: 0.9793 - 1s/epoch - 970us/step
Epoch 93/600
1268/1268 - 1s - loss: 0.0643 - accuracy: 0.9799 - 1s/epoch - 988us/step
Epoch 94/600
1268/1268 - 1s - loss: 0.0645 - accuracy: 0.9799 - 1s/epoch - 969us/step
Epoch 95/600
1268/1268 - 1s - loss: 0.0649 - accuracy: 0.9794 - 1s/epoch - 993us/step
Epoch 96/600
1268/1268 - 1s - loss: 0.0639 - accuracy: 0.9799 - 1s/epoch - 967us/step
Epoch 97/600
1268/1268 - 1s - loss: 0.0646 - accuracy: 0.9794 - 1s/epoch - 988us/step
Epoch 98/600
1268/1268 - 1s - loss: 0.0633 - accuracy: 0.9802 - 1s/epoch - 969us/step
Epoch 99/600
1268/1268 - 1s - loss: 0.0635 - accuracy: 0.9803 - 1s/epoch - 991us/step
Epoch 100/600
1268/1268 - 1s - loss: 0.0640 - accuracy: 0.9796 - 1s/epoch - 972us/step
Epoch 101/600
1268/1268 - 1s - loss: 0.0636 - accuracy: 0.9796 - 1s/epoch - 990us/step
Epoch 102/600
1268/1268 - 1s - loss: 0.0632 - accuracy: 0.9800 - 1s/epoch - 971us/step
Epoch 103/600
1268/1268 - 1s - loss: 0.0630 - accuracy: 0.9801 - 1s/epoch - 976us/step
Epoch 104/600
1268/1268 - 1s - loss: 0.0623 - accuracy: 0.9804 - 1s/epoch - 964us/step
Epoch 105/600
1268/1268 - 1s - loss: 0.0630 - accuracy: 0.9800 - 1s/epoch - 978us/step
Epoch 106/600
1268/1268 - 1s - loss: 0.0632 - accuracy: 0.9801 - 1s/epoch - 966us/step
Epoch 107/600
1268/1268 - 1s - loss: 0.0624 - accuracy: 0.9800 - 1s/epoch - 989us/step
Epoch 108/600
1268/1268 - 1s - loss: 0.0619 - accuracy: 0.9804 - 1s/epoch - 973us/step
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Epoch 109/600
1268/1268 - 1s - loss: 0.0622 - accuracy: 0.9799 - 1s/epoch - 995us/step
Epoch 110/600
1268/1268 - 1s - loss: 0.0614 - accuracy: 0.9805 - 1s/epoch - 967us/step
Epoch 111/600
1268/1268 - 1s - loss: 0.0621 - accuracy: 0.9803 - 1s/epoch - 993us/step
Epoch 112/600
1268/1268 - 1s - loss: 0.0613 - accuracy: 0.9806 - 1s/epoch - 972us/step
Epoch 113/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9803 - 1s/epoch - 985us/step
Epoch 114/600
1268/1268 - 1s - loss: 0.0606 - accuracy: 0.9809 - 1s/epoch - 966us/step
Epoch 115/600
1268/1268 - 1s - loss: 0.0616 - accuracy: 0.9805 - 1s/epoch - 991us/step
Epoch 116/600
1268/1268 - 1s - loss: 0.0609 - accuracy: 0.9811 - 1s/epoch - 970us/step
Epoch 117/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9804 - 1s/epoch - 985us/step
Epoch 118/600
1268/1268 - 1s - loss: 0.0601 - accuracy: 0.9810 - 1s/epoch - 977us/step
Epoch 119/600
1268/1268 - 1s - loss: 0.0609 - accuracy: 0.9805 - 1s/epoch - 991us/step
Epoch 120/600
1268/1268 - 1s - loss: 0.0600 - accuracy: 0.9809 - 1s/epoch - 969us/step
Epoch 121/600
1268/1268 - 1s - loss: 0.0607 - accuracy: 0.9807 - 1s/epoch - 987us/step
Epoch 122/600
1268/1268 - 1s - loss: 0.0598 - accuracy: 0.9810 - 1s/epoch - 976us/step
Epoch 123/600
1268/1268 - 1s - loss: 0.0604 - accuracy: 0.9805 - 1s/epoch - 988us/step
Epoch 124/600
1268/1268 - 1s - loss: 0.0595 - accuracy: 0.9809 - 1s/epoch - 972us/step
Epoch 125/600
1268/1268 - 1s - loss: 0.0597 - accuracy: 0.9807 - 1s/epoch - 987us/step
Epoch 126/600
1268/1268 - 1s - loss: 0.0592 - accuracy: 0.9810 - 1s/epoch - 970us/step
Epoch 127/600
1268/1268 - 1s - loss: 0.0597 - accuracy: 0.9809 - 1s/epoch - 989us/step
Epoch 128/600
1268/1268 - 1s - loss: 0.0595 - accuracy: 0.9811 - 1s/epoch - 974us/step
Epoch 129/600
1268/1268 - 1s - loss: 0.0587 - accuracy: 0.9810 - 1s/epoch - 987us/step
Epoch 130/600
1268/1268 - 1s - loss: 0.0592 - accuracy: 0.9810 - 1s/epoch - 962us/step
Epoch 131/600
1268/1268 - 1s - loss: 0.0588 - accuracy: 0.9810 - 1s/epoch - 985us/step
Epoch 132/600
1268/1268 - 1s - loss: 0.0589 - accuracy: 0.9811 - 1s/epoch - 988us/step
Epoch 133/600
1268/1268 - 1s - loss: 0.0586 - accuracy: 0.9814 - 1s/epoch - 1ms/step
Epoch 134/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9814 - 1s/epoch - 969us/step
Epoch 135/600
1268/1268 - 1s - loss: 0.0590 - accuracy: 0.9812 - 1s/epoch - 990us/step
Epoch 136/600
1268/1268 - 1s - loss: 0.0582 - accuracy: 0.9812 - 1s/epoch - 978us/step
Epoch 137/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9815 - 1s/epoch - 985us/step
Epoch 138/600
1268/1268 - 1s - loss: 0.0580 - accuracy: 0.9816 - 1s/epoch - 968us/step
Epoch 139/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9814 - 1s/epoch - 986us/step
Epoch 140/600
1268/1268 - 1s - loss: 0.0583 - accuracy: 0.9810 - 1s/epoch - 969us/step
Epoch 141/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9815 - 1s/epoch - 993us/step
Epoch 142/600
1268/1268 - 1s - loss: 0.0578 - accuracy: 0.9814 - 1s/epoch - 968us/step
Epoch 143/600
1268/1268 - 1s - loss: 0.0577 - accuracy: 0.9813 - 1s/epoch - 965us/step
Epoch 144/600
1268/1268 - 1s - loss: 0.0574 - accuracy: 0.9817 - 1s/epoch - 989us/step
Epoch 145/600
1268/1268 - 1s - loss: 0.0576 - accuracy: 0.9814 - 1s/epoch - 964us/step
Epoch 146/600
1268/1268 - 1s - loss: 0.0569 - accuracy: 0.9815 - 1s/epoch - 987us/step
Epoch 147/600
1268/1268 - 1s - loss: 0.0569 - accuracy: 0.9819 - 1s/epoch - 988us/step
Epoch 148/600
1268/1268 - 1s - loss: 0.0570 - accuracy: 0.9818 - 1s/epoch - 971us/step
Epoch 149/600
1268/1268 - 1s - loss: 0.0563 - accuracy: 0.9817 - 1s/epoch - 988us/step
Epoch 150/600
1268/1268 - 1s - loss: 0.0572 - accuracy: 0.9818 - 1s/epoch - 963us/step
Epoch 151/600
1268/1268 - 1s - loss: 0.0566 - accuracy: 0.9819 - 1s/epoch - 988us/step
Epoch 152/600
1268/1268 - 1s - loss: 0.0568 - accuracy: 0.9819 - 1s/epoch - 969us/step
Epoch 153/600
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1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9823 - 1s/epoch - 984us/step
Epoch 154/600
1268/1268 - 1s - loss: 0.0567 - accuracy: 0.9818 - 1s/epoch - 965us/step
Epoch 155/600
1268/1268 - 1s - loss: 0.0563 - accuracy: 0.9815 - 1s/epoch - 980us/step
Epoch 156/600
1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9815 - 1s/epoch - 967us/step
Epoch 157/600
1268/1268 - 1s - loss: 0.0565 - accuracy: 0.9818 - 1s/epoch - 981us/step
Epoch 158/600
1268/1268 - 1s - loss: 0.0559 - accuracy: 0.9817 - 1s/epoch - 966us/step
Epoch 159/600
1268/1268 - 1s - loss: 0.0555 - accuracy: 0.9822 - 1s/epoch - 991us/step
Epoch 160/600
1268/1268 - 1s - loss: 0.0564 - accuracy: 0.9815 - 1s/epoch - 968us/step
Epoch 161/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9823 - 1s/epoch - 982us/step
Epoch 162/600
1268/1268 - 1s - loss: 0.0554 - accuracy: 0.9823 - 1s/epoch - 969us/step
Epoch 163/600
1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9816 - 1s/epoch - 989us/step
Epoch 164/600
1268/1268 - 1s - loss: 0.0550 - accuracy: 0.9826 - 1s/epoch - 968us/step
Epoch 165/600
1268/1268 - 1s - loss: 0.0552 - accuracy: 0.9821 - 1s/epoch - 987us/step
Epoch 166/600
1268/1268 - 1s - loss: 0.0554 - accuracy: 0.9817 - 1s/epoch - 974us/step
Epoch 167/600
1268/1268 - 1s - loss: 0.0546 - accuracy: 0.9825 - 1s/epoch - 983us/step
Epoch 168/600
1268/1268 - 1s - loss: 0.0551 - accuracy: 0.9823 - 1s/epoch - 972us/step
Epoch 169/600
1268/1268 - 1s - loss: 0.0554 - accuracy: 0.9820 - 1s/epoch - 984us/step
Epoch 170/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9820 - 1s/epoch - 963us/step
Epoch 171/600
1268/1268 - 1s - loss: 0.0545 - accuracy: 0.9821 - 1s/epoch - 1ms/step
Epoch 172/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9820 - 1s/epoch - 971us/step
Epoch 173/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9825 - 1s/epoch - 990us/step
Epoch 174/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9823 - 1s/epoch - 969us/step
Epoch 175/600
1268/1268 - 1s - loss: 0.0548 - accuracy: 0.9821 - 1s/epoch - 990us/step
Epoch 176/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9825 - 1s/epoch - 971us/step
Epoch 177/600
1268/1268 - 1s - loss: 0.0540 - accuracy: 0.9825 - 1s/epoch - 987us/step
Epoch 178/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9826 - 1s/epoch - 966us/step
Epoch 179/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9822 - 1s/epoch - 985us/step
Epoch 180/600
1268/1268 - 1s - loss: 0.0545 - accuracy: 0.9824 - 1s/epoch - 970us/step
Epoch 181/600
1268/1268 - 1s - loss: 0.0536 - accuracy: 0.9829 - 1s/epoch - 995us/step
Epoch 182/600
1268/1268 - 1s - loss: 0.0535 - accuracy: 0.9829 - 1s/epoch - 983us/step
Epoch 183/600
1268/1268 - 1s - loss: 0.0539 - accuracy: 0.9829 - 1s/epoch - 1ms/step
Epoch 184/600
1268/1268 - 1s - loss: 0.0536 - accuracy: 0.9824 - 1s/epoch - 976us/step
Epoch 185/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9825 - 1s/epoch - 991us/step
Epoch 186/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9829 - 1s/epoch - 966us/step
Epoch 187/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9823 - 1s/epoch - 981us/step
Epoch 188/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9828 - 1s/epoch - 968us/step
Epoch 189/600
1268/1268 - 1s - loss: 0.0536 - accuracy: 0.9823 - 1s/epoch - 985us/step
Epoch 190/600
1268/1268 - 1s - loss: 0.0527 - accuracy: 0.9827 - 1s/epoch - 963us/step
Epoch 191/600
1268/1268 - 1s - loss: 0.0529 - accuracy: 0.9831 - 1s/epoch - 985us/step
Epoch 192/600
1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9829 - 1s/epoch - 970us/step
Epoch 193/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9824 - 1s/epoch - 991us/step
Epoch 194/600
1268/1268 - 1s - loss: 0.0525 - accuracy: 0.9831 - 1s/epoch - 965us/step
Epoch 195/600
1268/1268 - 1s - loss: 0.0524 - accuracy: 0.9831 - 1s/epoch - 982us/step
Epoch 196/600
1268/1268 - 1s - loss: 0.0524 - accuracy: 0.9827 - 1s/epoch - 969us/step
Epoch 197/600
1268/1268 - 1s - loss: 0.0521 - accuracy: 0.9829 - 1s/epoch - 969us/step
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Epoch 198/600
1268/1268 - 1s - loss: 0.0523 - accuracy: 0.9828 - 1s/epoch - 986us/step
Epoch 199/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9834 - 1s/epoch - 968us/step
Epoch 200/600
1268/1268 - 1s - loss: 0.0527 - accuracy: 0.9830 - 1s/epoch - 1ms/step
Epoch 201/600
1268/1268 - 1s - loss: 0.0527 - accuracy: 0.9829 - 1s/epoch - 964us/step
Epoch 202/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9828 - 1s/epoch - 989us/step
Epoch 203/600
1268/1268 - 1s - loss: 0.0522 - accuracy: 0.9830 - 1s/epoch - 963us/step
Epoch 204/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9831 - 1s/epoch - 980us/step
Epoch 205/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9831 - 1s/epoch - 965us/step
Epoch 206/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9834 - 1s/epoch - 988us/step
Epoch 207/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9831 - 1s/epoch - 965us/step
Epoch 208/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9831 - 1s/epoch - 989us/step
Epoch 209/600
1268/1268 - 1s - loss: 0.0512 - accuracy: 0.9832 - 1s/epoch - 963us/step
Epoch 210/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9830 - 1s/epoch - 988us/step
Epoch 211/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9830 - 1s/epoch - 965us/step
Epoch 212/600
1268/1268 - 1s - loss: 0.0509 - accuracy: 0.9836 - 1s/epoch - 987us/step
Epoch 213/600
1268/1268 - 1s - loss: 0.0510 - accuracy: 0.9834 - 1s/epoch - 965us/step
Epoch 214/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9832 - 1s/epoch - 983us/step
Epoch 215/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9830 - 1s/epoch - 968us/step
Epoch 216/600
1268/1268 - 1s - loss: 0.0514 - accuracy: 0.9833 - 1s/epoch - 980us/step
Epoch 217/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9835 - 1s/epoch - 969us/step
Epoch 218/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9835 - 1s/epoch - 983us/step
Epoch 219/600
1268/1268 - 1s - loss: 0.0504 - accuracy: 0.9831 - 1s/epoch - 973us/step
Epoch 220/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9838 - 1s/epoch - 980us/step
Epoch 221/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9835 - 1s/epoch - 964us/step
Epoch 222/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9836 - 1s/epoch - 963us/step
Epoch 223/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9832 - 1s/epoch - 986us/step
Epoch 224/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9835 - 1s/epoch - 970us/step
Epoch 225/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9837 - 1s/epoch - 996us/step
Epoch 226/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9833 - 1s/epoch - 960us/step
Epoch 227/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9834 - 1s/epoch - 985us/step
Epoch 228/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9835 - 1s/epoch - 968us/step
Epoch 229/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9835 - 1s/epoch - 993us/step
Epoch 230/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9836 - 1s/epoch - 966us/step
Epoch 231/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9836 - 1s/epoch - 984us/step
Epoch 232/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9839 - 1s/epoch - 969us/step
Epoch 233/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9839 - 1s/epoch - 971us/step
Epoch 234/600
1268/1268 - 1s - loss: 0.0496 - accuracy: 0.9838 - 1s/epoch - 988us/step
Epoch 235/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9832 - 1s/epoch - 972us/step
Epoch 236/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9837 - 1s/epoch - 964us/step
Epoch 237/600
1268/1268 - 1s - loss: 0.0497 - accuracy: 0.9841 - 1s/epoch - 989us/step
Epoch 238/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9837 - 1s/epoch - 974us/step
Epoch 239/600
1268/1268 - 1s - loss: 0.0496 - accuracy: 0.9838 - 1s/epoch - 980us/step
Epoch 240/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9839 - 1s/epoch - 964us/step
Epoch 241/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9840 - 1s/epoch - 995us/step
Epoch 242/600
```

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1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9839 - 1s/epoch - 973us/step
Epoch 243/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9835 - 1s/epoch - 982us/step
Epoch 244/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9840 - 1s/epoch - 967us/step
Epoch 245/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9835 - 1s/epoch - 966us/step
Epoch 246/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 247/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9838 - 1s/epoch - 970us/step
Epoch 248/600
1268/1268 - 1s - loss: 0.0485 - accuracy: 0.9840 - 1s/epoch - 990us/step
Epoch 249/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9837 - 1s/epoch - 971us/step
Epoch 250/600
1268/1268 - 1s - loss: 0.0488 - accuracy: 0.9842 - 1s/epoch - 986us/step
Epoch 251/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9839 - 1s/epoch - 970us/step
Epoch 252/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9839 - 1s/epoch - 986us/step
Epoch 253/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9840 - 1s/epoch - 967us/step
Epoch 254/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9840 - 1s/epoch - 989us/step
Epoch 255/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9840 - 1s/epoch - 961us/step
Epoch 256/600
1268/1268 - 1s - loss: 0.0487 - accuracy: 0.9840 - 1s/epoch - 984us/step
Epoch 257/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9839 - 1s/epoch - 973us/step
Epoch 258/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9841 - 1s/epoch - 989us/step
Epoch 259/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9840 - 1s/epoch - 969us/step
Epoch 260/600
1268/1268 - 1s - loss: 0.0484 - accuracy: 0.9842 - 1s/epoch - 971us/step
Epoch 261/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9842 - 1s/epoch - 982us/step
Epoch 262/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9842 - 1s/epoch - 987us/step
Epoch 263/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9840 - 1s/epoch - 973us/step
Epoch 264/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9842 - 1s/epoch - 986us/step
Epoch 265/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9841 - 1s/epoch - 971us/step
Epoch 266/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9839 - 1s/epoch - 986us/step
Epoch 267/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9844 - 1s/epoch - 969us/step
Epoch 268/600
1268/1268 - 1s - loss: 0.0485 - accuracy: 0.9838 - 1s/epoch - 999us/step
Epoch 269/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9845 - 1s/epoch - 967us/step
Epoch 270/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9846 - 1s/epoch - 982us/step
Epoch 271/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9840 - 1s/epoch - 964us/step
Epoch 272/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9846 - 1s/epoch - 983us/step
Epoch 273/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9845 - 1s/epoch - 975us/step
Epoch 274/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9843 - 1s/epoch - 986us/step
Epoch 275/600
1268/1268 - 1s - loss: 0.0474 - accuracy: 0.9843 - 1s/epoch - 964us/step
Epoch 276/600
1268/1268 - 1s - loss: 0.0473 - accuracy: 0.9842 - 1s/epoch - 972us/step
Epoch 277/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9842 - 1s/epoch - 990us/step
Epoch 278/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9848 - 1s/epoch - 985us/step
Epoch 279/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9844 - 1s/epoch - 972us/step
Epoch 280/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9843 - 1s/epoch - 991us/step
Epoch 281/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9845 - 1s/epoch - 969us/step
Epoch 282/600
1268/1268 - 1s - loss: 0.0474 - accuracy: 0.9839 - 1s/epoch - 982us/step
Epoch 283/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9847 - 1s/epoch - 964us/step
Epoch 284/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9844 - 1s/epoch - 987us/step
Epoch 285/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9846 - 1s/epoch - 973us/step
Epoch 286/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9843 - 1s/epoch - 987us/step
```

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Epoch 287/600
1268/1268 - 1s - loss: 0.0468 - accuracy: 0.9845 - 1s/epoch - 966us/step
Epoch 288/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9851 - 1s/epoch - 982us/step
Epoch 289/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9846 - 1s/epoch - 967us/step
Epoch 290/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9846 - 1s/epoch - 992us/step
Epoch 291/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9844 - 1s/epoch - 971us/step
Epoch 292/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9849 - 1s/epoch - 989us/step
Epoch 293/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9845 - 1s/epoch - 967us/step
Epoch 294/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9846 - 1s/epoch - 976us/step
Epoch 295/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9845 - 1s/epoch - 960us/step
Epoch 296/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9849 - 1s/epoch - 981us/step
Epoch 297/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9845 - 1s/epoch - 966us/step
