MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE GWALIOR

(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)

NAAC Accredited with A++ Grade

Project Report

on

Pattern Recognition in stock Market

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Faculty Mentor:

Prof. Bhagat Raghuvanshi, Assistant Professor

CENTRE FOR ARTIFICIAL INTELLIGENCE

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE

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CERTIFICATE

This is certified that **Subhash Singh(0901AD211062), Vikram(0901AD211065)** has submitted the project report titled Pattern Recognition in stock market under the mentorship of **Prof. Bhagat Singh Raghuvanshi**, in partial fulfilment of the requirement for the award of degree of Bachelor of Technology in **Artificial intelligence and data science** from Madhav Institute of Technology and Science, Gwalior.

23/11/23

Prof. Bhagat Singh Raghuvanshi
Faculty Mentor
Assistant Professor
Centre for Artificial Intelligence

23/11/23

Dr. R. R. Singh
Coordinator
Centre for Artificial Intelligence

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DECLARATION

I hereby declare that the work being presented in this project report, for the partial fulfilment of requirement for the award of the degree of Bachelor of Technology in **Artificial intelligence and data scientist** Madhav Institute of Technology & Science, Gwalior is an authenticated and original record of my work under the mentorship of **Prof. Bhagat Singh Raghuvanshi, Assistant Professor,** Centre of Artificial Intelligence

I declare that I have not submitted the matter embodied in this report for the award of any degree or diploma anywhere else.

Subhash Singh
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The full semester project has proved to be pivotal to my career. I am thankful to my institute, **Madhav Institute of Technology and Science** to allow me to continue my disciplinary/interdisciplinary project as a curriculum requirement, under the provisions of the Flexible Curriculum Scheme (based on the AICTE Model Curriculum 2018), approved by the Academic Council of the institute. I extend my gratitude to the Director of the institute, **Dr. R. K. Pandit** and Dean Academics, **Dr. Manjaree Pandit** for this.

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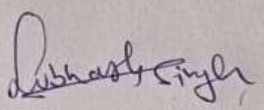

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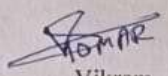

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ABSTRACT

The head and shoulders pattern is a widely recognized chart pattern in technical analysis that signals a potential trend reversal. It is characterized by three distinct peaks, with the middle peak being the highest (the "head") and the two outer peaks being lower and roughly equal in height (the "shoulders"). The formation of a neckline, a horizontal line connecting the troughs of the pattern, further reinforces its significance. When the price breaks below the neckline, it is considered a confirmation of the bearish trend reversal, indicating a potential decline in the asset's price.

This project focuses on developing an algorithm for recognizing head and shoulders patterns from candlestick charts. The algorithm utilizes a combination of image processing and pattern recognition techniques to identify the key components of the pattern, including the peaks, troughs, and neckline. It employs a thresholding approach to extract the relevant price data from the candlestick chart and subsequently applies a peak-finding algorithm to identify the three characteristic peaks. The neckline is determined by connecting the troughs of the pattern, and the pattern is validated based on the height and positional relationships of the peaks and troughs.

The effectiveness of the algorithm is evaluated using a dataset of candlestick charts containing both valid and invalid head and shoulders patterns. The results demonstrate that the algorithm achieves a high level of accuracy in identifying both valid and invalid patterns, confirming its viability for practical application in technical analysis.

Chapter 1: PROJECT OVERVIEW

1.1. Introduction

In the dynamic landscape of financial markets, technical analysis serves as a vital compass for traders and investors. Among the recognized chart patterns, the head and shoulders pattern stands out for its ability to signal potential trend reversals. This project addresses the need for automated pattern recognition by developing an algorithm focused on identifying head and shoulders patterns in candlestick charts.

Combining image processing and pattern recognition techniques, our algorithm extracts key components, such as peaks, troughs, and the neckline. The breaking of prices below the neckline confirms a bearish trend reversal. The algorithm's efficacy is demonstrated through a thorough evaluation using a dataset comprising both valid and invalid patterns, affirming its practical utility in enhancing decision-making processes in technical analysis. This introduction sets the stage for an in-depth exploration of the algorithm's development, methodology, and validation.

