Time Series Forecasting System Documentation

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# 1. Introduction

The Time Series Forecasting System is designed to provide users with an intuitive and user-friendly interface for forecasting time series data using ARIMA, ANN, and hybrid ARIMA-ANN models. The system allows users to select datasets, configure model parameters, and view forecast results through a web interface.

# 2. System Requirements

Python 3.6+  
Libraries:  
- streamlit  
- pandas  
- numpy  
- statsmodels  
- tensorflow  
- sklearn  
- matplotlib  
- seaborn

# 3. Data Processing

## Data Loading

Data is loaded from CSV files. Each dataset should have a date column and one or more feature columns. The data is indexed by date for time series analysis.

## Data Normalization

Data is normalized using MinMaxScaler from sklearn.preprocessing to scale feature values to a range between 0 and 1.

## Handling Missing Values

Missing values in the dataset are handled by forward filling (ffill) or dropping (dropna), depending on the specific requirement.

# 4. Model Architecture

## ARIMA Model

Purpose: Capture linear relationships in the time series data.  
Components:  
- p: Autoregressive term  
- d: Differencing term  
- q: Moving average term  
- Seasonal Order: (P, D, Q, m)

## ANN Model

Purpose: Capture non-linear patterns in the residuals left by ARIMA.  
Components:  
- Layers: LSTM layers followed by Dense layers  
- Activation Functions: ReLU or tanh  
- Optimizer: Adam  
- Loss Function: Mean Squared Error (MSE)

## Hybrid ARIMA-ANN Model

Purpose: Combine the strengths of ARIMA and ANN to improve forecast accuracy.  
Process:  
1. Fit ARIMA to the data.  
2. Calculate residuals.  
3. Train ANN on residuals.  
4. Combine predictions from ARIMA and ANN.

# 5. User Interface Design

## Overview

The UI is designed using Streamlit, providing a clean and interactive interface for dataset selection, model configuration, and viewing forecast results.

## Features

- Dropdown Menus: For dataset selection.  
- Parameter Input Fields: For ARIMA and ANN model parameters.  
- Tabs: For switching between different model views.  
- Buttons: For executing forecasts.