Epoch 298/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9846 - 1s/epoch - 986us/step
Epoch 299/600
1268/1268 - 1s - loss: 0.0460 - accuracy: 0.9852 - 1s/epoch - 967us/step
Epoch 300/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9846 - 1s/epoch - 990us/step
Epoch 301/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9846 - 1s/epoch - 967us/step
Epoch 302/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9845 - 1s/epoch - 988us/step
Epoch 303/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9845 - 1s/epoch - 963us/step
Epoch 304/600
1268/1268 - 1s - loss: 0.0462 - accuracy: 0.9847 - 1s/epoch - 983us/step
Epoch 305/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9847 - 1s/epoch - 965us/step
Epoch 306/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9850 - 1s/epoch - 989us/step
Epoch 307/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9848 - 1s/epoch - 969us/step
Epoch 308/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9847 - 1s/epoch - 986us/step
Epoch 309/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9847 - 1s/epoch - 965us/step
Epoch 310/600
1268/1268 - 1s - loss: 0.0460 - accuracy: 0.9850 - 1s/epoch - 978us/step
Epoch 311/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9848 - 1s/epoch - 963us/step
Epoch 312/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9851 - 1s/epoch - 989us/step
Epoch 313/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9850 - 1s/epoch - 964us/step
Epoch 314/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9848 - 1s/epoch - 988us/step
Epoch 315/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9847 - 1s/epoch - 962us/step
Epoch 316/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9850 - 1s/epoch - 983us/step
Epoch 317/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9852 - 1s/epoch - 976us/step
Epoch 318/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9848 - 1s/epoch - 981us/step
Epoch 319/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9849 - 1s/epoch - 963us/step
Epoch 320/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9849 - 1s/epoch - 987us/step
Epoch 321/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9849 - 1s/epoch - 965us/step
Epoch 322/600
1268/1268 - 1s - loss: 0.0456 - accuracy: 0.9849 - 1s/epoch - 979us/step
Epoch 323/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9849 - 1s/epoch - 962us/step
Epoch 324/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9846 - 1s/epoch - 982us/step
Epoch 325/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9853 - 1s/epoch - 967us/step
Epoch 326/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9849 - 1s/epoch - 989us/step
Epoch 327/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9848 - 1s/epoch - 959us/step
Epoch 328/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9853 - 1s/epoch - 981us/step
Epoch 329/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9850 - 1s/epoch - 970us/step
Epoch 330/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9851 - 1s/epoch - 990us/step
Epoch 331/600
```

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1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9850 - 1s/epoch - 964us/step
Epoch 332/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9858 - 1s/epoch - 986us/step
Epoch 333/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9848 - 1s/epoch - 974us/step
Epoch 334/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9853 - 1s/epoch - 987us/step
Epoch 335/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9855 - 1s/epoch - 963us/step
Epoch 336/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9853 - 1s/epoch - 980us/step
Epoch 337/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9852 - 1s/epoch - 962us/step
Epoch 338/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9850 - 1s/epoch - 995us/step
Epoch 339/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9849 - 1s/epoch - 969us/step
Epoch 340/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9851 - 1s/epoch - 980us/step
Epoch 341/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9851 - 1s/epoch - 966us/step
Epoch 342/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9856 - 1s/epoch - 971us/step
Epoch 343/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9852 - 1s/epoch - 983us/step
Epoch 344/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9855 - 1s/epoch - 964us/step
Epoch 345/600
1268/1268 - 1s - loss: 0.0448 - accuracy: 0.9852 - 1s/epoch - 987us/step
Epoch 346/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9858 - 1s/epoch - 974us/step
Epoch 347/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9852 - 1s/epoch - 977us/step
Epoch 348/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9861 - 1s/epoch - 962us/step
Epoch 349/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9853 - 1s/epoch - 967us/step
Epoch 350/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9851 - 1s/epoch - 986us/step
Epoch 351/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9852 - 1s/epoch - 985us/step
Epoch 352/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9854 - 1s/epoch - 961us/step
Epoch 353/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9852 - 1s/epoch - 987us/step
Epoch 354/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9855 - 1s/epoch - 972us/step
Epoch 355/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9854 - 1s/epoch - 989us/step
Epoch 356/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9851 - 1s/epoch - 967us/step
Epoch 357/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9859 - 1s/epoch - 991us/step
Epoch 358/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9853 - 1s/epoch - 971us/step
Epoch 359/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9856 - 1s/epoch - 982us/step
Epoch 360/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9854 - 1s/epoch - 971us/step
Epoch 361/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9855 - 1s/epoch - 985us/step
Epoch 362/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 363/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9854 - 1s/epoch - 980us/step
Epoch 364/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9857 - 1s/epoch - 987us/step
Epoch 365/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 366/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9853 - 1s/epoch - 975us/step
Epoch 367/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9856 - 1s/epoch - 987us/step
Epoch 368/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9856 - 1s/epoch - 967us/step
Epoch 369/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9858 - 1s/epoch - 983us/step
Epoch 370/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9859 - 1s/epoch - 967us/step
Epoch 371/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9855 - 1s/epoch - 981us/step
Epoch 372/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9852 - 1s/epoch - 967us/step
Epoch 373/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9856 - 1s/epoch - 982us/step
Epoch 374/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9858 - 1s/epoch - 963us/step
Epoch 375/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9856 - 1s/epoch - 986us/step
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Epoch 376/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9857 - 1s/epoch - 965us/step
Epoch 377/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 983us/step
Epoch 378/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9855 - 1s/epoch - 968us/step
Epoch 379/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9856 - 1s/epoch - 987us/step
Epoch 380/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9858 - 1s/epoch - 966us/step
Epoch 381/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 986us/step
Epoch 382/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9857 - 1s/epoch - 965us/step
Epoch 383/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9856 - 1s/epoch - 986us/step
Epoch 384/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9859 - 1s/epoch - 961us/step
Epoch 385/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9856 - 1s/epoch - 991us/step
Epoch 386/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9852 - 1s/epoch - 968us/step
Epoch 387/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9857 - 1s/epoch - 984us/step
Epoch 388/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9860 - 1s/epoch - 962us/step
Epoch 389/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9856 - 1s/epoch - 998us/step
Epoch 390/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9861 - 1s/epoch - 979us/step
Epoch 391/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9861 - 1s/epoch - 972us/step
Epoch 392/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9856 - 1s/epoch - 986us/step
Epoch 393/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9855 - 1s/epoch - 993us/step
Epoch 394/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9860 - 1s/epoch - 981us/step
Epoch 395/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9858 - 1s/epoch - 992us/step
Epoch 396/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9855 - 1s/epoch - 967us/step
Epoch 397/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9854 - 1s/epoch - 997us/step
Epoch 398/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9859 - 1s/epoch - 967us/step
Epoch 399/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9860 - 1s/epoch - 974us/step
Epoch 400/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9857 - 1s/epoch - 989us/step
Epoch 401/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9861 - 1s/epoch - 976us/step
Epoch 402/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9859 - 1s/epoch - 963us/step
Epoch 403/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9863 - 1s/epoch - 981us/step
Epoch 404/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9860 - 1s/epoch - 962us/step
Epoch 405/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9858 - 1s/epoch - 985us/step
Epoch 406/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9859 - 1s/epoch - 967us/step
Epoch 407/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9862 - 1s/epoch - 989us/step
Epoch 408/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9861 - 1s/epoch - 970us/step
Epoch 409/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 410/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9864 - 1s/epoch - 976us/step
Epoch 411/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9860 - 1s/epoch - 990us/step
Epoch 412/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9859 - 1s/epoch - 967us/step
Epoch 413/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9859 - 1s/epoch - 986us/step
Epoch 414/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9862 - 1s/epoch - 993us/step
Epoch 415/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9860 - 1s/epoch - 999us/step
Epoch 416/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9862 - 1s/epoch - 969us/step
Epoch 417/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9860 - 1s/epoch - 969us/step
Epoch 418/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9863 - 1s/epoch - 989us/step
Epoch 419/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9857 - 1s/epoch - 990us/step
Epoch 420/600
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1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9860 - 1s/epoch - 972us/step
Epoch 421/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9861 - 1s/epoch - 989us/step
Epoch 422/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9858 - 1s/epoch - 967us/step
Epoch 423/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9860 - 1s/epoch - 988us/step
Epoch 424/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9865 - 1s/epoch - 974us/step
Epoch 425/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9861 - 1s/epoch - 984us/step
Epoch 426/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9859 - 1s/epoch - 966us/step
Epoch 427/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9863 - 1s/epoch - 983us/step
Epoch 428/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9859 - 1s/epoch - 967us/step
Epoch 429/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9858 - 1s/epoch - 976us/step
Epoch 430/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9863 - 1s/epoch - 965us/step
Epoch 431/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9862 - 1s/epoch - 981us/step
Epoch 432/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9860 - 1s/epoch - 967us/step
Epoch 433/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9859 - 1s/epoch - 987us/step
Epoch 434/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9861 - 1s/epoch - 969us/step
Epoch 435/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9859 - 1s/epoch - 988us/step
Epoch 436/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9862 - 1s/epoch - 965us/step
Epoch 437/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9862 - 1s/epoch - 990us/step
Epoch 438/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9863 - 1s/epoch - 968us/step
Epoch 439/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 440/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9857 - 1s/epoch - 984us/step
Epoch 441/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9863 - 1s/epoch - 998us/step
Epoch 442/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9862 - 1s/epoch - 974us/step
Epoch 443/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9862 - 1s/epoch - 991us/step
Epoch 444/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9864 - 1s/epoch - 964us/step
Epoch 445/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9863 - 1s/epoch - 993us/step
Epoch 446/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9857 - 1s/epoch - 981us/step
Epoch 447/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 448/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9865 - 1s/epoch - 976us/step
Epoch 449/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9860 - 1s/epoch - 983us/step
Epoch 450/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9863 - 1s/epoch - 972us/step
Epoch 451/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9861 - 1s/epoch - 999us/step
Epoch 452/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9862 - 1s/epoch - 968us/step
Epoch 453/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9864 - 1s/epoch - 989us/step
Epoch 454/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9863 - 1s/epoch - 968us/step
Epoch 455/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9863 - 1s/epoch - 984us/step
Epoch 456/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9864 - 1s/epoch - 980us/step
Epoch 457/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9864 - 1s/epoch - 978us/step
Epoch 458/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9865 - 1s/epoch - 972us/step
Epoch 459/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9862 - 1s/epoch - 981us/step
Epoch 460/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9864 - 1s/epoch - 970us/step
Epoch 461/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9863 - 1s/epoch - 985us/step
Epoch 462/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9865 - 1s/epoch - 980us/step
Epoch 463/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9865 - 1s/epoch - 988us/step
Epoch 464/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9861 - 1s/epoch - 963us/step
```

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Epoch 465/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9866 - 1s/epoch - 990us/step
Epoch 466/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9867 - 1s/epoch - 995us/step
Epoch 467/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 970us/step
Epoch 468/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9862 - 1s/epoch - 994us/step
Epoch 469/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9865 - 1s/epoch - 984us/step
Epoch 470/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9868 - 1s/epoch - 964us/step
Epoch 471/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9860 - 1s/epoch - 986us/step
Epoch 472/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9868 - 1s/epoch - 963us/step
Epoch 473/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9861 - 1s/epoch - 974us/step
Epoch 474/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9867 - 1s/epoch - 965us/step
Epoch 475/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9864 - 1s/epoch - 986us/step
Epoch 476/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9863 - 1s/epoch - 962us/step
Epoch 477/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9867 - 1s/epoch - 961us/step
Epoch 478/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9866 - 1s/epoch - 984us/step
Epoch 479/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9867 - 1s/epoch - 982us/step
Epoch 480/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9867 - 1s/epoch - 964us/step
Epoch 481/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9868 - 1s/epoch - 977us/step
Epoch 482/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9866 - 1s/epoch - 967us/step
Epoch 483/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9865 - 1s/epoch - 983us/step
Epoch 484/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9868 - 1s/epoch - 962us/step
Epoch 485/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9861 - 1s/epoch - 976us/step
Epoch 486/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9867 - 1s/epoch - 962us/step
Epoch 487/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9866 - 1s/epoch - 985us/step
Epoch 488/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9864 - 1s/epoch - 969us/step
Epoch 489/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9867 - 1s/epoch - 984us/step
Epoch 490/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9867 - 1s/epoch - 965us/step
Epoch 491/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9864 - 1s/epoch - 984us/step
Epoch 492/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9868 - 1s/epoch - 969us/step
Epoch 493/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9863 - 1s/epoch - 980us/step
Epoch 494/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9866 - 1s/epoch - 966us/step
Epoch 495/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9869 - 1s/epoch - 986us/step
Epoch 496/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9867 - 1s/epoch - 970us/step
Epoch 497/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9865 - 1s/epoch - 988us/step
Epoch 498/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9868 - 1s/epoch - 967us/step
Epoch 499/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9865 - 1s/epoch - 989us/step
Epoch 500/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9873 - 1s/epoch - 966us/step