1.2 .Significance in the Real World:

The algorithm for recognizing head and shoulders patterns in candlestick charts holds practical value in real-world financial contexts.

1. **Swift Decision-Making:**
    - Enables quick identification of potential trend reversals, aiding traders in making timely decisions on entry, exit, and risk management.
2. **Risk Management:**
    - Offers a tool for mitigating risk by anticipating bearish trend reversals, helping traders adjust their positions to changing market conditions.
3. **Enhanced Technical Analysis:**
    - Streamlines technical analysis by automating the identification of a widely used chart pattern, saving time and improving accuracy.

4. **Strategic Decision Support:**
    - Empowers traders with refined market insights, facilitating more informed and strategic decision-making based on identified chart patterns.
5. **Adaptability Across Markets:**
    - Adaptable to diverse market scenarios and financial instruments, enhancing utility for a broad spectrum of traders and investors.
6. **Cognitive Load Reduction:**
    - Reduces cognitive load on traders, allowing them to focus on higher-level decision-making and minimizing the impact of emotional biases.
7. **Integration with Algorithmic Trading:**
    Seamless integration into algorithmic trading systems adds sophistication to automated trading strategies, improving overall effectiveness.

Objectives:

1. **Algorithm Development:**
    - Develop a robust algorithm capable of accurately identifying head and shoulders patterns in candlestick charts.
2. **Image Processing Integration:**
    - Integrate image processing techniques to enhance the visibility and clarity of candlestick chart patterns, optimizing the algorithm's pattern recognition capabilities.
3. **Thresholding and Data Extraction:**
    - Implement a thresholding approach to extract relevant price data from candlestick charts, ensuring the algorithm focuses on key components such as peaks, troughs, and the neckline.
4. **Peak Identification:**
    - Apply a peak-finding algorithm to precisely identify the three characteristic peaks of the head and shoulders pattern, with emphasis on accuracy and efficiency.
5. **Neckline Determination:**
    - Develop a method to determine the neckline by connecting troughs, employing techniques such as line fitting or curve interpolation.
6. **Pattern Validation Criteria:**
    - Establish robust criteria for validating head and shoulders patterns based on the height and positional relationships of identified peaks and troughs.
7. **Dataset Compilation:**
    - Curate a comprehensive dataset containing a diverse range of candlestick charts, encompassing both valid and invalid head and shoulders patterns, to rigorously evaluate the algorithm's performance.

8. **Evaluation Metrics:**
    - Define and employ evaluation metrics, including precision, recall, and F1 score, to quantitatively assess the algorithm's accuracy in identifying head and shoulders patterns.
9. **Optimization:**
    - Fine-tune the algorithm based on feedback from the evaluation phase, optimizing parameters and ensuring adaptability across different market conditions.
10. **Documentation and Visualization:**
    - Clearly document each step of the algorithm's development, implementation, and optimization, accompanied by visualizations of identified patterns on candlestick charts for clarity and interpretation.
11. **Real-world Applicability:**
    - Demonstrate the algorithm's practical applicability by showcasing its effectiveness in recognizing head and shoulders patterns in various market scenarios, thereby providing value to traders and investors.
12. **Future Enhancements:**
    - Identify opportunities for future enhancements, potentially exploring the integration of machine learning techniques for pattern recognition or expanding the algorithm to recognize other relevant chart patterns.

Scope in the Financial Field:

1. **Efficient Technical Analysis:**
    - Streamlines technical analysis by automating the identification of head and shoulders patterns, saving time and improving efficiency.
2. **Informed Decision-Making:**
    - Empowers traders with insights for more informed decisions on market entry, exit, and risk management through early recognition of potential trend reversals.
3. **Risk Mitigation:**
    - Assists in risk mitigation by providing advance warning of bearish trend reversals, allowing traders to adjust positions and minimize potential losses.
4. **Integration with Algorithmic Trading:**
    - Seamlessly integrates into algorithmic trading systems, enhancing the sophistication and effectiveness of automated trading strategies.
5. **Real-time Responsiveness:**
    - Operates in real-time, enabling traders to promptly respond to emerging head and shoulders patterns in fast-paced financial markets.

