Risk Based Portfolio Optimiser

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Introduction

The Risk Based Portfolio Optimiser is a comprehensive financial tool designed to empower users to make informed investment decisions by analyzing and optimizing portfolio allocation based on risk tolerance and expected returns. The application leverages Python's robust libraries to calculate future portfolio values using historical return rates of different asset classes such as bonds, mutual funds, and precious metals (gold). The outputs are displayed through interactive data visualizations, including pie charts, stacked bar graphs, and tables, enabling users to understand their portfolio's projected performance over time.

Project Objectives

The primary goal of the Risk Based Portfolio Optimiser is to enable users to:

1. Optimize Portfolio Allocation based on historical return data and expected performance.
2. Understand Risk Levels through an intuitive interface, classifying risk profiles from "very low" to "very high."
3. Visualize Investment Growth using easy-to-understand charts and graphs.
4. Manage Investments by considering initial investments, yearly contributions, and incremental growth.

Overview of the Risk Based Portfolio Optimiser

Key Inputs:

- **Starting Year:** The year when investments begin.
- **Final Year:** The target year for portfolio evaluation.
- **Initial Investment:** The capital available at the beginning of the investment cycle.
- **Investable Amount Per Annum (IAPA):** Annual contributions toward the investment.
- **IAPA Increment:** Annual increase in the investable amount.
- **Expected Return:** The total portfolio value desired by the end of the investment period.

Key Outputs:

1. Portfolio Allocation: A breakdown of the optimal asset allocation across different financial instruments.

2. Growth Forecast: Visualization of cumulative investment and return growth over the years.

3. Risk Level Assessment: Classification of risk tolerance based on expected returns.

Features and Functionalities

The application provides multiple features that cater to both novice and experienced investors:

1. Portfolio Optimization Based on Risk:

- The system defines four risk portfolios (P1, P2, P3, P4), each with a different allocation strategy across bonds, large-cap mutual funds, mid-cap mutual funds, small-cap mutual funds, and gold.
- Users can enter their expected returns, and the system will calculate the most appropriate asset allocation and suggest a risk level (from very low to very high).

2. Visual Data Representation:

- **Pie Chart:** This chart shows the asset allocation based on the user's inputs and expected returns.
- **Stacked Bar Graph:** This graph visualizes the cumulative investment and cumulative return year over year.
- **Detailed Table:** This table provides a yearly breakdown of total cumulative investment, total cumulative returns, and total portfolio value.

3. Interactive User Experience:

- The website allows users to dynamically input their data and observe real-time changes in outputs.

Technical Approach

The development of the "Risk Based Portfolio Optimiser" involved various technologies and techniques that showcase proficiency in Python, data analytics, data science, and web development. Below is an overview of the technical approach:

- Python for Core Computation: The core financial calculations and portfolio optimization are handled using Python. Python was chosen due to its versatility, extensive libraries for data analytics (like Pandas and NumPy), and ease of integration with other systems.

- Data Analytics and Financial Modelling: Financial analysis calculations, such as future value projections, rate of return estimations, and asset allocation optimization, were developed using Python. Functions were built to compute cumulative investments, returns, and portfolio allocations based on user inputs.

- **Web Development:** The interactive website is built using a combination of:
  - **HTML:** Structuring the content and ensuring proper layout of the web interface.
    - **CSS:** Styling the visual aspects of the website, ensuring it is both user-friendly and visually appealing.
  - **JavaScript:** Managing client-side interactions and dynamic updates, making the website responsive and interactive.

- **Visualization:** Python libraries (such as Matplotlib and Plotly) are used to generate graphs and charts to visualize the results. These visualizations are embedded in the website to make the user experience more intuitive.

The integration of these technologies allowed for a robust and user-friendly tool that combines the precision of data analytics with the accessibility of web technology.

Financial Analysis

Asset Classes and Their Returns:

In this project, the financial analysis is focused on the expected performance of different asset classes over a 12-year period from 2020 to 2032. To ensure realistic modeling, we based our assumptions on historical returns of various asset classes, including bonds, large-cap, mid-cap, and small-cap mutual funds, as well as precious metals (gold). These assumptions allow us to forecast future returns and investment growth in a risk-based portfolio.