Epoch 501/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9864 - 1s/epoch - 980us/step
Epoch 502/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9869 - 1s/epoch - 962us/step
Epoch 503/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9864 - 1s/epoch - 980us/step
Epoch 504/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9865 - 1s/epoch - 958us/step
Epoch 505/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9867 - 1s/epoch - 988us/step
Epoch 506/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9866 - 1s/epoch - 961us/step
Epoch 507/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9868 - 1s/epoch - 984us/step
Epoch 508/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9871 - 1s/epoch - 967us/step
Epoch 509/600
```

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1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9866 - 1s/epoch - 986us/step
Epoch 510/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9868 - 1s/epoch - 966us/step
Epoch 511/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9864 - 1s/epoch - 995us/step
Epoch 512/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9869 - 1s/epoch - 966us/step
Epoch 513/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9870 - 1s/epoch - 966us/step
Epoch 514/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9862 - 1s/epoch - 986us/step
Epoch 515/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9869 - 1s/epoch - 983us/step
Epoch 516/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9870 - 1s/epoch - 964us/step
Epoch 517/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9865 - 1s/epoch - 976us/step
Epoch 518/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9867 - 1s/epoch - 971us/step
Epoch 519/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9869 - 1s/epoch - 988us/step
Epoch 520/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9870 - 1s/epoch - 966us/step
Epoch 521/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9869 - 1s/epoch - 982us/step
Epoch 522/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9867 - 1s/epoch - 967us/step
Epoch 523/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9870 - 1s/epoch - 980us/step
Epoch 524/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9868 - 1s/epoch - 967us/step
Epoch 525/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9866 - 1s/epoch - 978us/step
Epoch 526/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9868 - 1s/epoch - 965us/step
Epoch 527/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9867 - 1s/epoch - 986us/step
Epoch 528/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9865 - 1s/epoch - 971us/step
Epoch 529/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9869 - 1s/epoch - 988us/step
Epoch 530/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9870 - 1s/epoch - 963us/step
Epoch 531/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9866 - 1s/epoch - 983us/step
Epoch 532/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9866 - 1s/epoch - 961us/step
Epoch 533/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9871 - 1s/epoch - 988us/step
Epoch 534/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9872 - 1s/epoch - 973us/step
Epoch 535/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9870 - 1s/epoch - 979us/step
Epoch 536/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9871 - 1s/epoch - 968us/step
Epoch 537/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9870 - 1s/epoch - 990us/step
Epoch 538/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9868 - 1s/epoch - 965us/step
Epoch 539/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9867 - 1s/epoch - 986us/step
Epoch 540/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9871 - 1s/epoch - 966us/step
Epoch 541/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9869 - 1s/epoch - 987us/step
Epoch 542/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9869 - 1s/epoch - 965us/step
Epoch 543/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9865 - 1s/epoch - 986us/step
Epoch 544/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 545/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 546/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9871 - 1s/epoch - 989us/step
Epoch 547/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9869 - 1s/epoch - 998us/step
Epoch 548/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9872 - 1s/epoch - 983us/step
Epoch 549/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9869 - 1s/epoch - 991us/step
Epoch 550/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9873 - 1s/epoch - 978us/step
Epoch 551/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9868 - 1s/epoch - 991us/step
Epoch 552/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9868 - 1s/epoch - 968us/step
Epoch 553/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9874 - 1s/epoch - 982us/step
```

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Epoch 554/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9871 - 1s/epoch - 970us/step
Epoch 555/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9871 - 1s/epoch - 980us/step
Epoch 556/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9867 - 1s/epoch - 968us/step
Epoch 557/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9872 - 1s/epoch - 986us/step
Epoch 558/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9868 - 1s/epoch - 968us/step
Epoch 559/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 988us/step
Epoch 560/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9869 - 1s/epoch - 964us/step
Epoch 561/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9872 - 1s/epoch - 994us/step
Epoch 562/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 973us/step
Epoch 563/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9867 - 1s/epoch - 989us/step
Epoch 564/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9868 - 1s/epoch - 968us/step
Epoch 565/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9871 - 1s/epoch - 982us/step
Epoch 566/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9868 - 1s/epoch - 968us/step
Epoch 567/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9873 - 1s/epoch - 985us/step
Epoch 568/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9869 - 1s/epoch - 970us/step
Epoch 569/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9871 - 1s/epoch - 987us/step
Epoch 570/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9871 - 1s/epoch - 972us/step
Epoch 571/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9872 - 1s/epoch - 988us/step
Epoch 572/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9873 - 1s/epoch - 970us/step
Epoch 573/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 975us/step
Epoch 574/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9867 - 1s/epoch - 963us/step
Epoch 575/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9874 - 1s/epoch - 990us/step
Epoch 576/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9871 - 1s/epoch - 966us/step
Epoch 577/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9869 - 1s/epoch - 985us/step
Epoch 578/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9874 - 1s/epoch - 974us/step
Epoch 579/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9874 - 1s/epoch - 969us/step
Epoch 580/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9873 - 1s/epoch - 988us/step
Epoch 581/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9869 - 1s/epoch - 984us/step
Epoch 582/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9871 - 1s/epoch - 974us/step
Epoch 583/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9869 - 1s/epoch - 989us/step
Epoch 584/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9870 - 1s/epoch - 967us/step
Epoch 585/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9871 - 1s/epoch - 982us/step
Epoch 586/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9872 - 1s/epoch - 969us/step
Epoch 587/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9866 - 1s/epoch - 983us/step
Epoch 588/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9876 - 1s/epoch - 975us/step
Epoch 589/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9866 - 1s/epoch - 995us/step
Epoch 590/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9873 - 1s/epoch - 969us/step
Epoch 591/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9873 - 1s/epoch - 988us/step
Epoch 592/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9869 - 1s/epoch - 972us/step
Epoch 593/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9874 - 1s/epoch - 984us/step
Epoch 594/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9872 - 1s/epoch - 965us/step
Epoch 595/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9866 - 1s/epoch - 989us/step
Epoch 596/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9872 - 1s/epoch - 967us/step
Epoch 597/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9868 - 1s/epoch - 995us/step
Epoch 598/600
```

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1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9873 - 1s/epoch - 971us/step
Epoch 599/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9871 - 1s/epoch - 989us/step
Epoch 600/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9876 - 1s/epoch - 967us/step
990/990 [==============================] - 1s 691us/step
Epoch 1/600
1268/1268 - 2s - loss: 0.3606 - accuracy: 0.8360 - 2s/epoch - 1ms/step
Epoch 2/600
1268/1268 - 1s - loss: 0.2239 - accuracy: 0.9110 - 1s/epoch - 965us/step
Epoch 3/600
1268/1268 - 1s - loss: 0.1838 - accuracy: 0.9302 - 1s/epoch - 989us/step
Epoch 4/600
1268/1268 - 1s - loss: 0.1639 - accuracy: 0.9392 - 1s/epoch - 964us/step
Epoch 5/600
1268/1268 - 1s - loss: 0.1525 - accuracy: 0.9444 - 1s/epoch - 985us/step
Epoch 6/600
1268/1268 - 1s - loss: 0.1432 - accuracy: 0.9484 - 1s/epoch - 967us/step
Epoch 7/600
1268/1268 - 1s - loss: 0.1357 - accuracy: 0.9515 - 1s/epoch - 995us/step
Epoch 8/600
1268/1268 - 1s - loss: 0.1298 - accuracy: 0.9543 - 1s/epoch - 961us/step
Epoch 9/600
1268/1268 - 1s - loss: 0.1254 - accuracy: 0.9562 - 1s/epoch - 985us/step
Epoch 10/600
1268/1268 - 1s - loss: 0.1211 - accuracy: 0.9578 - 1s/epoch - 961us/step
Epoch 11/600
1268/1268 - 1s - loss: 0.1177 - accuracy: 0.9594 - 1s/epoch - 978us/step
Epoch 12/600
1268/1268 - 1s - loss: 0.1143 - accuracy: 0.9615 - 1s/epoch - 956us/step
Epoch 13/600
1268/1268 - 1s - loss: 0.1109 - accuracy: 0.9622 - 1s/epoch - 981us/step
Epoch 14/600
1268/1268 - 1s - loss: 0.1092 - accuracy: 0.9634 - 1s/epoch - 959us/step
Epoch 15/600
1268/1268 - 1s - loss: 0.1066 - accuracy: 0.9639 - 1s/epoch - 980us/step
Epoch 16/600
1268/1268 - 1s - loss: 0.1043 - accuracy: 0.9650 - 1s/epoch - 960us/step
Epoch 17/600
1268/1268 - 1s - loss: 0.1023 - accuracy: 0.9655 - 1s/epoch - 988us/step
Epoch 18/600
1268/1268 - 1s - loss: 0.1010 - accuracy: 0.9663 - 1s/epoch - 959us/step
Epoch 19/600
1268/1268 - 1s - loss: 0.0990 - accuracy: 0.9666 - 1s/epoch - 982us/step
Epoch 20/600
1268/1268 - 1s - loss: 0.0979 - accuracy: 0.9677 - 1s/epoch - 962us/step
Epoch 21/600
1268/1268 - 1s - loss: 0.0958 - accuracy: 0.9682 - 1s/epoch - 986us/step
Epoch 22/600
1268/1268 - 1s - loss: 0.0946 - accuracy: 0.9686 - 1s/epoch - 958us/step
Epoch 23/600
1268/1268 - 1s - loss: 0.0935 - accuracy: 0.9695 - 1s/epoch - 955us/step
Epoch 24/600
1268/1268 - 1s - loss: 0.0929 - accuracy: 0.9692 - 1s/epoch - 978us/step
Epoch 25/600
1268/1268 - 1s - loss: 0.0920 - accuracy: 0.9698 - 1s/epoch - 982us/step
Epoch 26/600
1268/1268 - 1s - loss: 0.0906 - accuracy: 0.9703 - 1s/epoch - 961us/step
Epoch 27/600
1268/1268 - 1s - loss: 0.0903 - accuracy: 0.9705 - 1s/epoch - 981us/step
Epoch 28/600
1268/1268 - 1s - loss: 0.0891 - accuracy: 0.9713 - 1s/epoch - 960us/step
Epoch 29/600
1268/1268 - 1s - loss: 0.0878 - accuracy: 0.9717 - 1s/epoch - 984us/step
Epoch 30/600
1268/1268 - 1s - loss: 0.0872 - accuracy: 0.9715 - 1s/epoch - 958us/step
Epoch 31/600
1268/1268 - 1s - loss: 0.0862 - accuracy: 0.9724 - 1s/epoch - 980us/step
Epoch 32/600
1268/1268 - 1s - loss: 0.0863 - accuracy: 0.9718 - 1s/epoch - 966us/step
Epoch 33/600
1268/1268 - 1s - loss: 0.0856 - accuracy: 0.9718 - 1s/epoch - 985us/step
Epoch 34/600
1268/1268 - 1s - loss: 0.0846 - accuracy: 0.9726 - 1s/epoch - 961us/step
Epoch 35/600
1268/1268 - 1s - loss: 0.0836 - accuracy: 0.9727 - 1s/epoch - 977us/step
Epoch 36/600
1268/1268 - 1s - loss: 0.0833 - accuracy: 0.9732 - 1s/epoch - 965us/step
Epoch 37/600
1268/1268 - 1s - loss: 0.0822 - accuracy: 0.9733 - 1s/epoch - 983us/step
Epoch 38/600
1268/1268 - 1s - loss: 0.0819 - accuracy: 0.9738 - 1s/epoch - 962us/step
Epoch 39/600
1268/1268 - 1s - loss: 0.0805 - accuracy: 0.9741 - 1s/epoch - 980us/step
Epoch 40/600
1268/1268 - 1s - loss: 0.0808 - accuracy: 0.9744 - 1s/epoch - 963us/step
Epoch 41/600
1268/1268 - 1s - loss: 0.0797 - accuracy: 0.9743 - 1s/epoch - 982us/step
Epoch 42/600
```

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1268/1268 - 1s - loss: 0.0797 - accuracy: 0.9743 - 1s/epoch - 964us/step
Epoch 43/600
1268/1268 - 1s - loss: 0.0787 - accuracy: 0.9747 - 1s/epoch - 990us/step
Epoch 44/600
1268/1268 - 1s - loss: 0.0783 - accuracy: 0.9749 - 1s/epoch - 962us/step
Epoch 45/600
1268/1268 - 1s - loss: 0.0777 - accuracy: 0.9754 - 1s/epoch - 980us/step
Epoch 46/600
1268/1268 - 1s - loss: 0.0774 - accuracy: 0.9754 - 1s/epoch - 960us/step
Epoch 47/600
1268/1268 - 1s - loss: 0.0772 - accuracy: 0.9752 - 1s/epoch - 984us/step
Epoch 48/600
1268/1268 - 1s - loss: 0.0765 - accuracy: 0.9755 - 1s/epoch - 959us/step
Epoch 49/600
1268/1268 - 1s - loss: 0.0761 - accuracy: 0.9760 - 1s/epoch - 982us/step
Epoch 50/600
1268/1268 - 1s - loss: 0.0758 - accuracy: 0.9759 - 1s/epoch - 959us/step
Epoch 51/600
1268/1268 - 1s - loss: 0.0755 - accuracy: 0.9762 - 1s/epoch - 982us/step
Epoch 52/600
1268/1268 - 1s - loss: 0.0753 - accuracy: 0.9760 - 1s/epoch - 963us/step
Epoch 53/600
1268/1268 - 1s - loss: 0.0740 - accuracy: 0.9763 - 1s/epoch - 981us/step
Epoch 54/600
1268/1268 - 1s - loss: 0.0746 - accuracy: 0.9763 - 1s/epoch - 965us/step
Epoch 55/600
1268/1268 - 1s - loss: 0.0737 - accuracy: 0.9762 - 1s/epoch - 984us/step
Epoch 56/600
1268/1268 - 1s - loss: 0.0732 - accuracy: 0.9772 - 1s/epoch - 964us/step
Epoch 57/600
1268/1268 - 1s - loss: 0.0734 - accuracy: 0.9765 - 1s/epoch - 981us/step
Epoch 58/600
1268/1268 - 1s - loss: 0.0725 - accuracy: 0.9767 - 1s/epoch - 959us/step
Epoch 59/600
1268/1268 - 1s - loss: 0.0723 - accuracy: 0.9769 - 1s/epoch - 984us/step
Epoch 60/600
1268/1268 - 1s - loss: 0.0717 - accuracy: 0.9775 - 1s/epoch - 965us/step
Epoch 61/600
1268/1268 - 1s - loss: 0.0725 - accuracy: 0.9768 - 1s/epoch - 982us/step
Epoch 62/600
1268/1268 - 1s - loss: 0.0716 - accuracy: 0.9773 - 1s/epoch - 960us/step
Epoch 63/600
1268/1268 - 1s - loss: 0.0708 - accuracy: 0.9776 - 1s/epoch - 982us/step
Epoch 64/600
1268/1268 - 1s - loss: 0.0707 - accuracy: 0.9775 - 1s/epoch - 962us/step
Epoch 65/600
1268/1268 - 1s - loss: 0.0703 - accuracy: 0.9779 - 1s/epoch - 982us/step
Epoch 66/600
1268/1268 - 1s - loss: 0.0703 - accuracy: 0.9776 - 1s/epoch - 962us/step
Epoch 67/600
1268/1268 - 1s - loss: 0.0696 - accuracy: 0.9783 - 1s/epoch - 987us/step
Epoch 68/600
1268/1268 - 1s - loss: 0.0698 - accuracy: 0.9778 - 1s/epoch - 967us/step
Epoch 69/600
1268/1268 - 1s - loss: 0.0693 - accuracy: 0.9778 - 1s/epoch - 984us/step
Epoch 70/600
1268/1268 - 1s - loss: 0.0690 - accuracy: 0.9783 - 1s/epoch - 959us/step
Epoch 71/600
1268/1268 - 1s - loss: 0.0693 - accuracy: 0.9783 - 1s/epoch - 981us/step
Epoch 72/600
1268/1268 - 1s - loss: 0.0686 - accuracy: 0.9785 - 1s/epoch - 962us/step
Epoch 73/600
1268/1268 - 1s - loss: 0.0685 - accuracy: 0.9783 - 1s/epoch - 975us/step
Epoch 74/600
1268/1268 - 1s - loss: 0.0685 - accuracy: 0.9781 - 1s/epoch - 963us/step
Epoch 75/600
1268/1268 - 1s - loss: 0.0678 - accuracy: 0.9783 - 1s/epoch - 975us/step
Epoch 76/600
1268/1268 - 1s - loss: 0.0676 - accuracy: 0.9786 - 1s/epoch - 970us/step
Epoch 77/600
1268/1268 - 1s - loss: 0.0673 - accuracy: 0.9787 - 1s/epoch - 984us/step
Epoch 78/600
1268/1268 - 1s - loss: 0.0674 - accuracy: 0.9788 - 1s/epoch - 992us/step
Epoch 79/600
1268/1268 - 1s - loss: 0.0673 - accuracy: 0.9786 - 1s/epoch - 991us/step
Epoch 80/600
1268/1268 - 1s - loss: 0.0664 - accuracy: 0.9789 - 1s/epoch - 961us/step
Epoch 81/600
1268/1268 - 1s - loss: 0.0661 - accuracy: 0.9790 - 1s/epoch - 973us/step
Epoch 82/600
1268/1268 - 1s - loss: 0.0661 - accuracy: 0.9790 - 1s/epoch - 962us/step
Epoch 83/600
1268/1268 - 1s - loss: 0.0660 - accuracy: 0.9789 - 1s/epoch - 974us/step
Epoch 84/600
1268/1268 - 1s - loss: 0.0656 - accuracy: 0.9791 - 1s/epoch - 961us/step
Epoch 85/600
1268/1268 - 1s - loss: 0.0658 - accuracy: 0.9792 - 1s/epoch - 976us/step
Epoch 86/600
1268/1268 - 1s - loss: 0.0653 - accuracy: 0.9793 - 1s/epoch - 959us/step
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Epoch 87/600
1268/1268 - 1s - loss: 0.0650 - accuracy: 0.9794 - 1s/epoch - 969us/step
Epoch 88/600
1268/1268 - 1s - loss: 0.0648 - accuracy: 0.9795 - 1s/epoch - 961us/step
Epoch 89/600
1268/1268 - 1s - loss: 0.0642 - accuracy: 0.9797 - 1s/epoch - 976us/step
Epoch 90/600
1268/1268 - 1s - loss: 0.0651 - accuracy: 0.9792 - 1s/epoch - 956us/step
Epoch 91/600
1268/1268 - 1s - loss: 0.0639 - accuracy: 0.9800 - 1s/epoch - 964us/step
Epoch 92/600
1268/1268 - 1s - loss: 0.0639 - accuracy: 0.9796 - 1s/epoch - 988us/step
Epoch 93/600
1268/1268 - 1s - loss: 0.0639 - accuracy: 0.9800 - 1s/epoch - 984us/step
Epoch 94/600
1268/1268 - 1s - loss: 0.0640 - accuracy: 0.9794 - 1s/epoch - 963us/step
Epoch 95/600
1268/1268 - 1s - loss: 0.0636 - accuracy: 0.9799 - 1s/epoch - 971us/step
Epoch 96/600
1268/1268 - 1s - loss: 0.0633 - accuracy: 0.9802 - 1s/epoch - 964us/step
Epoch 97/600
1268/1268 - 1s - loss: 0.0626 - accuracy: 0.9802 - 1s/epoch - 984us/step
Epoch 98/600
1268/1268 - 1s - loss: 0.0625 - accuracy: 0.9803 - 1s/epoch - 963us/step
Epoch 99/600
1268/1268 - 1s - loss: 0.0627 - accuracy: 0.9804 - 1s/epoch - 974us/step
Epoch 100/600
1268/1268 - 1s - loss: 0.0623 - accuracy: 0.9804 - 1s/epoch - 962us/step
Epoch 101/600
1268/1268 - 1s - loss: 0.0624 - accuracy: 0.9801 - 1s/epoch - 982us/step
Epoch 102/600
1268/1268 - 1s - loss: 0.0614 - accuracy: 0.9807 - 1s/epoch - 954us/step
Epoch 103/600
1268/1268 - 1s - loss: 0.0616 - accuracy: 0.9802 - 1s/epoch - 980us/step
Epoch 104/600
1268/1268 - 1s - loss: 0.0617 - accuracy: 0.9807 - 1s/epoch - 971us/step
Epoch 105/600
1268/1268 - 1s - loss: 0.0612 - accuracy: 0.9802 - 1s/epoch - 988us/step
Epoch 106/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9805 - 1s/epoch - 967us/step
Epoch 107/600
1268/1268 - 1s - loss: 0.0613 - accuracy: 0.9803 - 1s/epoch - 983us/step
