

Student: João Paulo Brumatti Lousada

Midterm report

Task 1 - Candlestick Computation Implementation

- Overview
The system processes CSV weather data and generates candlestick information based on temperature readings, grouping data by year to create meaningful time-series analysis. The candlestick computation system successfully implements the core functionality for processing weather data and generating candlestick information. The modular design provides a solid foundation for future enhancements while maintaining code clarity and maintainability.
The implementation follows an object-oriented design with clear separation of concerns across multiple classes:

- Core Classes:
 1. CSVReader - Handles file I/O operations
 2. Tokeniser - Parses CSV lines into tokens
 3. CSVLine - Represents individual data records
 4. CSVLineList - Manages collections of CSV lines and grouping operations
 5. Candlestick - Computes and stores candlestick data
- Data Flow:
CSV File → CSVReader → Tokeniser → CSVLine → CSVLineList → Candlestick

The main.cpp file orchestrates the entire process:

1. File Reading: Uses CSVReader to load weather data
 2. Header Processing: Parses header to create column mapping
 3. Data Parsing: Creates CSVLine objects from each data row
 4. Data Grouping: Groups lines by year using CSVLineList
 5. Candlestick Generation: Creates candlestick objects for each year
 6. Output: Displays candlestick data (Date, Open, Close, High, Low)
- Output Screenshot:

Candlesticks:

```
Date: 1980-01-01T00:00:00Z Open: 0 Close: 8.70978 High: 23.054 Low: -3.612
Date: 1981-01-01T00:00:00Z Open: 8.70978 Close: 8.63427 High: 23.579 Low: -6.533
Date: 1982-01-01T00:00:00Z Open: 8.63427 Close: 9.2018 High: 23.859 Low: -7.184
Date: 1983-01-01T00:00:00Z Open: 9.2018 Close: 9.22931 High: 26.22 Low: -3.086
Date: 1984-01-01T00:00:00Z Open: 9.22931 Close: 9.09524 High: 25.09 Low: -2.993
Date: 1985-01-01T00:00:00Z Open: 9.09524 Close: 8.24556 High: 23.385 Low: -7.071
Date: 1986-01-01T00:00:00Z Open: 8.24556 Close: 8.09616 High: 24.636 Low: -5.952
Date: 1987-01-01T00:00:00Z Open: 8.09616 Close: 8.42091 High: 24.45 Low: -7.127
Date: 1988-01-01T00:00:00Z Open: 8.42091 Close: 9.16721 High: 23.981 Low: -2.135
Date: 1989-01-01T00:00:00Z Open: 9.16721 Close: 9.91542 High: 26.49 Low: -1.322
Date: 1990-01-01T00:00:00Z Open: 9.91542 Close: 10.0559 High: 29.48 Low: -1.765
Date: 1991-01-01T00:00:00Z Open: 10.0559 Close: 9.07515 High: 24.433 Low: -6.012
Date: 1992-01-01T00:00:00Z Open: 9.07515 Close: 9.248 High: 24.382 Low: -2.962
Date: 1993-01-01T00:00:00Z Open: 9.248 Close: 8.82823 High: 22.617 Low: -3.535
Date: 1994-01-01T00:00:00Z Open: 8.82823 Close: 9.42973 High: 24.679 Low: -3.27
Date: 1995-01-01T00:00:00Z Open: 9.42973 Close: 9.66995 High: 27.632 Low: -5.334
Date: 1996-01-01T00:00:00Z Open: 9.66995 Close: 8.51876 High: 25.441 Low: -3.433
Date: 1997-01-01T00:00:00Z Open: 8.51876 Close: 9.84359 High: 26.192 Low: -3.945
Date: 1998-01-01T00:00:00Z Open: 9.84359 Close: 9.62246 High: 24.125 Low: -1.96
Date: 1999-01-01T00:00:00Z Open: 9.62246 Close: 9.89734 High: 25.593 Low: -3.197
Date: 2000-01-01T00:00:00Z Open: 9.89734 Close: 9.60002 High: 24.307 Low: -1.586
Date: 2001-01-01T00:00:00Z Open: 9.60002 Close: 9.24029 High: 24.691 Low: -2.798
Date: 2002-01-01T00:00:00Z Open: 9.24029 Close: 9.94568 High: 24.616 Low: -3.338
Date: 2003-01-01T00:00:00Z Open: 9.94568 Close: 9.84366 High: 28.147 Low: -2.581
Date: 2004-01-01T00:00:00Z Open: 9.84366 Close: 9.89234 High: 25.029 Low: -2.264
Date: 2005-01-01T00:00:00Z Open: 9.89234 Close: 9.95244 High: 25.186 Low: -2.238
Date: 2006-01-01T00:00:00Z Open: 9.95244 Close: 10.2538 High: 28.169 Low: -2.12
Date: 2007-01-01T00:00:00Z Open: 10.2538 Close: 10.0504 High: 23.289 Low: -2.397
Date: 2008-01-01T00:00:00Z Open: 10.0504 Close: 9.52558 High: 24.556 Low: -2.04
Date: 2009-01-01T00:00:00Z Open: 9.52558 Close: 9.63124 High: 25.563 Low: -4.288
Date: 2010-01-01T00:00:00Z Open: 9.63124 Close: 8.42416 High: 23.663 Low: -4.609
Date: 2011-01-01T00:00:00Z Open: 8.42416 Close: 10.0731 High: 23.903 Low: -2.283
Date: 2012-01-01T00:00:00Z Open: 10.0731 Close: 9.16192 High: 23.794 Low: -5.121
Date: 2013-01-01T00:00:00Z Open: 9.16192 Close: 8.95727 High: 25.885 Low: -2.771
Date: 2014-01-01T00:00:00Z Open: 8.95727 Close: 10.3443 High: 24.603 Low: -1.035
Date: 2015-01-01T00:00:00Z Open: 10.3443 Close: 9.6715 High: 26.586 Low: -2.602
Date: 2016-01-01T00:00:00Z Open: 9.6715 Close: 9.67921 High: 26.949 Low: -1.399
Date: 2017-01-01T00:00:00Z Open: 9.67921 Close: 9.99256 High: 25.548 Low: -1.51
Date: 2018-01-01T00:00:00Z Open: 9.99256 Close: 10.0382 High: 27.342 Low: -4.516
Date: 2019-01-01T00:00:00Z Open: 10.0382 Close: 9.94746 High: 29.105 Low: -2.719
```