The asset class returns used for the analysis were as follows:

- **Bonds (fixed deposits and recurring deposits):** 6.5%
- **Large-Cap Mutual Funds:** 10.7%
- **Mid-Cap Mutual Funds:** 11.25%
- **Small-Cap Mutual Funds:** 11.85%
- **Gold (Precious Metals):** 9.3%

These return values are considered to be reasonably accurate based on historical data and expert financial sources. We assumed that the performance trends observed between 2020 and 2032 would mirror past

behavior. The sources for these assumed returns include reputable financial institutions and industry research reports, which are mentioned in the references section.

By incorporating these returns into our calculations, we generated different portfolio scenarios based on the user's risk tolerance and expected returns. The final portfolio allocation, asset growth, and overall performance are tailored to each scenario, providing a thorough financial analysis grounded in historical data.

This financial analysis demonstrates our ability to conduct rigorous data-driven forecasting and create informed investment strategies based on historical market behavior.

Risk-Based Allocation:

The system evaluates different risk portfolios, each with varying exposure to bonds, mutual funds, and gold. As the user’s risk tolerance increases, the allocation to more volatile assets such as small-cap funds increases, while safer assets like bonds decrease.

Data Analytics and Visualizations

Visualizing investment data helps users comprehend the impact of their financial decisions:

1. Pie Chart for Asset Allocation:

- This visualization provides a breakdown of the user’s portfolio allocation across bonds, various categories of mutual funds, and gold. The pie chart dynamically adjusts according to the expected return.

2. Stacked Bar Graph for Cumulative Growth:

- A stacked bar graph demonstrates how the investment grows over the years, with one bar for the total cumulative investment and another for the total cumulative return.

3. Yearly Portfolio Value Table:

- The table presents a clear yearly summary, showing how much is invested, how much is returned, and the total portfolio value at each year’s end.

Strategic Design and Usability Considerations

This project was designed with the following considerations:

1. User-Centric Design:

- The tool addresses the key concern of users—how to allocate investments based on desired returns and risk tolerance.
- Clear and intuitive visualizations enable users to make informed decisions.

2. Scalability:

- The modular design of the tool allows for further enhancement, including the addition of more asset classes, risk factors, or longer investment horizons.

3. Integration with Financial Platforms:

- The platform can be extended to integrate with real-time financial data providers, making it a live portfolio management tool.

Use Cases

1. Novice Investors:

- Can input their financial goals and expected returns to get a recommended portfolio allocation and risk level, aiding in investment decision-making.

2. Financial Advisors:

- Can use the tool to demonstrate different portfolio outcomes based on risk levels to clients.

3. Financial Institutions:

- Could integrate this tool into their platforms to provide customers with personalized portfolio optimization options.

Conclusion

The Risk Based Portfolio Optimiser demonstrates a strong intersection of Python programming, data analytics, data science, financial analysis, and product management. The tool not only provides personalized investment recommendations but also visualizes the data, helping users make better-informed financial decisions. The integration of financial data, risk classification algorithms, and user-friendly visualizations showcases proficiency in technical and product management skills.

References

- Traders Union Gold Forecast : https://tradersunion.com/currencies/forecast/gold/
- Groww - Large, Mid, Small Cap Mutual Funds : https://groww.in/blog/large-cap-mid-cap-small-cap-do-you-know-the-difference
- CRISIL Report on Mutual Fund Returns : https://www.crisil.com/content/dam/crisil/our-analysis/reports/Research/documents/2021/07/shrinking-alpha.pdf
- Tickertape - Mutual Funds by Market Cap : https://www.tickertape.in/blog/mutual-funds-based-on-market-capitalization/
- Statista GDP Growth : https://www.statista.com/statistics/263617/gross-domestic-product-gdp-growth-rate-in-india/
- Statista Inflation Rate : https://www.statista.com/statistics/271322/inflation-rate-in-india/