Epoch 108/600
1268/1268 - 1s - loss: 0.0608 - accuracy: 0.9804 - 1s/epoch - 963us/step
Epoch 109/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9806 - 1s/epoch - 1000us/step
Epoch 110/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9806 - 1s/epoch - 962us/step
Epoch 111/600
1268/1268 - 1s - loss: 0.0604 - accuracy: 0.9806 - 1s/epoch - 977us/step
Epoch 112/600
1268/1268 - 1s - loss: 0.0601 - accuracy: 0.9810 - 1s/epoch - 958us/step
Epoch 113/600
1268/1268 - 1s - loss: 0.0599 - accuracy: 0.9809 - 1s/epoch - 979us/step
Epoch 114/600
1268/1268 - 1s - loss: 0.0596 - accuracy: 0.9811 - 1s/epoch - 958us/step
Epoch 115/600
1268/1268 - 1s - loss: 0.0594 - accuracy: 0.9812 - 1s/epoch - 993us/step
Epoch 116/600
1268/1268 - 1s - loss: 0.0598 - accuracy: 0.9811 - 1s/epoch - 965us/step
Epoch 117/600
1268/1268 - 1s - loss: 0.0598 - accuracy: 0.9805 - 1s/epoch - 982us/step
Epoch 118/600
1268/1268 - 1s - loss: 0.0594 - accuracy: 0.9810 - 1s/epoch - 961us/step
Epoch 119/600
1268/1268 - 1s - loss: 0.0589 - accuracy: 0.9812 - 1s/epoch - 976us/step
Epoch 120/600
1268/1268 - 1s - loss: 0.0592 - accuracy: 0.9809 - 1s/epoch - 965us/step
Epoch 121/600
1268/1268 - 1s - loss: 0.0584 - accuracy: 0.9817 - 1s/epoch - 980us/step
Epoch 122/600
1268/1268 - 1s - loss: 0.0588 - accuracy: 0.9810 - 1s/epoch - 956us/step
Epoch 123/600
1268/1268 - 1s - loss: 0.0588 - accuracy: 0.9811 - 1s/epoch - 984us/step
Epoch 124/600
1268/1268 - 1s - loss: 0.0589 - accuracy: 0.9810 - 1s/epoch - 960us/step
Epoch 125/600
1268/1268 - 1s - loss: 0.0582 - accuracy: 0.9817 - 1s/epoch - 984us/step
Epoch 126/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9814 - 1s/epoch - 963us/step
Epoch 127/600
1268/1268 - 1s - loss: 0.0579 - accuracy: 0.9813 - 1s/epoch - 987us/step
Epoch 128/600
1268/1268 - 1s - loss: 0.0576 - accuracy: 0.9815 - 1s/epoch - 974us/step
Epoch 129/600
1268/1268 - 1s - loss: 0.0578 - accuracy: 0.9813 - 1s/epoch - 985us/step
Epoch 130/600
1268/1268 - 1s - loss: 0.0583 - accuracy: 0.9816 - 1s/epoch - 965us/step
Epoch 131/600
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1268/1268 - 1s - loss: 0.0575 - accuracy: 0.9817 - 1s/epoch - 984us/step
Epoch 132/600
1268/1268 - 1s - loss: 0.0576 - accuracy: 0.9812 - 1s/epoch - 965us/step
Epoch 133/600
1268/1268 - 1s - loss: 0.0570 - accuracy: 0.9819 - 1s/epoch - 983us/step
Epoch 134/600
1268/1268 - 1s - loss: 0.0574 - accuracy: 0.9813 - 1s/epoch - 961us/step
Epoch 135/600
1268/1268 - 1s - loss: 0.0571 - accuracy: 0.9818 - 1s/epoch - 979us/step
Epoch 136/600
1268/1268 - 1s - loss: 0.0576 - accuracy: 0.9812 - 1s/epoch - 1ms/step
Epoch 137/600
1268/1268 - 1s - loss: 0.0560 - accuracy: 0.9820 - 1s/epoch - 988us/step
Epoch 138/600
1268/1268 - 1s - loss: 0.0568 - accuracy: 0.9816 - 1s/epoch - 995us/step
Epoch 139/600
1268/1268 - 1s - loss: 0.0567 - accuracy: 0.9816 - 1s/epoch - 968us/step
Epoch 140/600
1268/1268 - 1s - loss: 0.0568 - accuracy: 0.9819 - 1s/epoch - 987us/step
Epoch 141/600
1268/1268 - 1s - loss: 0.0558 - accuracy: 0.9818 - 1s/epoch - 971us/step
Epoch 142/600
1268/1268 - 1s - loss: 0.0565 - accuracy: 0.9818 - 1s/epoch - 985us/step
Epoch 143/600
1268/1268 - 1s - loss: 0.0560 - accuracy: 0.9818 - 1s/epoch - 964us/step
Epoch 144/600
1268/1268 - 1s - loss: 0.0558 - accuracy: 0.9822 - 1s/epoch - 982us/step
Epoch 145/600
1268/1268 - 1s - loss: 0.0563 - accuracy: 0.9819 - 1s/epoch - 967us/step
Epoch 146/600
1268/1268 - 1s - loss: 0.0557 - accuracy: 0.9825 - 1s/epoch - 984us/step
Epoch 147/600
1268/1268 - 1s - loss: 0.0561 - accuracy: 0.9820 - 1s/epoch - 966us/step
Epoch 148/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9823 - 1s/epoch - 974us/step
Epoch 149/600
1268/1268 - 1s - loss: 0.0559 - accuracy: 0.9821 - 1s/epoch - 956us/step
Epoch 150/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9819 - 1s/epoch - 955us/step
Epoch 151/600
1268/1268 - 1s - loss: 0.0549 - accuracy: 0.9823 - 1s/epoch - 978us/step
Epoch 152/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9819 - 1s/epoch - 971us/step
Epoch 153/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9821 - 1s/epoch - 977us/step
Epoch 154/600
1268/1268 - 1s - loss: 0.0553 - accuracy: 0.9825 - 1s/epoch - 980us/step
Epoch 155/600
1268/1268 - 1s - loss: 0.0552 - accuracy: 0.9824 - 1s/epoch - 965us/step
Epoch 156/600
1268/1268 - 1s - loss: 0.0552 - accuracy: 0.9819 - 1s/epoch - 983us/step
Epoch 157/600
1268/1268 - 1s - loss: 0.0550 - accuracy: 0.9823 - 1s/epoch - 971us/step
Epoch 158/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9826 - 1s/epoch - 984us/step
Epoch 159/600
1268/1268 - 1s - loss: 0.0549 - accuracy: 0.9823 - 1s/epoch - 969us/step
Epoch 160/600
1268/1268 - 1s - loss: 0.0545 - accuracy: 0.9827 - 1s/epoch - 981us/step
Epoch 161/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9823 - 1s/epoch - 963us/step
Epoch 162/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9823 - 1s/epoch - 988us/step
Epoch 163/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9825 - 1s/epoch - 972us/step
Epoch 164/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9823 - 1s/epoch - 990us/step
Epoch 165/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9824 - 1s/epoch - 968us/step
Epoch 166/600
1268/1268 - 1s - loss: 0.0534 - accuracy: 0.9828 - 1s/epoch - 980us/step
Epoch 167/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9821 - 1s/epoch - 972us/step
Epoch 168/600
1268/1268 - 1s - loss: 0.0538 - accuracy: 0.9825 - 1s/epoch - 984us/step
Epoch 169/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9823 - 1s/epoch - 968us/step
Epoch 170/600
1268/1268 - 1s - loss: 0.0535 - accuracy: 0.9823 - 1s/epoch - 981us/step
Epoch 171/600
1268/1268 - 1s - loss: 0.0531 - accuracy: 0.9831 - 1s/epoch - 961us/step
Epoch 172/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9830 - 1s/epoch - 987us/step
Epoch 173/600
1268/1268 - 1s - loss: 0.0531 - accuracy: 0.9828 - 1s/epoch - 962us/step
Epoch 174/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9829 - 1s/epoch - 982us/step
Epoch 175/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9827 - 1s/epoch - 971us/step
```

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Epoch 176/600
1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9831 - 1s/epoch - 974us/step
Epoch 177/600
1268/1268 - 1s - loss: 0.0534 - accuracy: 0.9823 - 1s/epoch - 966us/step
Epoch 178/600
1268/1268 - 1s - loss: 0.0525 - accuracy: 0.9831 - 1s/epoch - 959us/step
Epoch 179/600
1268/1268 - 1s - loss: 0.0531 - accuracy: 0.9827 - 1s/epoch - 984us/step
Epoch 180/600
1268/1268 - 1s - loss: 0.0528 - accuracy: 0.9827 - 1s/epoch - 966us/step
Epoch 181/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9832 - 1s/epoch - 985us/step
Epoch 182/600
1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9829 - 1s/epoch - 965us/step
Epoch 183/600
1268/1268 - 1s - loss: 0.0523 - accuracy: 0.9831 - 1s/epoch - 976us/step
Epoch 184/600
1268/1268 - 1s - loss: 0.0522 - accuracy: 0.9830 - 1s/epoch - 962us/step
Epoch 185/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9831 - 1s/epoch - 982us/step
Epoch 186/600
1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9828 - 1s/epoch - 982us/step
Epoch 187/600
1268/1268 - 1s - loss: 0.0523 - accuracy: 0.9833 - 1s/epoch - 961us/step
Epoch 188/600
1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9833 - 1s/epoch - 965us/step
Epoch 189/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9832 - 1s/epoch - 985us/step
Epoch 190/600
1268/1268 - 1s - loss: 0.0513 - accuracy: 0.9834 - 1s/epoch - 969us/step
Epoch 191/600
1268/1268 - 1s - loss: 0.0517 - accuracy: 0.9835 - 1s/epoch - 982us/step
Epoch 192/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9831 - 1s/epoch - 984us/step
Epoch 193/600
1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9831 - 1s/epoch - 969us/step
Epoch 194/600
1268/1268 - 1s - loss: 0.0510 - accuracy: 0.9834 - 1s/epoch - 986us/step
Epoch 195/600
1268/1268 - 1s - loss: 0.0507 - accuracy: 0.9832 - 1s/epoch - 962us/step
Epoch 196/600
1268/1268 - 1s - loss: 0.0512 - accuracy: 0.9832 - 1s/epoch - 985us/step
Epoch 197/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9836 - 1s/epoch - 967us/step
Epoch 198/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9834 - 1s/epoch - 989us/step
Epoch 199/600
1268/1268 - 1s - loss: 0.0512 - accuracy: 0.9835 - 1s/epoch - 965us/step
Epoch 200/600
1268/1268 - 1s - loss: 0.0507 - accuracy: 0.9835 - 1s/epoch - 968us/step
Epoch 201/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9832 - 1s/epoch - 986us/step
Epoch 202/600
1268/1268 - 1s - loss: 0.0509 - accuracy: 0.9832 - 1s/epoch - 976us/step
Epoch 203/600
1268/1268 - 1s - loss: 0.0504 - accuracy: 0.9838 - 1s/epoch - 987us/step
Epoch 204/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9838 - 1s/epoch - 965us/step
Epoch 205/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9840 - 1s/epoch - 981us/step
Epoch 206/600
1268/1268 - 1s - loss: 0.0507 - accuracy: 0.9835 - 1s/epoch - 984us/step
Epoch 207/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9836 - 1s/epoch - 965us/step
Epoch 208/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9836 - 1s/epoch - 985us/step
Epoch 209/600
1268/1268 - 1s - loss: 0.0504 - accuracy: 0.9832 - 1s/epoch - 970us/step
Epoch 210/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9836 - 1s/epoch - 990us/step
Epoch 211/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9836 - 1s/epoch - 964us/step
Epoch 212/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9836 - 1s/epoch - 995us/step
Epoch 213/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9838 - 1s/epoch - 978us/step
Epoch 214/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9835 - 1s/epoch - 963us/step
Epoch 215/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9836 - 1s/epoch - 986us/step
Epoch 216/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9839 - 1s/epoch - 965us/step
Epoch 217/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9839 - 1s/epoch - 991us/step
Epoch 218/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9838 - 1s/epoch - 973us/step
Epoch 219/600
1268/1268 - 1s - loss: 0.0496 - accuracy: 0.9836 - 1s/epoch - 985us/step
Epoch 220/600
```

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1268/1268 - 1s - loss: 0.0499 - accuracy: 0.9838 - 1s/epoch - 969us/step
Epoch 221/600
1268/1268 - 1s - loss: 0.0496 - accuracy: 0.9836 - 1s/epoch - 987us/step
Epoch 222/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9838 - 1s/epoch - 961us/step
Epoch 223/600
1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9838 - 1s/epoch - 980us/step
Epoch 224/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9836 - 1s/epoch - 965us/step
Epoch 225/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9840 - 1s/epoch - 994us/step
Epoch 226/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9840 - 1s/epoch - 968us/step
Epoch 227/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9842 - 1s/epoch - 975us/step
Epoch 228/600
1268/1268 - 1s - loss: 0.0491 - accuracy: 0.9841 - 1s/epoch - 969us/step
Epoch 229/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9841 - 1s/epoch - 985us/step
Epoch 230/600
1268/1268 - 1s - loss: 0.0491 - accuracy: 0.9837 - 1s/epoch - 967us/step
Epoch 231/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9842 - 1s/epoch - 983us/step
Epoch 232/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9839 - 1s/epoch - 962us/step
Epoch 233/600
1268/1268 - 1s - loss: 0.0490 - accuracy: 0.9841 - 1s/epoch - 983us/step
Epoch 234/600
1268/1268 - 1s - loss: 0.0484 - accuracy: 0.9844 - 1s/epoch - 969us/step
Epoch 235/600
1268/1268 - 1s - loss: 0.0485 - accuracy: 0.9842 - 1s/epoch - 984us/step
Epoch 236/600
1268/1268 - 1s - loss: 0.0488 - accuracy: 0.9842 - 1s/epoch - 967us/step
Epoch 237/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9844 - 1s/epoch - 983us/step
Epoch 238/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9845 - 1s/epoch - 968us/step
Epoch 239/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9844 - 1s/epoch - 975us/step
Epoch 240/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9844 - 1s/epoch - 970us/step
Epoch 241/600
1268/1268 - 1s - loss: 0.0477 - accuracy: 0.9845 - 1s/epoch - 991us/step
Epoch 242/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9841 - 1s/epoch - 967us/step
Epoch 243/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9844 - 1s/epoch - 986us/step
Epoch 244/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9843 - 1s/epoch - 966us/step
Epoch 245/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9847 - 1s/epoch - 985us/step
Epoch 246/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9840 - 1s/epoch - 965us/step
Epoch 247/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9844 - 1s/epoch - 988us/step
Epoch 248/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9848 - 1s/epoch - 966us/step
Epoch 249/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9840 - 1s/epoch - 984us/step
Epoch 250/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9843 - 1s/epoch - 968us/step
Epoch 251/600
1268/1268 - 1s - loss: 0.0473 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 252/600
1268/1268 - 1s - loss: 0.0473 - accuracy: 0.9846 - 1s/epoch - 961us/step
Epoch 253/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9843 - 1s/epoch - 981us/step
Epoch 254/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9848 - 1s/epoch - 963us/step
Epoch 255/600
1268/1268 - 1s - loss: 0.0475 - accuracy: 0.9845 - 1s/epoch - 979us/step
Epoch 256/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9847 - 1s/epoch - 958us/step
Epoch 257/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9844 - 1s/epoch - 978us/step
Epoch 258/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9842 - 1s/epoch - 966us/step
Epoch 259/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9848 - 1s/epoch - 983us/step
Epoch 260/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9843 - 1s/epoch - 964us/step
Epoch 261/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9845 - 1s/epoch - 965us/step
Epoch 262/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9844 - 1s/epoch - 985us/step
Epoch 263/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9847 - 1s/epoch - 986us/step
Epoch 264/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9846 - 1s/epoch - 965us/step
```

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Epoch 265/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9845 - 1s/epoch - 992us/step
Epoch 266/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9843 - 1s/epoch - 966us/step
Epoch 267/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9846 - 1s/epoch - 983us/step
Epoch 268/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9846 - 1s/epoch - 960us/step
Epoch 269/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9845 - 1s/epoch - 985us/step
Epoch 270/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9847 - 1s/epoch - 967us/step
Epoch 271/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9844 - 1s/epoch - 978us/step
Epoch 272/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9847 - 1s/epoch - 972us/step
Epoch 273/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9848 - 1s/epoch - 988us/step
Epoch 274/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9850 - 1s/epoch - 966us/step
Epoch 275/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9845 - 1s/epoch - 996us/step
Epoch 276/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9843 - 1s/epoch - 964us/step
Epoch 277/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9847 - 1s/epoch - 986us/step
Epoch 278/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9849 - 1s/epoch - 969us/step
Epoch 279/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9847 - 1s/epoch - 968us/step
Epoch 280/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9849 - 1s/epoch - 986us/step
Epoch 281/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9845 - 1s/epoch - 974us/step
Epoch 282/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9848 - 1s/epoch - 971us/step
Epoch 283/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9848 - 1s/epoch - 983us/step
Epoch 284/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9850 - 1s/epoch - 963us/step
Epoch 285/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9849 - 1s/epoch - 967us/step
Epoch 286/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9849 - 1s/epoch - 980us/step
Epoch 287/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9849 - 1s/epoch - 991us/step
Epoch 288/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9846 - 1s/epoch - 964us/step
Epoch 289/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9851 - 1s/epoch - 985us/step
Epoch 290/600
1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9855 - 1s/epoch - 969us/step
Epoch 291/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9849 - 1s/epoch - 968us/step
Epoch 292/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9846 - 1s/epoch - 978us/step
Epoch 293/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9850 - 1s/epoch - 982us/step
Epoch 294/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9851 - 1s/epoch - 964us/step
Epoch 295/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9850 - 1s/epoch - 987us/step
Epoch 296/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9853 - 1s/epoch - 970us/step
Epoch 297/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9851 - 1s/epoch - 987us/step
Epoch 298/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9852 - 1s/epoch - 963us/step
Epoch 299/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9851 - 1s/epoch - 978us/step
Epoch 300/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9845 - 1s/epoch - 982us/step
Epoch 301/600
1268/1268 - 1s - loss: 0.0447 - accuracy: 0.9851 - 1s/epoch - 986us/step
Epoch 302/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9848 - 1s/epoch - 969us/step
Epoch 303/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9850 - 1s/epoch - 991us/step
Epoch 304/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9854 - 1s/epoch - 986us/step
Epoch 305/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9848 - 1s/epoch - 964us/step
Epoch 306/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9853 - 1s/epoch - 963us/step
Epoch 307/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9847 - 1s/epoch - 984us/step
Epoch 308/600
1268/1268 - 1s - loss: 0.0448 - accuracy: 0.9851 - 1s/epoch - 984us/step
Epoch 309/600
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1268/1268 - 1s - loss: 0.0448 - accuracy: 0.9852 - 1s/epoch - 968us/step
Epoch 310/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9853 - 1s/epoch - 961us/step