Task 2: Create a text-based plot of the candlestick data

- Overview:

The system extends the existing candlestick computation framework by providing visual representation of temperature data over time, using ASCII and color coding to represent candlestick patterns.

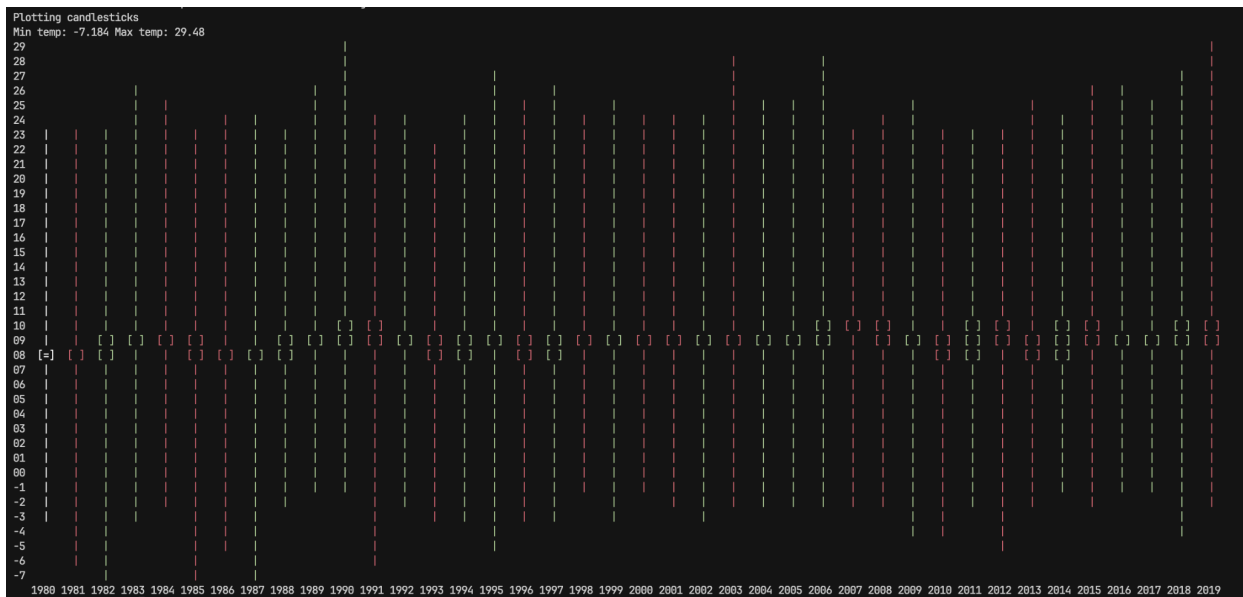
The plotting algorithm begins by determining the overall temperature range.

The visualization is generated from top to bottom (highest to lowest temperature).

