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Data Analysis for Mutual Fund

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ABSTRACT: Mutual funds have emerged as an integral part of the investment strategy for Indians, where investments have crossed 50 lakh crores. However, comparing these mutual funds is not an easy task; it requires the use of numbers. Concepts such as NAV, returns, and risks seem complicated and difficult to understand for most of us. Nowadays, there are websites covering these concepts, showing a need for better tools to assess mutual funds.
The following paper introduces a system that seeks to ease the process of analyzing mutual funds and increase efficiency. The system has been developed using the Python programming language and the Django framework to gather data regarding mutual funds, such as net asset value, performance, and risks associated with them.
It also includes a SIP calculator based on actual past data, not rough assumptions, to show expected returns more believably. Machine learning is added to recommend similar funds as per the user's search. This system feels more useful and less limited. It supports personalized analysis, explains measures like the Sharpe ratio and Beta more clearly, and saves investors a lot of effort.Overall, it helps people make sharper investment decisions, and later it could grow into a portfolio tracking, tax tools, and even a mobile app.
Keywords: Mutual Fund Analysis, Django, Visualization, Machine Learning, SIP Calculator.

I. INTRODUCTION

The trend towards mutual funds has been gaining momentum in India, as the assets managed through mutual funds have crossed the figure of 50 lakh crore rupees. Individuals choose mutual funds because of their diversification and flexibility, regardless of the sum invested by an individual. However, the decision-making process for selecting the correct mutual fund requires careful thought and analysis. There are many components of a mutual fund, including NAV, history, expense ratio, risk profile, and compatibility with investor objectives. This process may be overwhelming for an ordinary investor.

This paper describes a novel Web-based Mutual Fund Data Analysis System that seeks to resolve such issues. Created using the Python programming language, it utilizes information regarding past mutual funds, including net asset value, investment returns, and risks. Information can be filtered based on individual user requirements, and a comparative study of different funds is possible. Graphical representations are also provided.

There are different types of machine learning methods, such as the cosine similarity method, employed to recommend funds that are alike. Such a solution provides numerous benefits in comparison with the existing applications. First of all, it allows customizing analysis according to personal preferences and risk appetite. Important risk measures, such as the Sharpe ratio, Beta, and Alpha, are shown conveniently on the screen. Graphs make it possible for users to see patterns easily in the performance of a fund.

II. SYSTEM ANALYSIS

A. EXISTING SYSTEM

Mutual Fund Structures & Metrics guided the design of the fund data model and analytical features. It covered key evaluation parameters like NAV, expense ratios, and return calculations.[1].AMFI Used as a reference for standard mutual fund categories (Equity, Debt, Hybrid) and industry data formats. It ensured calculated performance metrics followed official reporting conventions.[2]

Risk-Return Trade-offs provided the theoretical foundation for performance evaluation using the Sharpe ratio, Beta, and risk-adjusted returns. This helped implement robust risk metrics in the fund comparison module.[3].The SIP Calculator Formula offered a formula for calculating compound interest that could be used to determine the future value of periodic investments, thus the layout for the SIP calculator.[4]

The Moneycontrol Benchmark is utilized to present the information about mutual funds in an easily understandable web-based interface. The mutual funds fact sheet and comparative tables provided by this benchmark became the basis for the interface design.[5]

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Mutual fund analysis may be carried out using many different internet platforms and smartphone applications. Normally, the operation takes place on the online platform, where the analysis is mostly pre-defined and automated, and not much customization is left for users.

Disadvantages of the existing mechanism include:

- Lack of customization according to personal requirements.
- Shallow analysis, with emphasis only on the NAV of the mutual fund.
- Limited information in the chart.
- Lack of transparency, as there are no underlying data provided.

Comparing two funds directly may not be easy, and even when calculating metrics like Sharpe Ratio, Beta, and Alpha, the results may be insufficient.

B. PROPOSED SYSTEM

1) MOTIVATION

This research is about developing the Mutual Fund Data Analysis System, which can provide users with interactive and comparative analysis capabilities for mutual funds. The need for such software arises because there is too much choice of schemes available to investors today, and insufficient analytical capabilities to evaluate the risks involved. The current methods involve providing information regarding only the NAV and percentage return on investment figures.