Epoch 311/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9853 - 1s/epoch - 986us/step
Epoch 312/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9853 - 1s/epoch - 971us/step
Epoch 313/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9851 - 1s/epoch - 961us/step
Epoch 314/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9854 - 1s/epoch - 982us/step
Epoch 315/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9851 - 1s/epoch - 961us/step
Epoch 316/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9852 - 1s/epoch - 969us/step
Epoch 317/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9856 - 1s/epoch - 965us/step
Epoch 318/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9853 - 1s/epoch - 991us/step
Epoch 319/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9855 - 1s/epoch - 968us/step
Epoch 320/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9855 - 1s/epoch - 985us/step
Epoch 321/600
1268/1268 - 1s - loss: 0.0444 - accuracy: 0.9853 - 1s/epoch - 966us/step
Epoch 322/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9852 - 1s/epoch - 986us/step
Epoch 323/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9856 - 1s/epoch - 965us/step
Epoch 324/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9851 - 1s/epoch - 986us/step
Epoch 325/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9850 - 1s/epoch - 961us/step
Epoch 326/600
1268/1268 - 1s - loss: 0.0443 - accuracy: 0.9852 - 1s/epoch - 964us/step
Epoch 327/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9854 - 1s/epoch - 985us/step
Epoch 328/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9853 - 1s/epoch - 976us/step
Epoch 329/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9852 - 1s/epoch - 963us/step
Epoch 330/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9857 - 1s/epoch - 963us/step
Epoch 331/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9856 - 1s/epoch - 985us/step
Epoch 332/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9858 - 1s/epoch - 982us/step
Epoch 333/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9855 - 1s/epoch - 967us/step
Epoch 334/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9855 - 1s/epoch - 987us/step
Epoch 335/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9856 - 1s/epoch - 961us/step
Epoch 336/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9852 - 1s/epoch - 989us/step
Epoch 337/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9856 - 1s/epoch - 964us/step
Epoch 338/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9855 - 1s/epoch - 988us/step
Epoch 339/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9854 - 1s/epoch - 966us/step
Epoch 340/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9857 - 1s/epoch - 983us/step
Epoch 341/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9856 - 1s/epoch - 965us/step
Epoch 342/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9856 - 1s/epoch - 978us/step
Epoch 343/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9858 - 1s/epoch - 965us/step
Epoch 344/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9857 - 1s/epoch - 984us/step
Epoch 345/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9855 - 1s/epoch - 972us/step
Epoch 346/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9856 - 1s/epoch - 987us/step
Epoch 347/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9855 - 1s/epoch - 965us/step
Epoch 348/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 990us/step
Epoch 349/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9859 - 1s/epoch - 965us/step
Epoch 350/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9859 - 1s/epoch - 982us/step
Epoch 351/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9854 - 1s/epoch - 960us/step
Epoch 352/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9854 - 1s/epoch - 996us/step
Epoch 353/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9858 - 1s/epoch - 967us/step
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Epoch 354/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9860 - 1s/epoch - 983us/step
Epoch 355/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9852 - 1s/epoch - 972us/step
Epoch 356/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9859 - 1s/epoch - 988us/step
Epoch 357/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9862 - 1s/epoch - 965us/step
Epoch 358/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9857 - 1s/epoch - 967us/step
Epoch 359/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9861 - 1s/epoch - 982us/step
Epoch 360/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9860 - 1s/epoch - 990us/step
Epoch 361/600
1268/1268 - 1s - loss: 0.0433 - accuracy: 0.9855 - 1s/epoch - 961us/step
Epoch 362/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9856 - 1s/epoch - 964us/step
Epoch 363/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9854 - 1s/epoch - 983us/step
Epoch 364/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9860 - 1s/epoch - 972us/step
Epoch 365/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9855 - 1s/epoch - 965us/step
Epoch 366/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9860 - 1s/epoch - 954us/step
Epoch 367/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9862 - 1s/epoch - 973us/step
Epoch 368/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9858 - 1s/epoch - 980us/step
Epoch 369/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9858 - 1s/epoch - 968us/step
Epoch 370/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9858 - 1s/epoch - 983us/step
Epoch 371/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9861 - 1s/epoch - 966us/step
Epoch 372/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9861 - 1s/epoch - 957us/step
Epoch 373/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9860 - 1s/epoch - 978us/step
Epoch 374/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9862 - 1s/epoch - 969us/step
Epoch 375/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9862 - 1s/epoch - 960us/step
Epoch 376/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9861 - 1s/epoch - 985us/step
Epoch 377/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9857 - 1s/epoch - 959us/step
Epoch 378/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9860 - 1s/epoch - 975us/step
Epoch 379/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9862 - 1s/epoch - 956us/step
Epoch 380/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9860 - 1s/epoch - 989us/step
Epoch 381/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9861 - 1s/epoch - 963us/step
Epoch 382/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9856 - 1s/epoch - 988us/step
Epoch 383/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9862 - 1s/epoch - 961us/step
Epoch 384/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9862 - 1s/epoch - 988us/step
Epoch 385/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9861 - 1s/epoch - 971us/step
Epoch 386/600
1268/1268 - 1s - loss: 0.0417 - accuracy: 0.9858 - 1s/epoch - 970us/step
Epoch 387/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9861 - 1s/epoch - 965us/step
Epoch 388/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9860 - 1s/epoch - 980us/step
Epoch 389/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9864 - 1s/epoch - 957us/step
Epoch 390/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9865 - 1s/epoch - 977us/step
Epoch 391/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9862 - 1s/epoch - 959us/step
Epoch 392/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9860 - 1s/epoch - 978us/step
Epoch 393/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9865 - 1s/epoch - 959us/step
Epoch 394/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9861 - 1s/epoch - 977us/step
Epoch 395/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9861 - 1s/epoch - 962us/step
Epoch 396/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9865 - 1s/epoch - 970us/step
Epoch 397/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9859 - 1s/epoch - 965us/step
Epoch 398/600
```

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1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9863 - 1s/epoch - 980us/step
Epoch 399/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9863 - 1s/epoch - 962us/step
Epoch 400/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9863 - 1s/epoch - 982us/step
Epoch 401/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9861 - 1s/epoch - 970us/step
Epoch 402/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9863 - 1s/epoch - 983us/step
Epoch 403/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9861 - 1s/epoch - 969us/step
Epoch 404/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9862 - 1s/epoch - 984us/step
Epoch 405/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9863 - 1s/epoch - 973us/step
Epoch 406/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9862 - 1s/epoch - 970us/step
Epoch 407/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9863 - 1s/epoch - 971us/step
Epoch 408/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9863 - 1s/epoch - 982us/step
Epoch 409/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9859 - 1s/epoch - 967us/step
Epoch 410/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9866 - 1s/epoch - 983us/step
Epoch 411/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9863 - 1s/epoch - 961us/step
Epoch 412/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9865 - 1s/epoch - 986us/step
Epoch 413/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9867 - 1s/epoch - 964us/step
Epoch 414/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9863 - 1s/epoch - 989us/step
Epoch 415/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9863 - 1s/epoch - 966us/step
Epoch 416/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9864 - 1s/epoch - 972us/step
Epoch 417/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9863 - 1s/epoch - 966us/step
Epoch 418/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9867 - 1s/epoch - 978us/step
Epoch 419/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9864 - 1s/epoch - 991us/step
Epoch 420/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9861 - 1s/epoch - 965us/step
Epoch 421/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9867 - 1s/epoch - 982us/step
Epoch 422/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9867 - 1s/epoch - 963us/step
Epoch 423/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9868 - 1s/epoch - 984us/step
Epoch 424/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9866 - 1s/epoch - 969us/step
Epoch 425/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9864 - 1s/epoch - 988us/step
Epoch 426/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9865 - 1s/epoch - 955us/step
Epoch 427/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 428/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9863 - 1s/epoch - 969us/step
Epoch 429/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9863 - 1s/epoch - 996us/step
Epoch 430/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9865 - 1s/epoch - 965us/step
Epoch 431/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9867 - 1s/epoch - 991us/step
Epoch 432/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9863 - 1s/epoch - 963us/step
Epoch 433/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9865 - 1s/epoch - 982us/step
Epoch 434/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9866 - 1s/epoch - 959us/step
Epoch 435/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9866 - 1s/epoch - 974us/step
Epoch 436/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9866 - 1s/epoch - 959us/step
Epoch 437/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9866 - 1s/epoch - 992us/step
Epoch 438/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9866 - 1s/epoch - 964us/step
Epoch 439/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9865 - 1s/epoch - 961us/step
Epoch 440/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9866 - 1s/epoch - 980us/step
Epoch 441/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9868 - 1s/epoch - 986us/step
Epoch 442/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9867 - 1s/epoch - 961us/step
```

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Epoch 443/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9864 - 1s/epoch - 984us/step
Epoch 444/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9867 - 1s/epoch - 987us/step
Epoch 445/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9864 - 1s/epoch - 961us/step
Epoch 446/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9869 - 1s/epoch - 989us/step
Epoch 447/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9867 - 1s/epoch - 984us/step
Epoch 448/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9868 - 1s/epoch - 961us/step
Epoch 449/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9864 - 1s/epoch - 968us/step
Epoch 450/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9867 - 1s/epoch - 988us/step
Epoch 451/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9868 - 1s/epoch - 984us/step
Epoch 452/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 963us/step
Epoch 453/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9868 - 1s/epoch - 978us/step
Epoch 454/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9867 - 1s/epoch - 963us/step
Epoch 455/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9868 - 1s/epoch - 971us/step
Epoch 456/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9866 - 1s/epoch - 970us/step
Epoch 457/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 986us/step
Epoch 458/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9869 - 1s/epoch - 965us/step
Epoch 459/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9869 - 1s/epoch - 965us/step
Epoch 460/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9866 - 1s/epoch - 990us/step
Epoch 461/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9869 - 1s/epoch - 984us/step
Epoch 462/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9865 - 1s/epoch - 971us/step
Epoch 463/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9868 - 1s/epoch - 984us/step
Epoch 464/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9867 - 1s/epoch - 965us/step
Epoch 465/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9871 - 1s/epoch - 972us/step
Epoch 466/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9868 - 1s/epoch - 973us/step
Epoch 467/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9866 - 1s/epoch - 957us/step
Epoch 468/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9873 - 1s/epoch - 975us/step
Epoch 469/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9866 - 1s/epoch - 958us/step
Epoch 470/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9869 - 1s/epoch - 965us/step
Epoch 471/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9866 - 1s/epoch - 979us/step
Epoch 472/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9867 - 1s/epoch - 959us/step
Epoch 473/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9867 - 1s/epoch - 975us/step
Epoch 474/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9871 - 1s/epoch - 967us/step
Epoch 475/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9866 - 1s/epoch - 977us/step
Epoch 476/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9870 - 1s/epoch - 957us/step
Epoch 477/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9867 - 1s/epoch - 975us/step
Epoch 478/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9869 - 1s/epoch - 958us/step
Epoch 479/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9868 - 1s/epoch - 979us/step
Epoch 480/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9872 - 1s/epoch - 956us/step
Epoch 481/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9872 - 1s/epoch - 977us/step
Epoch 482/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9869 - 1s/epoch - 965us/step
Epoch 483/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9869 - 1s/epoch - 964us/step
Epoch 484/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9868 - 1s/epoch - 974us/step
Epoch 485/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 967us/step
Epoch 486/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 984us/step
Epoch 487/600
```

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1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9867 - 1s/epoch - 979us/step
Epoch 488/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9870 - 1s/epoch - 964us/step
Epoch 489/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 974us/step
Epoch 490/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9870 - 1s/epoch - 966us/step
Epoch 491/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 979us/step
Epoch 492/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9873 - 1s/epoch - 966us/step
Epoch 493/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9868 - 1s/epoch - 987us/step
Epoch 494/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9871 - 1s/epoch - 965us/step
Epoch 495/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9870 - 1s/epoch - 992us/step
Epoch 496/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9872 - 1s/epoch - 962us/step
Epoch 497/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9869 - 1s/epoch - 977us/step
Epoch 498/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9871 - 1s/epoch - 963us/step
Epoch 499/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9870 - 1s/epoch - 976us/step
Epoch 500/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9876 - 1s/epoch - 956us/step
Epoch 501/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9870 - 1s/epoch - 978us/step
Epoch 502/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 961us/step
Epoch 503/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9872 - 1s/epoch - 983us/step
Epoch 504/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9872 - 1s/epoch - 960us/step
Epoch 505/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 983us/step
Epoch 506/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9875 - 1s/epoch - 967us/step
Epoch 507/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9871 - 1s/epoch - 986us/step
Epoch 508/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9870 - 1s/epoch - 968us/step
Epoch 509/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9874 - 1s/epoch - 982us/step
Epoch 510/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9867 - 1s/epoch - 968us/step
Epoch 511/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9875 - 1s/epoch - 980us/step
Epoch 512/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9872 - 1s/epoch - 966us/step
