**Executive Summary: Digit Recognizer Deployment for Automated Check Scanning**

**Introduction**

Metropolitan Bank processes over 100,000 paper checks daily. The current manual system for entering check amounts is time-consuming, error-prone, and costly. To address these challenges, a machine learning-based digit recognizer has been developed and integrated into an automated check scanner system.

**Business Problem**

* **Manual System Drawbacks:**
  + 2-3 minutes per check processing time.
  + 2% error rate.
  + $2M annual labor cost.
  + Significant delays for customers.
* **Solution Requirements:**
  + Automated handwriting recognition.
  + Processing checks within 5 seconds.
  + 99.9% accuracy.
  + Low-confidence prediction flagging.
  + Robustness to diverse handwriting styles.

**Expected Business Impact**

* 90% reduction in processing time.
* $1.8M annual savings.
* Enhanced customer satisfaction.
* Reduced error correction costs.
* Reallocation of clerical staff to strategic tasks.

**Model Development**

**Training Data**

The dataset comprises 28x28 grayscale images of handwritten digits. The training data has 785 columns, with pixel values ranging from 0 to 255.

**Model Pipeline**

1. **Data Preprocessing:** Conversion of images to tensors.
2. **Model Architecture:** Feedforward Neural Network (FNN).
3. **Training and Validation Split:** 80-20 stratified division.
4. **Evaluation Metrics:** Accuracy and loss curves.

**Results**

**Training Performance**

* **Loss Curve:** Rapid initial decrease, stabilizing with minor fluctuations.
* **Accuracy Curve:** Early improvement, reaching over 98% by epoch 5, gradually approaching 100%.

**Validation Performance**

* **Confusion Matrix Analysis:**
  + High diagonal density indicates strong performance.
  + Few misclassifications scattered off-diagonal.
* **Metrics:**
  + Validation Loss: 0.1570
  + Validation Accuracy: 98.02%

**Prediction Summary**

|  |  |  |
| --- | --- | --- |
| **Class** | **True Predictions** | **Misclassifications** |
| 0 | 807 | 16 |
| 1 | 967 | 12 |
| 2 | 789 | 22 |
| 3 | 860 | 15 |
| 4 | 799 | 11 |
| 5 | 735 | 19 |
| 6 | 783 | 17 |
| 7 | 834 | 23 |
| 8 | 815 | 15 |
| 9 | 845 | 21 |
| **Total** | **8334** | **171** |

**Deployment Guidelines**

1. **Model Packaging:** Save the trained model as a serialized object.
2. **Integration:** Incorporate the model into the bank’s Auto Check Scanner application.
3. **API Development:** Build RESTful APIs to connect with existing systems.
4. **Infrastructure Setup:** Use cloud deployment based on the bank’s requirements.
5. **Monitoring:** Implement logging and alerting for model drift, performance, and prediction errors.

**Release and Launch Metrics**

* **Key Performance Indicators (KPIs):**
  + Processing Time: <5 seconds per check.
  + Accuracy: 99.9%.
  + Confidence Flagging Rate: <5%.
* **Monitoring Metrics:**
  + Real-time latency.
  + Error rate trends.
  + Customer satisfaction scores post-launch.
* **Release Phases:**
  + **Pilot:** Roll out to select branches for testing.
  + **Feedback Loop:** Address issues and refine the system.
  + **Full Launch:** Deploy across all branches.

**Conclusion**

The digit recognizer achieves the desired accuracy and efficiency, significantly improving operational workflows while saving costs. With proper deployment and monitoring, it will transform check processing at Metropolitan Bank, enhancing customer satisfaction and operational efficiency.