The SIP Calculator is based on historical data, the watchlist enables users to track the performance of funds, and machine learning is used to provide recommendations for similar funds.

The web application is developed in Python using the Django framework and has been created to allow users to analyze mutual funds interactively by making use of past figures such as NAV, return rates, and risk associated with different types of funds, comparing them based on their type, ratings, and risks.

Some of the most notable modules of the project include the Authentication module, the Fund Details module, the Fund Analysis module, the Returns Calculator, and the Visualization module. The web app also uses machine learning algorithms to recommend comparable funds and estimate risk for each fund.

Such systems have the following advantages: flexible and customized analysis, the ability to analyze different funds simultaneously, and complex calculations related to risks, such as the Sharpe Ratio and Beta.

2) METHODOLOGY

It is based on a systematic and well-defined procedure where the Authentication Module will be responsible for user registration, verification of the authenticity of their email addresses, password strength check, hash the password, and commence a time-out session of 30 minutes if there is inactivity.

Pseudo Code for SIP Calculator:

```
months = years × 12
monthly_rate = rate / 12 / 100
total = upfront, future = upfront
FOR each month:
   total = total + monthly
   future = (future + monthly) × (1 + monthly_rate)

annual_return = ((future / total)^(1/years) - 1) × 100
RETURN future, total, annual_return
END
```

The Returns Calculator Module computes SIP future value using the annuity due formula:

$$FV = P \times \frac{(1+r)^n - 1}{r} \times (1 + r) \quad [1]$$

Where P = monthly SIP amount,

r = monthly rate (Annual Return / 12 / 100), and

n = number of months (years × 12).

For upfront investments, the total future value is:

$$FV_{total} = FV_{upfront} \times (1 + r)^n + F \quad [2]$$

The ML Recommendation Module employs Cosine Similarity to identify similar mutual funds. Each fund is represented as a feature vector (returns, expense ratio, AUM). The similarity score is calculated as:

$$\text{Similarity}(A, B) = \cos(\theta) = \frac{A \cdot B}{\|A\| \times \|B\|} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum A_i^2} \times \sqrt{\sum B_i^2}} \quad [3]$$

Scores range from 0 to 1, with values above 0.8 indicating highly similar funds for portfolio diversification recommendations.

III. DEVELOPMENT ENVIRONMENT

1) HARDWARE REQUIREMENT

Processor Type : Intel Core i3
Processor Speed:2.4GHz
RAM : 4 GB
Hard Disk : 500 GB

2) SOFTWARE REQUIREMENT

Programming Language : Python
Framework : Django 5.2
IDE : VS Code
Operating system : Windows 11
Machine Learning : Scikit-Learn
Database : SQLite

IV. MODULES DESCRIPTION

1) AUTHENTICATION MODULE

This module is responsible for providing the mechanism for secure login through the process of registering a new account and logging in. Whenever an individual signs up for an account, they will be prompted to provide an email address and password, and the application will verify if that particular email address doesn't exist in order to save it. For authentication purposes, the login information provided by users will be compared to data stored within the application's database.

2) FUND DETAILS MODULE

The current module acts as the post-login dashboard. Here, all mutual funds have been listed in a tabular form. The module will include key information such as fund name, Net Asset Value, type of fund, risk factor, expense ratio, Asset Under Management, ratings, and one-year/three years/five-year performance. There is also an interactive chart available to help users analyze the performance of the fund against relevant benchmark indices and average category performance. The user can use filters to search for a specific fund and sort based on fund house, type, rating, and risk.

3) FUND ANALYSIS MODULE

The Fund Analysis module integrates a powerful recommendation engine based on machine learning technology, which detects funds that share similarities with the fund being analyzed. The engine analyzes several characteristics, such as the category of the fund, its risk, cost, size of the managed portfolio, and historical performance, to identify similar funds. Applying distance-based calculations (cosine similarity), the engine compares the selected fund with all other funds in the database and recommends the top N similar funds.