Epoch 513/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9868 - 1s/epoch - 959us/step
Epoch 514/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9879 - 1s/epoch - 983us/step
Epoch 515/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9876 - 1s/epoch - 982us/step
Epoch 516/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9872 - 1s/epoch - 963us/step
Epoch 517/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9874 - 1s/epoch - 984us/step
Epoch 518/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9877 - 1s/epoch - 982us/step
Epoch 519/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9874 - 1s/epoch - 986us/step
Epoch 520/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9870 - 1s/epoch - 970us/step
Epoch 521/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 986us/step
Epoch 522/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9872 - 1s/epoch - 961us/step
Epoch 523/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9876 - 1s/epoch - 985us/step
Epoch 524/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9873 - 1s/epoch - 992us/step
Epoch 525/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9868 - 1s/epoch - 965us/step
Epoch 526/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9880 - 1s/epoch - 982us/step
Epoch 527/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9876 - 1s/epoch - 964us/step
Epoch 528/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9872 - 1s/epoch - 982us/step
Epoch 529/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9871 - 1s/epoch - 963us/step
Epoch 530/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9871 - 1s/epoch - 986us/step
Epoch 531/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9870 - 1s/epoch - 995us/step
```

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Epoch 532/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9874 - 1s/epoch - 970us/step
Epoch 533/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9876 - 1s/epoch - 985us/step
Epoch 534/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9871 - 1s/epoch - 968us/step
Epoch 535/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9878 - 1s/epoch - 985us/step
Epoch 536/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9871 - 1s/epoch - 981us/step
Epoch 537/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9872 - 1s/epoch - 966us/step
Epoch 538/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9873 - 1s/epoch - 986us/step
Epoch 539/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9871 - 1s/epoch - 971us/step
Epoch 540/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9873 - 1s/epoch - 984us/step
Epoch 541/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9873 - 1s/epoch - 966us/step
Epoch 542/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9872 - 1s/epoch - 991us/step
Epoch 543/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9872 - 1s/epoch - 998us/step
Epoch 544/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9875 - 1s/epoch - 973us/step
Epoch 545/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9874 - 1s/epoch - 986us/step
Epoch 546/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9874 - 1s/epoch - 964us/step
Epoch 547/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9871 - 1s/epoch - 983us/step
Epoch 548/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9876 - 1s/epoch - 962us/step
Epoch 549/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9871 - 1s/epoch - 971us/step
Epoch 550/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9874 - 1s/epoch - 958us/step
Epoch 551/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9878 - 1s/epoch - 960us/step
Epoch 552/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9872 - 1s/epoch - 984us/step
Epoch 553/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9876 - 1s/epoch - 976us/step
Epoch 554/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9874 - 1s/epoch - 961us/step
Epoch 555/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9874 - 1s/epoch - 992us/step
Epoch 556/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9873 - 1s/epoch - 969us/step
Epoch 557/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9876 - 1s/epoch - 967us/step
Epoch 558/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9873 - 1s/epoch - 984us/step
Epoch 559/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9870 - 1s/epoch - 986us/step
Epoch 560/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9876 - 1s/epoch - 975us/step
Epoch 561/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9877 - 1s/epoch - 990us/step
Epoch 562/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9875 - 1s/epoch - 963us/step
Epoch 563/600
1268/1268 - 1s - loss: 0.0376 - accuracy: 0.9870 - 1s/epoch - 988us/step
Epoch 564/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9875 - 1s/epoch - 989us/step
Epoch 565/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9876 - 1s/epoch - 961us/step
Epoch 566/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9873 - 1s/epoch - 984us/step
Epoch 567/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9876 - 1s/epoch - 970us/step
Epoch 568/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 569/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9875 - 1s/epoch - 985us/step
Epoch 570/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9876 - 1s/epoch - 967us/step
Epoch 571/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9874 - 1s/epoch - 989us/step
Epoch 572/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9873 - 1s/epoch - 968us/step
Epoch 573/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9875 - 1s/epoch - 981us/step
Epoch 574/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9878 - 1s/epoch - 956us/step
Epoch 575/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9876 - 1s/epoch - 973us/step
Epoch 576/600
```

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1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9876 - 1s/epoch - 982us/step
Epoch 577/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9875 - 1s/epoch - 966us/step
Epoch 578/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9871 - 1s/epoch - 973us/step
Epoch 579/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9872 - 1s/epoch - 992us/step
Epoch 580/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9875 - 1s/epoch - 964us/step
Epoch 581/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9875 - 1s/epoch - 984us/step
Epoch 582/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9876 - 1s/epoch - 966us/step
Epoch 583/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9875 - 1s/epoch - 980us/step
Epoch 584/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9882 - 1s/epoch - 990us/step
Epoch 585/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9875 - 1s/epoch - 963us/step
Epoch 586/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9878 - 1s/epoch - 982us/step
Epoch 587/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9875 - 1s/epoch - 987us/step
Epoch 588/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9871 - 1s/epoch - 966us/step
Epoch 589/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9877 - 1s/epoch - 998us/step
Epoch 590/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9878 - 1s/epoch - 983us/step
Epoch 591/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9877 - 1s/epoch - 991us/step
Epoch 592/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9876 - 1s/epoch - 992us/step
Epoch 593/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9877 - 1s/epoch - 990us/step
Epoch 594/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9878 - 1s/epoch - 967us/step
Epoch 595/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 596/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9878 - 1s/epoch - 988us/step
Epoch 597/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9879 - 1s/epoch - 965us/step
Epoch 598/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9876 - 1s/epoch - 984us/step
Epoch 599/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9876 - 1s/epoch - 986us/step
Epoch 600/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9877 - 1s/epoch - 967us/step
990/990 [==============================] - 1s 722us/step
Epoch 1/600
1268/1268 - 2s - loss: 0.3681 - accuracy: 0.8322 - 2s/epoch - 1ms/step
Epoch 2/600
1268/1268 - 1s - loss: 0.2339 - accuracy: 0.9059 - 1s/epoch - 1ms/step
Epoch 3/600
1268/1268 - 1s - loss: 0.1881 - accuracy: 0.9273 - 1s/epoch - 1ms/step
Epoch 4/600
1268/1268 - 1s - loss: 0.1633 - accuracy: 0.9389 - 1s/epoch - 1ms/step
Epoch 5/600
1268/1268 - 1s - loss: 0.1481 - accuracy: 0.9463 - 1s/epoch - 1ms/step
Epoch 6/600
1268/1268 - 1s - loss: 0.1379 - accuracy: 0.9506 - 1s/epoch - 1ms/step
Epoch 7/600
1268/1268 - 1s - loss: 0.1298 - accuracy: 0.9544 - 1s/epoch - 1ms/step
Epoch 8/600
1268/1268 - 1s - loss: 0.1249 - accuracy: 0.9566 - 1s/epoch - 1ms/step
Epoch 9/600
1268/1268 - 1s - loss: 0.1200 - accuracy: 0.9583 - 1s/epoch - 1ms/step
Epoch 10/600
1268/1268 - 1s - loss: 0.1159 - accuracy: 0.9608 - 1s/epoch - 1ms/step
Epoch 11/600
1268/1268 - 1s - loss: 0.1125 - accuracy: 0.9614 - 1s/epoch - 1ms/step
Epoch 12/600
1268/1268 - 1s - loss: 0.1090 - accuracy: 0.9639 - 1s/epoch - 1ms/step
Epoch 13/600
1268/1268 - 1s - loss: 0.1063 - accuracy: 0.9644 - 1s/epoch - 1ms/step
Epoch 14/600
1268/1268 - 1s - loss: 0.1039 - accuracy: 0.9658 - 1s/epoch - 1ms/step
Epoch 15/600
1268/1268 - 1s - loss: 0.1025 - accuracy: 0.9662 - 1s/epoch - 1ms/step
Epoch 16/600
1268/1268 - 1s - loss: 0.0998 - accuracy: 0.9670 - 1s/epoch - 1ms/step
Epoch 17/600
1268/1268 - 1s - loss: 0.0979 - accuracy: 0.9682 - 1s/epoch - 1ms/step
Epoch 18/600
1268/1268 - 1s - loss: 0.0968 - accuracy: 0.9683 - 1s/epoch - 1ms/step
Epoch 19/600
1268/1268 - 1s - loss: 0.0951 - accuracy: 0.9689 - 1s/epoch - 1ms/step
Epoch 20/600
```

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1268/1268 - 1s - loss: 0.0934 - accuracy: 0.9693 - 1s/epoch - 1ms/step
Epoch 21/600
1268/1268 - 1s - loss: 0.0920 - accuracy: 0.9699 - 1s/epoch - 1ms/step
Epoch 22/600
1268/1268 - 1s - loss: 0.0908 - accuracy: 0.9704 - 1s/epoch - 1ms/step
Epoch 23/600
1268/1268 - 1s - loss: 0.0902 - accuracy: 0.9707 - 1s/epoch - 1ms/step
Epoch 24/600
1268/1268 - 1s - loss: 0.0893 - accuracy: 0.9715 - 1s/epoch - 1ms/step
Epoch 25/600
1268/1268 - 1s - loss: 0.0878 - accuracy: 0.9720 - 1s/epoch - 1ms/step
Epoch 26/600
1268/1268 - 1s - loss: 0.0866 - accuracy: 0.9719 - 1s/epoch - 1ms/step
Epoch 27/600
1268/1268 - 1s - loss: 0.0859 - accuracy: 0.9728 - 1s/epoch - 1ms/step
Epoch 28/600
1268/1268 - 1s - loss: 0.0850 - accuracy: 0.9729 - 1s/epoch - 1ms/step
Epoch 29/600
1268/1268 - 1s - loss: 0.0839 - accuracy: 0.9731 - 1s/epoch - 1ms/step
Epoch 30/600
1268/1268 - 1s - loss: 0.0837 - accuracy: 0.9734 - 1s/epoch - 1ms/step
Epoch 31/600
1268/1268 - 1s - loss: 0.0826 - accuracy: 0.9738 - 1s/epoch - 1ms/step
Epoch 32/600
1268/1268 - 1s - loss: 0.0820 - accuracy: 0.9738 - 1s/epoch - 1ms/step
Epoch 33/600
1268/1268 - 1s - loss: 0.0807 - accuracy: 0.9746 - 1s/epoch - 1ms/step
Epoch 34/600
1268/1268 - 1s - loss: 0.0805 - accuracy: 0.9742 - 1s/epoch - 1ms/step
Epoch 35/600
1268/1268 - 1s - loss: 0.0795 - accuracy: 0.9751 - 1s/epoch - 1ms/step
Epoch 36/600
1268/1268 - 1s - loss: 0.0792 - accuracy: 0.9748 - 1s/epoch - 1ms/step
Epoch 37/600
1268/1268 - 1s - loss: 0.0791 - accuracy: 0.9752 - 1s/epoch - 1ms/step
Epoch 38/600
1268/1268 - 1s - loss: 0.0788 - accuracy: 0.9750 - 1s/epoch - 1ms/step
Epoch 39/600
1268/1268 - 1s - loss: 0.0771 - accuracy: 0.9759 - 1s/epoch - 1ms/step
Epoch 40/600
1268/1268 - 1s - loss: 0.0774 - accuracy: 0.9754 - 1s/epoch - 1ms/step
Epoch 41/600
1268/1268 - 1s - loss: 0.0768 - accuracy: 0.9757 - 1s/epoch - 1ms/step
Epoch 42/600
1268/1268 - 1s - loss: 0.0761 - accuracy: 0.9759 - 1s/epoch - 999us/step
Epoch 43/600
1268/1268 - 1s - loss: 0.0754 - accuracy: 0.9762 - 1s/epoch - 1ms/step
Epoch 44/600
1268/1268 - 1s - loss: 0.0749 - accuracy: 0.9764 - 1s/epoch - 1ms/step
Epoch 45/600
1268/1268 - 1s - loss: 0.0753 - accuracy: 0.9760 - 1s/epoch - 1ms/step
Epoch 46/600
1268/1268 - 1s - loss: 0.0740 - accuracy: 0.9765 - 1s/epoch - 1ms/step
Epoch 47/600
1268/1268 - 1s - loss: 0.0734 - accuracy: 0.9767 - 1s/epoch - 1ms/step
Epoch 48/600
1268/1268 - 1s - loss: 0.0734 - accuracy: 0.9767 - 1s/epoch - 1ms/step
Epoch 49/600
1268/1268 - 1s - loss: 0.0729 - accuracy: 0.9769 - 1s/epoch - 1ms/step
Epoch 50/600
1268/1268 - 1s - loss: 0.0728 - accuracy: 0.9771 - 1s/epoch - 1ms/step
Epoch 51/600
1268/1268 - 1s - loss: 0.0720 - accuracy: 0.9773 - 1s/epoch - 1ms/step
Epoch 52/600
1268/1268 - 1s - loss: 0.0722 - accuracy: 0.9770 - 1s/epoch - 1ms/step
Epoch 53/600
1268/1268 - 1s - loss: 0.0712 - accuracy: 0.9779 - 1s/epoch - 1ms/step
Epoch 54/600
1268/1268 - 1s - loss: 0.0713 - accuracy: 0.9775 - 1s/epoch - 1ms/step
Epoch 55/600
1268/1268 - 1s - loss: 0.0707 - accuracy: 0.9774 - 1s/epoch - 1ms/step
Epoch 56/600
1268/1268 - 1s - loss: 0.0702 - accuracy: 0.9777 - 1s/epoch - 1ms/step
Epoch 57/600
1268/1268 - 1s - loss: 0.0701 - accuracy: 0.9777 - 1s/epoch - 1ms/step
Epoch 58/600
1268/1268 - 1s - loss: 0.0697 - accuracy: 0.9778 - 1s/epoch - 1ms/step
Epoch 59/600
1268/1268 - 1s - loss: 0.0691 - accuracy: 0.9779 - 1s/epoch - 1ms/step
Epoch 60/600
1268/1268 - 1s - loss: 0.0690 - accuracy: 0.9780 - 1s/epoch - 1ms/step
Epoch 61/600
1268/1268 - 1s - loss: 0.0691 - accuracy: 0.9779 - 1s/epoch - 1ms/step
Epoch 62/600
1268/1268 - 1s - loss: 0.0684 - accuracy: 0.9786 - 1s/epoch - 1ms/step
Epoch 63/600
1268/1268 - 1s - loss: 0.0688 - accuracy: 0.9781 - 1s/epoch - 1ms/step
Epoch 64/600
1268/1268 - 1s - loss: 0.0681 - accuracy: 0.9784 - 1s/epoch - 1ms/step
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Epoch 65/600
1268/1268 - 1s - loss: 0.0680 - accuracy: 0.9781 - 1s/epoch - 1ms/step
Epoch 66/600
1268/1268 - 1s - loss: 0.0675 - accuracy: 0.9789 - 1s/epoch - 1ms/step
Epoch 67/600
1268/1268 - 1s - loss: 0.0677 - accuracy: 0.9783 - 1s/epoch - 1ms/step
Epoch 68/600
1268/1268 - 1s - loss: 0.0666 - accuracy: 0.9786 - 1s/epoch - 999us/step
Epoch 69/600
1268/1268 - 1s - loss: 0.0669 - accuracy: 0.9787 - 1s/epoch - 1ms/step
Epoch 70/600
1268/1268 - 1s - loss: 0.0661 - accuracy: 0.9788 - 1s/epoch - 1ms/step
Epoch 71/600
1268/1268 - 1s - loss: 0.0662 - accuracy: 0.9789 - 1s/epoch - 1ms/step
Epoch 72/600
1268/1268 - 1s - loss: 0.0663 - accuracy: 0.9789 - 1s/epoch - 1ms/step
Epoch 73/600
1268/1268 - 1s - loss: 0.0658 - accuracy: 0.9790 - 1s/epoch - 1ms/step
Epoch 74/600
1268/1268 - 1s - loss: 0.0657 - accuracy: 0.9794 - 1s/epoch - 1ms/step
Epoch 75/600
1268/1268 - 1s - loss: 0.0652 - accuracy: 0.9793 - 1s/epoch - 1ms/step
Epoch 76/600
1268/1268 - 1s - loss: 0.0654 - accuracy: 0.9789 - 1s/epoch - 1ms/step
Epoch 77/600
1268/1268 - 1s - loss: 0.0648 - accuracy: 0.9793 - 1s/epoch - 1000us/step
Epoch 78/600
1268/1268 - 1s - loss: 0.0644 - accuracy: 0.9795 - 1s/epoch - 1ms/step
Epoch 79/600
1268/1268 - 1s - loss: 0.0644 - accuracy: 0.9798 - 1s/epoch - 1ms/step
Epoch 80/600
1268/1268 - 1s - loss: 0.0640 - accuracy: 0.9797 - 1s/epoch - 1000us/step
Epoch 81/600
1268/1268 - 1s - loss: 0.0638 - accuracy: 0.9798 - 1s/epoch - 1ms/step
Epoch 82/600
1268/1268 - 1s - loss: 0.0635 - accuracy: 0.9800 - 1s/epoch - 1ms/step
Epoch 83/600
1268/1268 - 1s - loss: 0.0637 - accuracy: 0.9799 - 1s/epoch - 1ms/step
Epoch 84/600
1268/1268 - 1s - loss: 0.0634 - accuracy: 0.9797 - 1s/epoch - 1ms/step
Epoch 85/600
1268/1268 - 1s - loss: 0.0628 - accuracy: 0.9801 - 1s/epoch - 1ms/step
Epoch 86/600
1268/1268 - 1s - loss: 0.0628 - accuracy: 0.9801 - 1s/epoch - 1ms/step
Epoch 87/600
1268/1268 - 1s - loss: 0.0627 - accuracy: 0.9802 - 1s/epoch - 1ms/step
Epoch 88/600
1268/1268 - 1s - loss: 0.0625 - accuracy: 0.9801 - 1s/epoch - 1ms/step
Epoch 89/600
1268/1268 - 1s - loss: 0.0618 - accuracy: 0.9802 - 1s/epoch - 999us/step
Epoch 90/600
1268/1268 - 1s - loss: 0.0621 - accuracy: 0.9805 - 1s/epoch - 1ms/step
Epoch 91/600
1268/1268 - 1s - loss: 0.0618 - accuracy: 0.9805 - 1s/epoch - 1ms/step
Epoch 92/600
1268/1268 - 1s - loss: 0.0614 - accuracy: 0.9803 - 1s/epoch - 1ms/step
Epoch 93/600
1268/1268 - 1s - loss: 0.0613 - accuracy: 0.9806 - 1s/epoch - 1ms/step
Epoch 94/600
1268/1268 - 1s - loss: 0.0617 - accuracy: 0.9804 - 1s/epoch - 1ms/step
Epoch 95/600
1268/1268 - 1s - loss: 0.0610 - accuracy: 0.9805 - 1s/epoch - 1ms/step
Epoch 96/600
1268/1268 - 1s - loss: 0.0609 - accuracy: 0.9803 - 1s/epoch - 1ms/step
Epoch 97/600
1268/1268 - 1s - loss: 0.0606 - accuracy: 0.9807 - 1s/epoch - 1ms/step
Epoch 98/600
1268/1268 - 1s - loss: 0.0605 - accuracy: 0.9805 - 1s/epoch - 1ms/step
Epoch 99/600
1268/1268 - 1s - loss: 0.0601 - accuracy: 0.9810 - 1s/epoch - 1ms/step
Epoch 100/600
1268/1268 - 1s - loss: 0.0604 - accuracy: 0.9810 - 1s/epoch - 1ms/step
Epoch 101/600
1268/1268 - 1s - loss: 0.0604 - accuracy: 0.9808 - 1s/epoch - 1ms/step
Epoch 102/600
1268/1268 - 1s - loss: 0.0600 - accuracy: 0.9811 - 1s/epoch - 1ms/step
Epoch 103/600
1268/1268 - 1s - loss: 0.0600 - accuracy: 0.9808 - 1s/epoch - 1ms/step
Epoch 104/600
1268/1268 - 1s - loss: 0.0592 - accuracy: 0.9815 - 1s/epoch - 1ms/step
Epoch 105/600
1268/1268 - 1s - loss: 0.0594 - accuracy: 0.9811 - 1s/epoch - 999us/step
Epoch 106/600
1268/1268 - 1s - loss: 0.0590 - accuracy: 0.9808 - 1s/epoch - 1ms/step
Epoch 107/600
1268/1268 - 1s - loss: 0.0587 - accuracy: 0.9813 - 1s/epoch - 1ms/step
Epoch 108/600
1268/1268 - 1s - loss: 0.0590 - accuracy: 0.9809 - 1s/epoch - 999us/step
Epoch 109/600
```

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1268/1268 - 1s - loss: 0.0589 - accuracy: 0.9808 - 1s/epoch - 1ms/step
Epoch 110/600
1268/1268 - 1s - loss: 0.0584 - accuracy: 0.9814 - 1s/epoch - 1ms/step
Epoch 111/600
1268/1268 - 1s - loss: 0.0586 - accuracy: 0.9814 - 1s/epoch - 1ms/step
Epoch 112/600
1268/1268 - 1s - loss: 0.0587 - accuracy: 0.9813 - 1s/epoch - 1ms/step
Epoch 113/600
1268/1268 - 1s - loss: 0.0581 - accuracy: 0.9810 - 1s/epoch - 1ms/step
Epoch 114/600
1268/1268 - 1s - loss: 0.0584 - accuracy: 0.9811 - 1s/epoch - 999us/step
Epoch 115/600
1268/1268 - 1s - loss: 0.0579 - accuracy: 0.9816 - 1s/epoch - 1ms/step
Epoch 116/600
1268/1268 - 1s - loss: 0.0580 - accuracy: 0.9814 - 1s/epoch - 1ms/step
Epoch 117/600
1268/1268 - 1s - loss: 0.0574 - accuracy: 0.9817 - 1s/epoch - 997us/step
Epoch 118/600
1268/1268 - 1s - loss: 0.0574 - accuracy: 0.9819 - 1s/epoch - 1ms/step
Epoch 119/600
1268/1268 - 1s - loss: 0.0571 - accuracy: 0.9818 - 1s/epoch - 1ms/step
Epoch 120/600
1268/1268 - 1s - loss: 0.0575 - accuracy: 0.9816 - 1s/epoch - 1ms/step
Epoch 121/600
1268/1268 - 1s - loss: 0.0576 - accuracy: 0.9815 - 1s/epoch - 1ms/step
Epoch 122/600
1268/1268 - 1s - loss: 0.0564 - accuracy: 0.9821 - 1s/epoch - 1ms/step
Epoch 123/600
