Forex Data Dashboard Documentation

1. Overview

The Forex Data Dashboard is a comprehensive web-based application built with Streamlit that provides real-time visualization and analysis of currency pair data. The dashboard helps traders and financial analysts track trends, monitor volatility, and make informed trading decisions through interactive charts and analytical components.

2. System Architecture

2.1 Core Components

- **Frontend**: Streamlit-based web interface that provides an interactive UI
- **Data Processing**: Pandas for data manipulation, cleaning, and transformation
- **Visualization**: Plotly for creating interactive, publication-quality charts
- **Data Storage**: Snowflake Cloud Data Warehouse for data persistence

2.2 Data Flow

1. Data loading from source files into Snowflake
2. Data preprocessing and cleaning
3. Technical indicator calculation
4. Visualization rendering
5. User interaction handling

3. Key Features

3.1 Price Analysis

- **Candlestick Charts**: Visualizes open, high, low, and close (OHLC) prices
    - Green candles: Closing price higher than opening price
    - Red candles: Closing price lower than opening price
    - Upper/lower wicks: High and low prices
- **Key Metrics Display**:
    - Latest Close: Current market price
    - Daily Change: Absolute and percentage change
    - Period High/Low: Maximum/minimum price in selected range

3.2 Trend Analysis

- **Moving Averages**:
    - SMA-20: Short-term trend indicator (20-day simple moving average)
    - SMA-50: Medium-term trend indicator (50-day simple moving average)
    - SMA-200: Long-term trend indicator (200-day simple moving average)
- **Crossover Signals**:
    - Golden Cross: When SMA-50 crosses above SMA-200 (bullish signal)
    - Death Cross: When SMA-50 crosses below SMA-200 (bearish signal)
- **Performance Metrics**:
    - Period Return: Percentage return over selected time period

3.3 Volatility Analysis

- **Daily Price Movement**:
    - Daily Change: Close price minus open price
    - Daily Change Percentage: (Close - Open) / Open * 100
- **Price Range**:
    - Daily Range: High price minus low price
    - Daily Range Percentage: Daily Range / Open * 100
- **Statistical Measures**:
    - Average Daily Range: Mean of daily range percentages
    - Maximum Daily Range: Highest daily range percentage
    - Standard Deviation: Volatility measure of daily price changes
    - Rolling Volatility: 20-day standard deviation of returns

3.4 Technical Indicators

- **Bollinger Bands**:
    - Middle Band: 20-day simple moving average
    - Upper Band: Middle band + (2 * standard deviation)
    - Lower Band: Middle band - (2 * standard deviation)
    - Usage: Identifies overbought/oversold conditions and potential reversals
- **MACD (Moving Average Convergence Divergence)**:
    - MACD Line: Difference between 12-day and 26-day EMAs
    - Signal Line: 9-day EMA of the MACD Line
    - Histogram: MACD Line minus Signal Line
    - Usage: Identifies momentum shifts and potential trend changes
- **RSI (Relative Strength Index)**:
    - 14-day calculation of relative strength
    - Overbought level: 70
    - Oversold level: 30
    - Midline: 50
    - Usage: Measures speed and change of price movements

3.5 Trading Signals

- **Signal Generation**:
    - Moving Average signals (Golden Cross, Death Cross)
    - RSI overbought/oversold signals
    - MACD crossover signals
    - Bollinger Band breakout signals
- **Signal Strength Visualization**:
    - Buy/Sell/Neutral signal counts
    - Overall signal recommendation
- **Historical Performance**:
    - Average return by signal type
    - Win rate percentage

3.6 Currency Pair Comparison

- **Multiple Pair Analysis**:
    - Normalized comparison (Base 100)
    - Actual rate comparison
    - Performance correlation
- **Synchronized Date Ranges**:
    - Coordinated time period selection
    - Equal comparison basis

3.7 Support and Resistance Levels

- **Level Detection**:
    - Local minima identification (support)
    - Local maxima identification (resistance)
    - Configurable detection window
- **Visualization**:
    - Horizontal line indicators on charts
    - Color-coded levels (green for support, red for resistance)

4. User Interface Components

4.1 Navigation Tabs

- **Price Charts**: Candlestick view with moving averages
- **Technical Indicators**: Bollinger Bands, MACD, RSI
- **Performance Analysis**: Returns and volatility measures
- **Trading Signals**: Signal generation and performance
- **Raw Data**: Tabular view with download option

4.2 Control Panel

- **Currency Pair Selection**: Dropdown for selecting forex pairs
- **Date Range Selection**: Date picker for time period analysis
- **Advanced Settings**:
    - Moving average visibility toggle
    - Volume display option
    - Support/resistance level detection
    - Signal display controls

4.3 Interactive Elements

- **Tooltips**: Hover information on charts
- **Zoom Controls**: Timeline magnification
- **Download Options**: CSV export of filtered data
- **Dynamic Updates**: Real-time metric calculation

5. Data Processing

5.1 Data Loading and Preprocessing

- CSV file reading with error handling
- Column name standardization
- Date conversion and sorting
- Missing value detection and handling

5.2 Technical Indicator Calculation

- Moving average computation
- Bollinger Band calculation
- MACD component derivation
- RSI formula implementation

5.3 Statistical Analysis

- Return calculation
- Volatility measurement
- Correlation computation
- Signal strength determination

6. Visualization Techniques

6.1 Chart Types

- Candlestick charts for price action
- Line charts for trends and moving averages
- Bar charts for volume and returns
- Histograms for distribution analysis
- Heatmaps for correlation visualization

6.2 Visual Enhancements

- Color-coding for up/down movements
- Transparent fill areas for bands
- Dashed lines for support/resistance
- Consistent color schemes for indicators

7. Performance Considerations

7.1 Data Caching

- `@st.cache_data` decorator for expensive operations
- Optimized data loading and processing
- Incremental updates where possible

7.2 Error Handling

- Data validation checks
- Exception management
- User-friendly error messages
- Fallback options for missing data

8. Future Enhancements

8.1 Advanced Analytics

- Machine learning-based prediction models
- Sentiment analysis integration
- Pattern recognition algorithms
- Custom indicator development

8.2 Additional Features

- Real-time data streaming
- Alert system for price movements
- Portfolio impact analysis
- Economic calendar integration

8.3 UI Improvements

- Dark/light mode toggle
- Mobile-responsive design
- Customizable dashboard layouts
- Additional visualization options

9. Implementation Guidelines

9.1 Installation Requirements

- Python 3.7+
- Streamlit, Pandas, Plotly packages
- Snowflake connector
- Additional libraries for advanced features

9.2 Configuration Options

- Data source settings
- Update frequency parameters
- Default display preferences
- API connection details

9.3 Deployment Considerations

- Server requirements
- Authentication setup
- Data refresh strategies
- Backup and recovery plans