4) RETURNS CALCULATOR MODULE

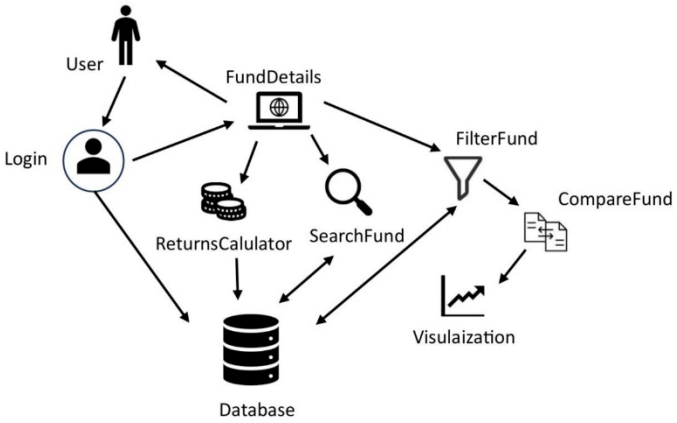
The Returns Calculator module enables the user to estimate possible gains in a Systematic Investment Plan using the concept of compound interest. All you have to do is input the monthly SIP contribution, initial contribution, period for which investments are to be made, and the annual return rate. Using these inputs, the system computes the final amount gained, total contributions, and return on investment, all displayed in close vicinity of an interactive graph showing growth against the total invested amount.

5) VISUALIZATION MODULE

The Visualization module converts information about mutual funds into visually appealing formats such as line graphs and bar charts, thus simplifying the complex nature of finance. Information about the performance and comparative data is extracted from the database and converted into historical trends and comparative bar graphs.

Users can easily recognize trends in growth and comparative standings among different funds. The user can point to a particular graph for detailed figures and click on any item from the legend to display or hide specific data lines.

V. SYSTEM ARCHITECTURE



VI. RESULTS AND DISCUSSIONS

1) EXPERIMENTAL EVALUATION

The experiments to evaluate the Mutual Fund Data Analysis System were conducted to assess the performance, accuracy, and efficiency of the various components. These included experiments to test the Cosine Similarity algorithm that gives fund recommendations, the SIP calculator to predict investments, and system response time.

2) EVALUATION OF COSINE SIMILARITY ALGORITHM

The performance of the Cosine Similarity algorithm in identifying similar funds is described in Table 1 below. To begin with, for each individual fund in the database, we calculated the degree of similarity between this fund and all others based on seven characteristics, namely 1-, 3-, and 5-year returns, expense ratio, total assets, category code, and risk code. Then, we selected five most similar funds and evaluated the relevance of this result according to such indicators as category, risk, and returns.

Table 1

Target Fund	Recommended Fund	Similarity Score	Category Match	Risk Match
HDFC Balanced Fund	ICICI Balanced Fund	0.94	Yes	Yes
SBI Bluechip Fund	ICICI Bluechip Fund	0.91	Yes	Yes
Axis Small Cap Fund	Kotak Small Cap Fund	0.89	Yes	Yes
HDFC Short Term Debt	ICICI Short Term Debt	0.87	Yes	Yes

3) EVALUATION OF SIP CALCULATOR

As shown in Table 2 below, the SIP calculator works as it should. When the monthly deposit rate doubles, the future value also doubles. When the time of investing increases, there is a higher future value since it grows exponentially due to compound interest. An increase in the expected return results in an increase in the future value. All annualized returns equal the expected return percent.

Table 2

Monthly Amount (₹)	Years	Expected Return (%)	Total Invested (₹)	Future Value (₹)	Annualized Return (%)
5,000	5	12	3,00,000	4,12,431	12.00
10,000	5	12	6,00,000	8,24,863	12.00
10,000	10	12	12,00,000	23,23,879	12.00
10,000	5	15	6,00,000	8,91,743	15.00

Fig. 1 shows the growth of investment amount with 5% of returns in the SBI mutual fund over 13 years.

Fig 1 End Balance over the years

VII. CONCLUSION

Mutual Funds Data Analysis Tool is a web application developed using the programming languages of Python and Django to assist investors in evaluating mutual fund performance based on the historical values of NAV, rate of return, and risk data. Users can select mutual funds according to their preferred categories, ratings, and risks, as well as compare two mutual funds simultaneously while identifying the best one, viewing charts, and estimating future returns from SIPs for better planning. In addition, it provides watchlists for keeping track of your selected mutual funds with added notes for every fund and sharing capabilities to spread fund information via multiple channels.