1268/1268 - 1s - loss: 0.0566 - accuracy: 0.9821 - 1s/epoch - 998us/step
Epoch 124/600
1268/1268 - 1s - loss: 0.0570 - accuracy: 0.9819 - 1s/epoch - 1ms/step
Epoch 125/600
1268/1268 - 1s - loss: 0.0565 - accuracy: 0.9820 - 1s/epoch - 1ms/step
Epoch 126/600
1268/1268 - 1s - loss: 0.0566 - accuracy: 0.9819 - 1s/epoch - 1ms/step
Epoch 127/600
1268/1268 - 1s - loss: 0.0565 - accuracy: 0.9818 - 1s/epoch - 1ms/step
Epoch 128/600
1268/1268 - 1s - loss: 0.0564 - accuracy: 0.9820 - 1s/epoch - 1ms/step
Epoch 129/600
1268/1268 - 1s - loss: 0.0562 - accuracy: 0.9818 - 1s/epoch - 1000us/step
Epoch 130/600
1268/1268 - 1s - loss: 0.0556 - accuracy: 0.9821 - 1s/epoch - 1ms/step
Epoch 131/600
1268/1268 - 1s - loss: 0.0556 - accuracy: 0.9823 - 1s/epoch - 1ms/step
Epoch 132/600
1268/1268 - 1s - loss: 0.0555 - accuracy: 0.9821 - 1s/epoch - 1ms/step
Epoch 133/600
1268/1268 - 1s - loss: 0.0556 - accuracy: 0.9821 - 1s/epoch - 1ms/step
Epoch 134/600
1268/1268 - 1s - loss: 0.0557 - accuracy: 0.9819 - 1s/epoch - 994us/step
Epoch 135/600
1268/1268 - 1s - loss: 0.0550 - accuracy: 0.9826 - 1s/epoch - 1ms/step
Epoch 136/600
1268/1268 - 1s - loss: 0.0555 - accuracy: 0.9822 - 1s/epoch - 1ms/step
Epoch 137/600
1268/1268 - 1s - loss: 0.0554 - accuracy: 0.9822 - 1s/epoch - 1ms/step
Epoch 138/600
1268/1268 - 1s - loss: 0.0548 - accuracy: 0.9818 - 1s/epoch - 1ms/step
Epoch 139/600
1268/1268 - 1s - loss: 0.0551 - accuracy: 0.9821 - 1s/epoch - 1ms/step
Epoch 140/600
1268/1268 - 1s - loss: 0.0550 - accuracy: 0.9826 - 1s/epoch - 1ms/step
Epoch 141/600
1268/1268 - 1s - loss: 0.0548 - accuracy: 0.9824 - 1s/epoch - 1ms/step
Epoch 142/600
1268/1268 - 1s - loss: 0.0544 - accuracy: 0.9829 - 1s/epoch - 1ms/step
Epoch 143/600
1268/1268 - 1s - loss: 0.0546 - accuracy: 0.9824 - 1s/epoch - 998us/step
Epoch 144/600
1268/1268 - 1s - loss: 0.0547 - accuracy: 0.9824 - 1s/epoch - 1ms/step
Epoch 145/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9824 - 1s/epoch - 1ms/step
Epoch 146/600
1268/1268 - 1s - loss: 0.0545 - accuracy: 0.9823 - 1s/epoch - 1ms/step
Epoch 147/600
1268/1268 - 1s - loss: 0.0539 - accuracy: 0.9828 - 1s/epoch - 1ms/step
Epoch 148/600
1268/1268 - 1s - loss: 0.0542 - accuracy: 0.9825 - 1s/epoch - 1ms/step
Epoch 149/600
1268/1268 - 1s - loss: 0.0536 - accuracy: 0.9829 - 1s/epoch - 1ms/step
Epoch 150/600
1268/1268 - 1s - loss: 0.0541 - accuracy: 0.9824 - 1s/epoch - 1ms/step
Epoch 151/600
1268/1268 - 1s - loss: 0.0536 - accuracy: 0.9829 - 1s/epoch - 1ms/step
Epoch 152/600
1268/1268 - 1s - loss: 0.0532 - accuracy: 0.9828 - 1s/epoch - 1ms/step
Epoch 153/600
1268/1268 - 1s - loss: 0.0534 - accuracy: 0.9829 - 1s/epoch - 997us/step
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Epoch 154/600
1268/1268 - 1s - loss: 0.0529 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 155/600
1268/1268 - 1s - loss: 0.0533 - accuracy: 0.9827 - 1s/epoch - 1ms/step
Epoch 156/600
1268/1268 - 1s - loss: 0.0534 - accuracy: 0.9832 - 1s/epoch - 995us/step
Epoch 157/600
1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 158/600
1268/1268 - 1s - loss: 0.0529 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 159/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9830 - 1s/epoch - 1ms/step
Epoch 160/600
1268/1268 - 1s - loss: 0.0528 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 161/600
1268/1268 - 1s - loss: 0.0530 - accuracy: 0.9828 - 1s/epoch - 1ms/step
Epoch 162/600
1268/1268 - 1s - loss: 0.0525 - accuracy: 0.9830 - 1s/epoch - 999us/step
Epoch 163/600
1268/1268 - 1s - loss: 0.0524 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 164/600
1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 165/600
1268/1268 - 1s - loss: 0.0528 - accuracy: 0.9830 - 1s/epoch - 1ms/step
Epoch 166/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9835 - 1s/epoch - 1ms/step
Epoch 167/600
1268/1268 - 1s - loss: 0.0522 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 168/600
1268/1268 - 1s - loss: 0.0526 - accuracy: 0.9830 - 1s/epoch - 1ms/step
Epoch 169/600
1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 170/600
1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 171/600
1268/1268 - 1s - loss: 0.0520 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 172/600
1268/1268 - 1s - loss: 0.0518 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 173/600
1268/1268 - 1s - loss: 0.0519 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 174/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9834 - 1s/epoch - 1ms/step
Epoch 175/600
1268/1268 - 1s - loss: 0.0517 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 176/600
1268/1268 - 1s - loss: 0.0514 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 177/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9837 - 1s/epoch - 1000us/step
Epoch 178/600
1268/1268 - 1s - loss: 0.0515 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 179/600
1268/1268 - 1s - loss: 0.0516 - accuracy: 0.9831 - 1s/epoch - 1ms/step
Epoch 180/600
1268/1268 - 1s - loss: 0.0509 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 181/600
1268/1268 - 1s - loss: 0.0511 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 182/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9837 - 1s/epoch - 1ms/step
Epoch 183/600
1268/1268 - 1s - loss: 0.0510 - accuracy: 0.9834 - 1s/epoch - 1ms/step
Epoch 184/600
1268/1268 - 1s - loss: 0.0507 - accuracy: 0.9838 - 1s/epoch - 998us/step
Epoch 185/600
1268/1268 - 1s - loss: 0.0510 - accuracy: 0.9832 - 1s/epoch - 1ms/step
Epoch 186/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 187/600
1268/1268 - 1s - loss: 0.0505 - accuracy: 0.9835 - 1s/epoch - 1ms/step
Epoch 188/600
1268/1268 - 1s - loss: 0.0506 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 189/600
1268/1268 - 1s - loss: 0.0508 - accuracy: 0.9835 - 1s/epoch - 1ms/step
Epoch 190/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9837 - 1s/epoch - 1ms/step
Epoch 191/600
1268/1268 - 1s - loss: 0.0502 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 192/600
1268/1268 - 1s - loss: 0.0504 - accuracy: 0.9837 - 1s/epoch - 1ms/step
Epoch 193/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 194/600
1268/1268 - 1s - loss: 0.0501 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 195/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9835 - 1s/epoch - 1ms/step
Epoch 196/600
1268/1268 - 1s - loss: 0.0500 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 197/600
1268/1268 - 1s - loss: 0.0498 - accuracy: 0.9839 - 1s/epoch - 1ms/step
Epoch 198/600
```

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1268/1268 - 1s - loss: 0.0495 - accuracy: 0.9840 - 1s/epoch - 1ms/step
Epoch 199/600
1268/1268 - 1s - loss: 0.0503 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 200/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 201/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9840 - 1s/epoch - 1ms/step
Epoch 202/600
1268/1268 - 1s - loss: 0.0499 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 203/600
1268/1268 - 1s - loss: 0.0494 - accuracy: 0.9840 - 1s/epoch - 1ms/step
Epoch 204/600
1268/1268 - 1s - loss: 0.0497 - accuracy: 0.9837 - 1s/epoch - 1ms/step
Epoch 205/600
1268/1268 - 1s - loss: 0.0497 - accuracy: 0.9837 - 1s/epoch - 1ms/step
Epoch 206/600
1268/1268 - 1s - loss: 0.0490 - accuracy: 0.9840 - 1s/epoch - 1ms/step
Epoch 207/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 208/600
1268/1268 - 1s - loss: 0.0491 - accuracy: 0.9836 - 1s/epoch - 1ms/step
Epoch 209/600
1268/1268 - 1s - loss: 0.0493 - accuracy: 0.9843 - 1s/epoch - 997us/step
Epoch 210/600
1268/1268 - 1s - loss: 0.0491 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 211/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 212/600
1268/1268 - 1s - loss: 0.0489 - accuracy: 0.9841 - 1s/epoch - 1ms/step
Epoch 213/600
1268/1268 - 1s - loss: 0.0492 - accuracy: 0.9840 - 1s/epoch - 1ms/step
Epoch 214/600
1268/1268 - 1s - loss: 0.0488 - accuracy: 0.9839 - 1s/epoch - 1ms/step
Epoch 215/600
1268/1268 - 1s - loss: 0.0486 - accuracy: 0.9841 - 1s/epoch - 1ms/step
Epoch 216/600
1268/1268 - 1s - loss: 0.0490 - accuracy: 0.9834 - 1s/epoch - 1ms/step
Epoch 217/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 218/600
1268/1268 - 1s - loss: 0.0484 - accuracy: 0.9844 - 1s/epoch - 998us/step
Epoch 219/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 220/600
1268/1268 - 1s - loss: 0.0490 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 221/600
1268/1268 - 1s - loss: 0.0482 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 222/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 223/600
1268/1268 - 1s - loss: 0.0481 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 224/600
1268/1268 - 1s - loss: 0.0483 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 225/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 226/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9846 - 1s/epoch - 1ms/step
Epoch 227/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 228/600
1268/1268 - 1s - loss: 0.0479 - accuracy: 0.9840 - 1s/epoch - 1ms/step
Epoch 229/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9843 - 1s/epoch - 1ms/step
Epoch 230/600
1268/1268 - 1s - loss: 0.0478 - accuracy: 0.9843 - 1s/epoch - 1ms/step
Epoch 231/600
1268/1268 - 1s - loss: 0.0480 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 232/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 233/600
1268/1268 - 1s - loss: 0.0476 - accuracy: 0.9838 - 1s/epoch - 1ms/step
Epoch 234/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 235/600
1268/1268 - 1s - loss: 0.0473 - accuracy: 0.9847 - 1s/epoch - 1ms/step
Epoch 236/600
1268/1268 - 1s - loss: 0.0474 - accuracy: 0.9843 - 1s/epoch - 1ms/step
Epoch 237/600
1268/1268 - 1s - loss: 0.0470 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 238/600
1268/1268 - 1s - loss: 0.0473 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 239/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 240/600
1268/1268 - 1s - loss: 0.0474 - accuracy: 0.9843 - 1s/epoch - 1ms/step
Epoch 241/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9842 - 1s/epoch - 1ms/step
Epoch 242/600
1268/1268 - 1s - loss: 0.0471 - accuracy: 0.9845 - 1s/epoch - 1ms/step
```

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Epoch 243/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9847 - 1s/epoch - 1ms/step
Epoch 244/600
1268/1268 - 1s - loss: 0.0472 - accuracy: 0.9846 - 1s/epoch - 1ms/step
Epoch 245/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 246/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9847 - 1s/epoch - 1ms/step
Epoch 247/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9847 - 1s/epoch - 1ms/step
Epoch 248/600
1268/1268 - 1s - loss: 0.0465 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 249/600
1268/1268 - 1s - loss: 0.0469 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 250/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 251/600
1268/1268 - 1s - loss: 0.0463 - accuracy: 0.9846 - 1s/epoch - 1ms/step
Epoch 252/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9848 - 1s/epoch - 1ms/step
Epoch 253/600
1268/1268 - 1s - loss: 0.0464 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 254/600
1268/1268 - 1s - loss: 0.0467 - accuracy: 0.9843 - 1s/epoch - 1ms/step
Epoch 255/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9846 - 1s/epoch - 1ms/step
Epoch 256/600
1268/1268 - 1s - loss: 0.0458 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 257/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9847 - 1s/epoch - 1ms/step
Epoch 258/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9850 - 1s/epoch - 1ms/step
Epoch 259/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 260/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9850 - 1s/epoch - 1ms/step
Epoch 261/600
1268/1268 - 1s - loss: 0.0466 - accuracy: 0.9846 - 1s/epoch - 1ms/step
Epoch 262/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9851 - 1s/epoch - 1ms/step
Epoch 263/600
1268/1268 - 1s - loss: 0.0461 - accuracy: 0.9844 - 1s/epoch - 1ms/step
Epoch 264/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 265/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 266/600
1268/1268 - 1s - loss: 0.0457 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 267/600
1268/1268 - 1s - loss: 0.0459 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 268/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 269/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 270/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9845 - 1s/epoch - 1ms/step
Epoch 271/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9850 - 1s/epoch - 1ms/step
Epoch 272/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9848 - 1s/epoch - 1ms/step
Epoch 273/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 274/600
1268/1268 - 1s - loss: 0.0454 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 275/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9850 - 1s/epoch - 1ms/step
Epoch 276/600
1268/1268 - 1s - loss: 0.0450 - accuracy: 0.9851 - 1s/epoch - 1ms/step
Epoch 277/600
1268/1268 - 1s - loss: 0.0453 - accuracy: 0.9848 - 1s/epoch - 1ms/step
Epoch 278/600
1268/1268 - 1s - loss: 0.0452 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 279/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 280/600
1268/1268 - 1s - loss: 0.0455 - accuracy: 0.9848 - 1s/epoch - 997us/step
Epoch 281/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9851 - 1s/epoch - 1ms/step
Epoch 282/600
1268/1268 - 1s - loss: 0.0449 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 283/600
1268/1268 - 1s - loss: 0.0446 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 284/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9849 - 1s/epoch - 1ms/step
Epoch 285/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 286/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9848 - 1s/epoch - 1ms/step
Epoch 287/600
```

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1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 288/600
1268/1268 - 1s - loss: 0.0451 - accuracy: 0.9850 - 1s/epoch - 1ms/step
Epoch 289/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9855 - 1s/epoch - 1ms/step
Epoch 290/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 291/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 292/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 293/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 294/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 295/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 296/600
1268/1268 - 1s - loss: 0.0445 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 297/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 298/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9852 - 1s/epoch - 1ms/step
Epoch 299/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 300/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 301/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 302/600
1268/1268 - 1s - loss: 0.0442 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 303/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 304/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 305/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 306/600
1268/1268 - 1s - loss: 0.0440 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 307/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 308/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 309/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 310/600
1268/1268 - 1s - loss: 0.0435 - accuracy: 0.9855 - 1s/epoch - 1ms/step
Epoch 311/600
1268/1268 - 1s - loss: 0.0438 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 312/600
1268/1268 - 1s - loss: 0.0437 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 313/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9855 - 1s/epoch - 1ms/step
Epoch 314/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 315/600
1268/1268 - 1s - loss: 0.0439 - accuracy: 0.9851 - 1s/epoch - 1ms/step
Epoch 316/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 317/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9858 - 1s/epoch - 1ms/step
Epoch 318/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 319/600
1268/1268 - 1s - loss: 0.0441 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 320/600
1268/1268 - 1s - loss: 0.0436 - accuracy: 0.9855 - 1s/epoch - 1ms/step
Epoch 321/600
1268/1268 - 1s - loss: 0.0429 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 322/600
1268/1268 - 1s - loss: 0.0434 - accuracy: 0.9854 - 1s/epoch - 1ms/step
Epoch 323/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 324/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 325/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9858 - 1s/epoch - 1ms/step
Epoch 326/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 327/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 328/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 329/600
1268/1268 - 1s - loss: 0.0427 - accuracy: 0.9855 - 1s/epoch - 1ms/step
Epoch 330/600
1268/1268 - 1s - loss: 0.0430 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 331/600
1268/1268 - 1s - loss: 0.0431 - accuracy: 0.9856 - 1s/epoch - 1ms/step
```

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Epoch 332/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9858 - 1s/epoch - 1ms/step
Epoch 333/600
1268/1268 - 1s - loss: 0.0432 - accuracy: 0.9853 - 1s/epoch - 1ms/step
Epoch 334/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 335/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 336/600
1268/1268 - 1s - loss: 0.0428 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 337/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 338/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 339/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 340/600
1268/1268 - 1s - loss: 0.0426 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 341/600
1268/1268 - 1s - loss: 0.0424 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 342/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 343/600
1268/1268 - 1s - loss: 0.0423 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 344/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 345/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 346/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 347/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 348/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 349/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 350/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 351/600
1268/1268 - 1s - loss: 0.0422 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 352/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 353/600