System Requirements:

1. **Hardware:**
   - Minimum: Dual-core processor, 4 GB RAM
   - Recommended: Quad-core processor or higher, 8 GB RAM or higher
2. **Operating System:**
   - Windows 10, macOS, or Linux (64-bit)
3. **Software Dependencies:**
   - Python 3.x
   - Required Python Libraries: NumPy, Pandas, Matplotlib, OpenCV, Scikit-learn
4. **Image Processing Capabilities:**
   - Graphics processing unit (GPU) recommended for enhanced image processing performance
5. **Storage:**
   - Minimum 10 GB free disk space for dataset storage and algorithm output
6. **Internet Connection:**
   - Required for initial library installations, updates, and potential dataset retrieval
7. **Display:**
   - Monitor with a minimum resolution of 1280x720 pixels
8. **Development Environment:**
   - Integrated Development Environment (IDE) such as Jupyter Notebook or Visual Studio Code for algorithm development and testing

Code of the project

In [1]:
```
# loding the dataset
import pandas as pd
df = pd.read_csv(r"C:\Users\ABC\Downloads\EURUSD_Candlestick_4_Hour_ASK_05.
```

In [3]:
```
#:Check if NA values are in data
df=df[df['volume']!=0]        # removing those row where volume =0 in the ma
df.reset_index(drop=True, inplace=True)
df.isna().sum()
df.head(10)
```

Out[3]:

	Gmt time	open	high	low	close	volume
0	04.05.2003 21:00:00.000	1.12354	1.12354	1.12166	1.12274	95533.0976
1	05.05.2003 01:00:00.000	1.12242	1.12276	1.12067	1.12126	93778.5996
2	05.05.2003 05:00:00.000	1.12139	1.12255	1.12030	1.12113	90924.6992
3	05.05.2003 09:00:00.000	1.12092	1.12331	1.12049	1.12174	91254.6992
4	05.05.2003 13:00:00.000	1.12194	1.12900	1.12130	1.12712	308003.4083
5	05.05.2003 17:00:00.000	1.12718	1.13019	1.12657	1.12804	373668.2930
6	05.05.2003 21:00:00.000	1.12798	1.13004	1.12772	1.12913	94283.7988
7	06.05.2003 01:00:00.000	1.12892	1.12967	1.12743	1.12855	95461.9980
8	06.05.2003 05:00:00.000	1.12856	1.13412	1.12738	1.13381	92809.0996
9	06.05.2003 09:00:00.000	1.13383	1.13662	1.13188	1.13456	90255.7988

In [4]:
```
df.shape
```

Out[4]: (28826, 6)

In [5]:

```
def pivotid(df1, l, n1, n2): #n1 n2 before and after candle l

    if l-n1 < 0 or l+n2 >= len(df1):

        return 0



    pividlow
    =1
    pividhig
    h=1

    for i in range(l-n1, l+n2+1):

        if(df1.low[l]>df1.low[i
            ]):pividlow=0

        if(df1.high[l]<df1.high[i
            ]):pividhigh=0

    if pividlow and pividhigh:

        return 3

    elif pividlow:

        return 1

    elif pividhigh:

        return 2

    else:

        return 0


df['pivot'] = df.apply(lambda x: pivotid(df, x.name,15,15), axis=1)

df['shortpivot'] = df.apply(lambda x: pivotid(df, x.name,5,5), axis=1)
```

In [6]:

