**ADTA 5560: Recurrent Neural Networks for Sequence Data**

**Final Project Presentation**

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**1. Introduction**

* Project Scope: Implementation and analysis of RNN architectures
* Key Components:
  + Time series data analysis
  + Simple RNN implementation
  + LSTM network development
  + Performance optimization
* Tools Used: TensorFlow, Python, Keras

**2. Time-series Dataset Selection**

**Global Land-Ocean Temperature Index Data**

* Source: NASA's Goddard Institute for Space Studies (GISS)
* Characteristics:
  + Monthly temperature measurements
  + 144+ years of data (1880-present)
  + ~1,700 data points
* Format: CSV with temperature anomalies

**3. Simple RNN Implementation**

**Sine Wave Prediction**

* Architecture:
  + Input Layer: 60 timesteps × 1 feature
  + SimpleRNN Layer 1: 128 units
  + SimpleRNN Layer 2: 64 units
  + Dense Output Layer
* Results:
  + Training Loss: ~0.0023
  + Successful pattern capture

**4. LSTM Implementation**

**Temperature Prediction Model**

* Architecture:
  + LSTM (64 units)
  + Dropout (0.2)
  + LSTM (32 units)
  + Dense layers
* Training:
  + 100 epochs
  + Batch size: 32
  + 80/20 train/test split

**5. Network Redesign**

**Improvements Made**

* Increased capacity:
  + LSTM: 128 → 64 units
  + Dropout: 0.3
  + Dense: 32 units
* Training adjustments:
  + Batch size: 16
  + Epochs: 150

**6. Performance Comparison**

**Results Analysis**

* Original Model:
  + MAE < 0.1°C
  + Training time: ~3 min
* Modified Model:
  + MAE < 0.08°C
  + Training time: ~5 min
* Trade-offs:
  + Accuracy vs. Computation
  + Resource requirements

**7. Conclusions**

* Key Findings:
  + LSTM outperforms Simple RNN
  + Trade-off between complexity and performance
  + Successful temperature prediction
* Future Work:
  + Alternative architectures
  + Hyperparameter optimization
  + Data augmentation strategies