The **CandlestickPlotter** implementation builds upon the existing candlestick computation system and introduces a new visualization layer:

- Core Classes:
 1. CandlestickPlotter - Handles visualization and plotting of candlestick data
 2. Candlestick - Provides data access methods for plotting (existing class)
- Visual Elements:
 - Body Representation: Uses [] symbols to represent the candlestick body (open/close range)
 - Wick Representation: Uses | symbols to represent the high/low range
 - Color Coding:
 - Green (\033[32m) candlesticks (close > open)
 - Red (\033[31m) candlesticks (close < open)
 - White (\033[37m) candlesticks (close = open)

- Output screenshot:



Task 3: Filter Data and Plotting using text

- Overview:

The implementation of a filter system for weather data analysis, consisting of Country and Date Range filters. The system provides users with the ability to selectively analyze weather data by geographic region (country) and temporal boundaries (year range).

The filter system is implemented through two independent but complementary filter classes that work together to constrain data processing and visualization.

- Core Classes:
 1. CountryFilter - Manages geographic data filtering by country codes;
 2. DateRangeFilter - Handles temporal data filtering by year ranges;
 3. Menu - Provides user interface for filter configuration and management.
- Output screenshot:

Summary:

selected Country: PT

selected Date range: 1980 - 2025

1: Select country

2: Select date range

3: Plot chart

4: Exit app

Type in 1-6

2

You chose: 2

Select date range

Enter start year: 2005

Enter end year: 2011

Summary:

selected Country: PT

selected Date range: 2005 - 2011

1: Select country

2: Select date range

3: Plot chart

4: Exit app

Type in 1-6

3

You chose: 3

Plotting chart

Candlestick: 2005-01-01T00:00:00Z 15.2008 15.3418 35.258 -0.54

Candlestick: 2006-01-01T00:00:00Z 15.3418 15.8571 34.178 1.177

Candlestick: 2007-01-01T00:00:00Z 15.8571 15.1282 33.919 1.901

Candlestick: 2008-01-01T00:00:00Z 15.1282 15.0688 31.817 3.334

Candlestick: 2009-01-01T00:00:00Z 15.0688 15.6189 32.493 0.077

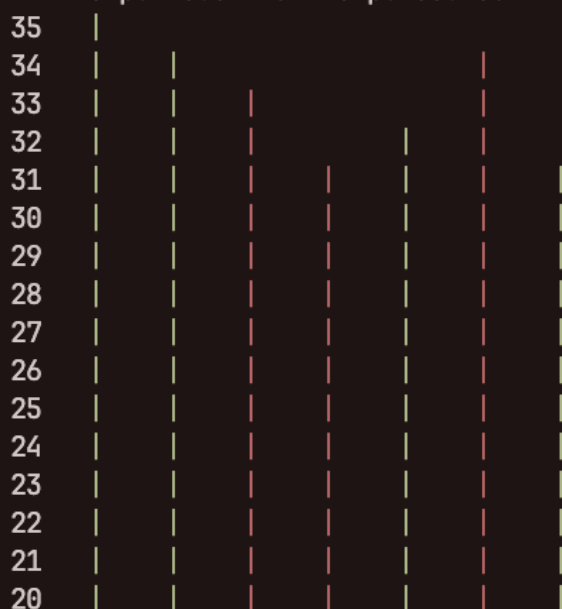
Candlestick: 2010-01-01T00:00:00Z 15.6189 15.3389 34.179 1.618

Candlestick: 2011-01-01T00:00:00Z 15.3389 15.7582 31.669 2.572

Plotting candlesticks

Candlesticks size: 7

Min temp: -0.54 Max temp: 35.258



Task 4: Predicting Data and Plotting

- Overview:
The implementation of a temperature prediction system that analyses historical weather data to forecast future temperature. The system uses a simple method of calculating the average yearly temperature change and then predicting the temperature for a given number of years, without using any machine learning or other complex methods. It integrates seamlessly with the existing weather data processing framework, leveraging candlestick computation for historical data extraction and supporting country-specific analysis through the filter system.
- Core Classes:
 1. TemperaturePredictor - Main prediction engine for temperature forecasting.
- Output screenshot:

```
=== MENU ===
Applied filters:
    selected Country: GB
    selected Date range: 1980 - 2025
Options:
1: Select country
2: Select date range
3: Plot chart
4: Predict temperature
5: Exit app
=== END MENU ===
Type in 1-6
4
You chose: 4
=== TEMPERATURE PREDICTION ===
Selected Country: GB
Enter number of years to predict (1-5): 5
Analyzing historical data...
Country: GB
Last recorded temperature: 9.94746°C
Yearly temperature change: 0.0317355°C per year
Predicted temperature for 5 years.
Predicted Average Temperatures:
2020: 9.98°C
2021: 10.01°C
2022: 10.04°C
2023: 10.07°C
2024: 10.11°C
```