1268/1268 - 1s - loss: 0.0419 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 354/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 355/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 356/600
1268/1268 - 1s - loss: 0.0425 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 357/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 358/600
1268/1268 - 1s - loss: 0.0420 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 359/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 360/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 361/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 362/600
1268/1268 - 1s - loss: 0.0421 - accuracy: 0.9856 - 1s/epoch - 1ms/step
Epoch 363/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 364/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 365/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9857 - 1s/epoch - 1ms/step
Epoch 366/600
1268/1268 - 1s - loss: 0.0418 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 367/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 368/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 369/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 370/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 371/600
1268/1268 - 1s - loss: 0.0416 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 372/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 373/600
1268/1268 - 1s - loss: 0.0413 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 374/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 375/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 376/600
```

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1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 377/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 378/600
1268/1268 - 1s - loss: 0.0410 - accuracy: 0.9860 - 1s/epoch - 996us/step
Epoch 379/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 380/600
1268/1268 - 1s - loss: 0.0415 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 381/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 382/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 383/600
1268/1268 - 1s - loss: 0.0409 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 384/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9863 - 1s/epoch - 999us/step
Epoch 385/600
1268/1268 - 1s - loss: 0.0411 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 386/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9865 - 1s/epoch - 999us/step
Epoch 387/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 388/600
1268/1268 - 1s - loss: 0.0414 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 389/600
1268/1268 - 1s - loss: 0.0400 - accuracy: 0.9866 - 1s/epoch - 997us/step
Epoch 390/600
1268/1268 - 1s - loss: 0.0412 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 391/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 392/600
1268/1268 - 1s - loss: 0.0406 - accuracy: 0.9863 - 1s/epoch - 994us/step
Epoch 393/600
1268/1268 - 1s - loss: 0.0408 - accuracy: 0.9859 - 1s/epoch - 1ms/step
Epoch 394/600
1268/1268 - 1s - loss: 0.0405 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 395/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9866 - 1s/epoch - 996us/step
Epoch 396/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9861 - 1s/epoch - 1ms/step
Epoch 397/600
1268/1268 - 1s - loss: 0.0407 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 398/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 399/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 400/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 401/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9866 - 1s/epoch - 998us/step
Epoch 402/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 403/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 404/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 405/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 406/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 407/600
1268/1268 - 1s - loss: 0.0404 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 408/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9866 - 1s/epoch - 1ms/step
Epoch 409/600
1268/1268 - 1s - loss: 0.0403 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 410/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 411/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 412/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 413/600
1268/1268 - 1s - loss: 0.0399 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 414/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9862 - 1s/epoch - 1ms/step
Epoch 415/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 416/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 417/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9866 - 1s/epoch - 1ms/step
Epoch 418/600
1268/1268 - 1s - loss: 0.0401 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 419/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 420/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9866 - 1s/epoch - 1ms/step
```

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Epoch 421/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9860 - 1s/epoch - 1ms/step
Epoch 422/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 423/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 424/600
1268/1268 - 1s - loss: 0.0397 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 425/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 426/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 427/600
1268/1268 - 1s - loss: 0.0402 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 428/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 429/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 430/600
1268/1268 - 1s - loss: 0.0393 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 431/600
1268/1268 - 1s - loss: 0.0390 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 432/600
1268/1268 - 1s - loss: 0.0398 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 433/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 434/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 435/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 436/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 437/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 438/600
1268/1268 - 1s - loss: 0.0396 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 439/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 440/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 441/600
1268/1268 - 1s - loss: 0.0394 - accuracy: 0.9865 - 1s/epoch - 1ms/step
Epoch 442/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 443/600
1268/1268 - 1s - loss: 0.0389 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 444/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 445/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9863 - 1s/epoch - 1ms/step
Epoch 446/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 447/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 448/600
1268/1268 - 1s - loss: 0.0391 - accuracy: 0.9866 - 1s/epoch - 1ms/step
Epoch 449/600
1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 450/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 451/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 452/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 453/600
1268/1268 - 1s - loss: 0.0395 - accuracy: 0.9864 - 1s/epoch - 1ms/step
Epoch 454/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 455/600
1268/1268 - 1s - loss: 0.0388 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 456/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 457/600
1268/1268 - 1s - loss: 0.0392 - accuracy: 0.9866 - 1s/epoch - 1ms/step
Epoch 458/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 459/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 460/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 461/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 462/600
1268/1268 - 1s - loss: 0.0385 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 463/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 464/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 465/600
```

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1268/1268 - 1s - loss: 0.0387 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 466/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9866 - 1s/epoch - 1ms/step
Epoch 467/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 468/600
1268/1268 - 1s - loss: 0.0384 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 469/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 470/600
1268/1268 - 1s - loss: 0.0386 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 471/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 472/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 473/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 474/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 475/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 476/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 477/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 478/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9867 - 1s/epoch - 1ms/step
Epoch 479/600
1268/1268 - 1s - loss: 0.0383 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 480/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9868 - 1s/epoch - 1ms/step
Epoch 481/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 482/600
1268/1268 - 1s - loss: 0.0380 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 483/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 484/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 485/600
1268/1268 - 1s - loss: 0.0381 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 486/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 487/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 488/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 489/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 490/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 491/600
1268/1268 - 1s - loss: 0.0379 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 492/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 493/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 494/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 495/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 496/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 497/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 498/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 499/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 500/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 501/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 502/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 503/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 504/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 505/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 506/600
1268/1268 - 1s - loss: 0.0374 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 507/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 508/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 509/600
1268/1268 - 1s - loss: 0.0378 - accuracy: 0.9871 - 1s/epoch - 1ms/step
```

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Epoch 510/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 511/600
1268/1268 - 1s - loss: 0.0375 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 512/600
1268/1268 - 1s - loss: 0.0382 - accuracy: 0.9869 - 1s/epoch - 1ms/step
Epoch 513/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 514/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 515/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 516/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 517/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 518/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 519/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 520/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 521/600
1268/1268 - 1s - loss: 0.0369 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 522/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 523/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 524/600
1268/1268 - 1s - loss: 0.0372 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 525/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 526/600
1268/1268 - 1s - loss: 0.0377 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 527/600
1268/1268 - 1s - loss: 0.0365 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 528/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 529/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 530/600
1268/1268 - 1s - loss: 0.0368 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 531/600
1268/1268 - 1s - loss: 0.0367 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 532/600
1268/1268 - 1s - loss: 0.0373 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 533/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 534/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 535/600
1268/1268 - 1s - loss: 0.0371 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 536/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 537/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 538/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 539/600
1268/1268 - 1s - loss: 0.0370 - accuracy: 0.9871 - 1s/epoch - 1ms/step
Epoch 540/600
1268/1268 - 1s - loss: 0.0356 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 541/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 542/600
1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 543/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 544/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 545/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 546/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9881 - 1s/epoch - 1ms/step
Epoch 547/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 548/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 549/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9882 - 1s/epoch - 1ms/step
Epoch 550/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 551/600
1268/1268 - 1s - loss: 0.0362 - accuracy: 0.9874 - 1s/epoch - 1ms/step
Epoch 552/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 553/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 554/600
```

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1268/1268 - 1s - loss: 0.0363 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 555/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 556/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 557/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 558/600
1268/1268 - 1s - loss: 0.0366 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 559/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 560/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 561/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 562/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 563/600
1268/1268 - 1s - loss: 0.0364 - accuracy: 0.9872 - 1s/epoch - 1ms/step
Epoch 564/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 565/600
1268/1268 - 1s - loss: 0.0361 - accuracy: 0.9870 - 1s/epoch - 1ms/step
Epoch 566/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 567/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9875 - 1s/epoch - 1ms/step
Epoch 568/600
1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 569/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 570/600
1268/1268 - 1s - loss: 0.0360 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 571/600
1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 572/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9873 - 1s/epoch - 1ms/step
Epoch 573/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 574/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 575/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9882 - 1s/epoch - 1ms/step
Epoch 576/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9876 - 1s/epoch - 1ms/step
Epoch 577/600
1268/1268 - 1s - loss: 0.0348 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 578/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 579/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 580/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9883 - 1s/epoch - 1ms/step
Epoch 581/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 582/600
1268/1268 - 1s - loss: 0.0358 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 583/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 584/600
1268/1268 - 1s - loss: 0.0355 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 585/600
1268/1268 - 1s - loss: 0.0353 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 586/600
1268/1268 - 1s - loss: 0.0357 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 587/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 588/600
1268/1268 - 1s - loss: 0.0350 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 589/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9880 - 1s/epoch - 1ms/step
Epoch 590/600
1268/1268 - 1s - loss: 0.0356 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 591/600
1268/1268 - 1s - loss: 0.0349 - accuracy: 0.9882 - 1s/epoch - 1ms/step
Epoch 592/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 593/600
1268/1268 - 1s - loss: 0.0359 - accuracy: 0.9877 - 1s/epoch - 1ms/step
Epoch 594/600
1268/1268 - 1s - loss: 0.0354 - accuracy: 0.9879 - 1s/epoch - 1ms/step
Epoch 595/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9878 - 1s/epoch - 1ms/step
Epoch 596/600
1268/1268 - 1s - loss: 0.0348 - accuracy: 0.9881 - 1s/epoch - 1ms/step
Epoch 597/600
1268/1268 - 1s - loss: 0.0349 - accuracy: 0.9881 - 1s/epoch - 1ms/step
Epoch 598/600
1268/1268 - 1s - loss: 0.0352 - accuracy: 0.9876 - 1s/epoch - 1ms/step
```

```
Epoch 599/600
1268/1268 - 1s - loss: 0.0345 - accuracy: 0.9883 - 1s/epoch - 1ms/step
Epoch 600/600
1268/1268 - 1s - loss: 0.0351 - accuracy: 0.9880 - 1s/epoch - 1ms/step
990/990 [==============================] - 1s 710us/step
Final Best Threshold: 0.888888888888889
[[93040  1806]
 [ 5247 58299]]
              precision    recall  f1-score   support

           0       0.95      0.98      0.96     94846
           1       0.97      0.92      0.94     63546

    accuracy                           0.96    158392
   macro avg       0.96      0.95      0.95    158392
weighted avg       0.96      0.96      0.96    158392
```

In [ ]:
```
sns.heatmap(conf_matrix, annot=True, fmt='.0f', cmap = 'mako')
plt.title('Full Data Prediction Matrix - Deep Neural Network Cost Optimized')
plt.xticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.yticks(ticks = [.5,1.5], labels = ['No','Yes'])
plt.show()
```