VIII. FUTURE ENHANCEMENT

The system can be enhanced with real-time data integration to provide live NAV updates, portfolio tracking to manage personal investments, tax calculations for capital gains, and mobile app development for on-the-go access.

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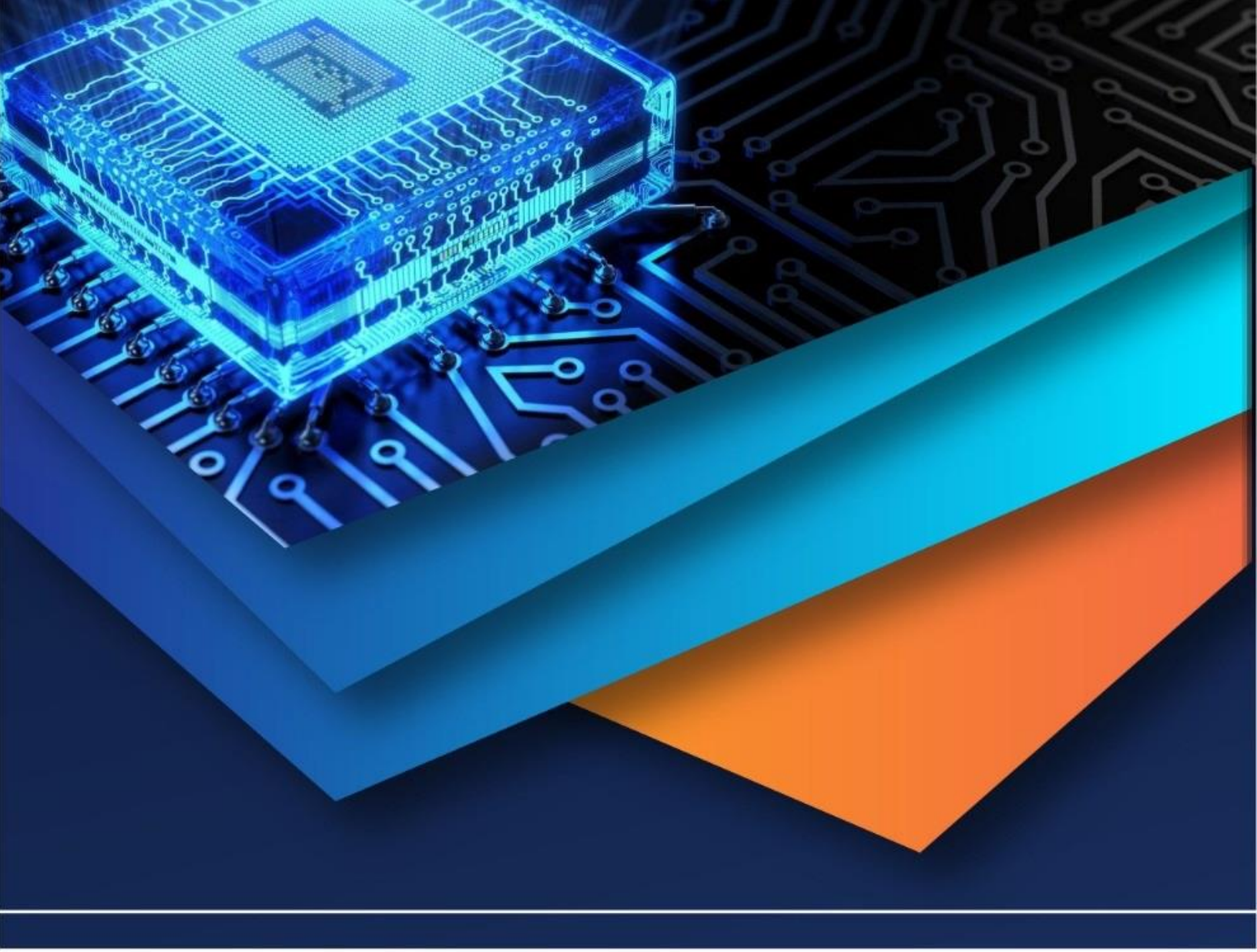

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