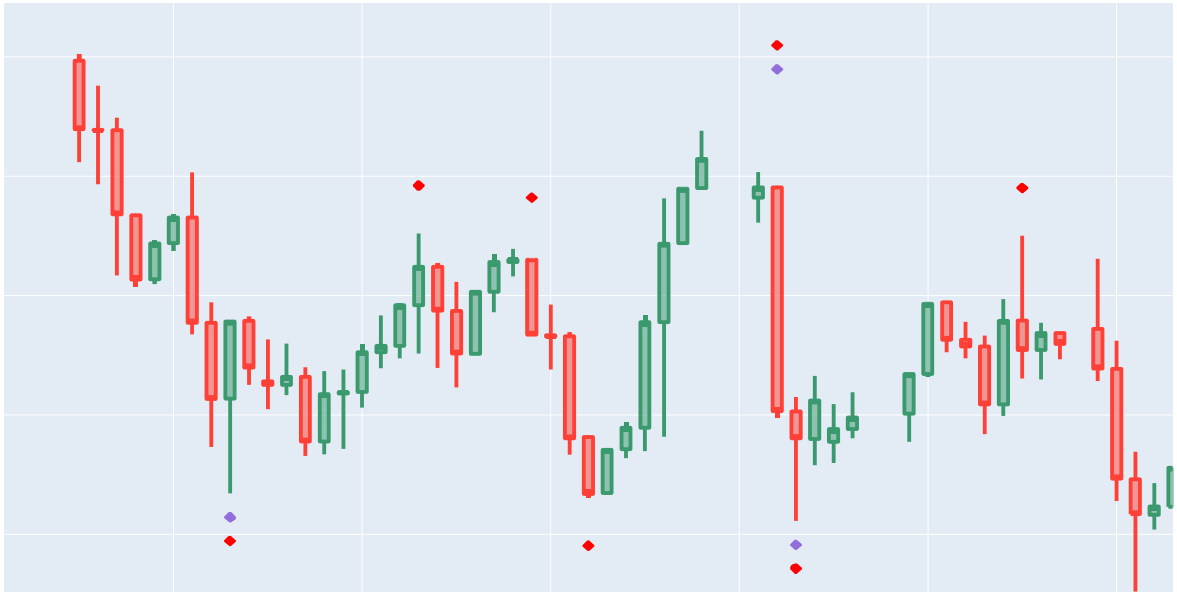
```
import numpy as np

def pointpos(x):
    if x['pivot']==1:
        return x['low']-1e-3
    elif x['pivot']==2:
        return x['high']+1e-3
    else:
        return np.nan


def shortpointpos(x):
    if x['shortpivot']==1:
return x['low']-2e-
                3
               elif
x['shortpivot']==2:
        return x['high']+2e-3
    else:
        return np.nan


df['pointpos'] = df.apply(lambda row: pointpos(row), axis=1)
df['shortpointpos'] = df.apply(lambda row: shortpointpos(row),
axis=1)
```

In [7]:

```
import plotly.graph_objects as go

from plotly.subplots import make_subplots

from datetime import datetime
dfpl = df[28000:28500]

fig = go.Figure(data=[go.Candlestick(x=dfpl.index,
                open=dfpl['open'],

                high=dfpl['high'],
                low=dfpl['low'],

                close=dfpl['close'])])


fig.add_scatter(x=dfpl.index, y=dfpl['pointpos'], mode="markers",
                marker=dict(size=5, color="MediumPurple"),

                name="pivot")

#fig.update_layout(xaxis_rangeslider_visible=False)

fig.show()
```

In [8]:

```
import plotly.graph_objects as go
from plotly.subplots import make_subplots
from datetime import datetime
dfpl = df[15375:15440]
fig = go.Figure(data=[go.Candlestick(x=dfpl.index,
                open=dfpl['open'],
                high=dfpl['high'],
                low=dfpl['low'],
                close=dfpl['close'])])


fig.add_scatter(x=dfpl.index, y=dfpl['pointpos'], mode="markers",
                marker=dict(size=5, color="MediumPurple"),
                name="pivot")
fig.add_scatter(x=dfpl.index, y=dfpl['shortpointpos'], mode="markers",
                marker=dict(size=5, color="red"),
                name="shortpivot")
fig.update_layout(xaxis_rangeslider_visible=False)
fig.show()
```



Pivot point find by the algorithm

Head and shoulder pattern identify by the algorithm

List of References

The reference material should include the author name, title, year in detail.

1. Guide to Technical Analysis & candlesticks
   (by : Ravi Patel)
2. Candlesticks chart pattern
3. https://youtu.be/8cZ-ljrSaEw?feature=shared
4. https://youtu.be/n1LkQV10SnE?feature=shared