AI Solution Intern – Case Study

Introduction

The rapid advancements in generative AI have opened new avenues for streamlining complex and time-intensive tasks such as financial report generation.

This document outlines a comprehensive solution proposal to automate investment report creation for a mid-sized asset management firm. The proposed approach leverages generative AI to produce accurate, compliant, and client-specific reports, ensuring alignment with industry standards and individual client preferences.

The case study tasks involve:

1. Designing prompts that generate detailed, compliant investment reports tailored to client profiles.

2. Proposing strategies to improve prompt engineering and workflows for accuracy and compliance.

3. Developing methodologies to enhance customization for diverse client needs.

This document includes:

1. Refined prompts with sample data and test outcomes.

2. A report on debugging strategies to improve workflow efficiency.

3. Proposed enhancements to make the report generation process more accurate, customizable, and user-friendly.

Goals of the Solution:

The primary goals of this solution are:

1. **Accuracy**: Generate factual, error-free, and consistent investment reports using portfolio performance metrics and benchmarks.

2. **Compliance**: Ensure reports include mandatory regulatory disclosures in adherence to SEBI, SEC, MiFID II, or similar standards.

3. **Customization**: Tailor the content to individual client preferences, simplifying financial jargon for non-technical users and providing in-depth analysis for advanced users.

Through this approach, the asset management firm will benefit from improved efficiency, reduced manual effort, and enhanced client satisfaction.

Prompt Design along with Input and Output Sample

1) Prompt

The design of effective prompts is central to generating detailed, accurate, and client-specific investment reports.

```
1. You are any Intelligent, High IQ, Financial Project Report Creator. You are well versed in
the Financial World. You have worked as a Financial Consultant for 10+years.

2. You need to create a Financial report using the Portfolio Performance Metrics data given in
{Portfolio_Performance_Metrics} and Benchmarks data given in {Benchmarks}
Then, You need to create Insights regarding the Portfolio.
Here is an sample input data :

Portfolio Performance Metrics :
- Returns: 4% YTD, 5% CAGR over 8 years.
- Asset Allocation: 20% Equity, 70% Fixed Income, 10% Cash.
- Risk Metrics: Sharpe Ratio = 0.8, Volatility = 5%.

Benchmarks:
- S&P 500: 7% YTD.
- Fixed Income Index: 3% YTD.

Performance Metrics data will be provided as a list of Key Value pairs like this : - Key :
Returns, Value : 4% YTD, 5% CAGR over 8 years. The Benchmark data will also be provided like
this.

3. You need to use Portfolio Performance Metrics and Benchmarks available in
{Portfolio_Performance_Metrics} and {Benchmarks} for that.
Then, You need to create Recommendations to give to the customer regarding the portfolio.

4. For that first you need to analyze and understand the client preference using the data
available in {Client_Profile}.

Here is a sample Client preference example:
- Name: John Williams.
- Goals: Wealth preservation with minimal risk.
- Risk Appetite: Low.
- Preferences: High allocation to bonds and fixed income.
- Report Preference: Simplified

5. If the Report Preference in client preference is Technical then explain as you would
usually do but if its Simplified consider the user not familiar with financial world and make
sure you avoid complex financial jargon and explain it in simple terms, use everyday language
and examples, like comparing portfolio allocation to a balanced meal.

6. You are free to tailor content to different Clients depending on their profile. Display
Client preference data at the top.

Then, using that knowledge, create Recommendations for that client. You can use Portfolio
Performance Metrics and Benchmarks available in {Portfolio_Performance_Metrics} and
{Benchmarks} as well if needed.

7. Finally, display a Compliance Note for the User cautioning the user that the data provided
was for informational purposes only and should not be a substitute for Financial Advice. This
is Mandatory.
```

```
8. Some Examples of Compliance Note :
This report is for informational purposes only and should not be considered as investment
advice. Past performance is not indicative of future results. All data presented complies with
SEBI/SEC/MiFID 2 or any other local regulatory standards.
The information provided in this report is for informational purposes only and should not be
considered a substitute for personalized financial advice. It is recommended that client
consult with a qualified financial advisor to tailor investment strategies to their specific
financial situation and goals. All data presented complies with SEBI/SEC/MiFID 2 or any other
local regulatory standards.

8. You are not allowed to use any data other than the data given here but you are free to do
any calculations if required but make sure that calculations are correct, retry them out
multiple times to cross-check if the answers are consistent.

10. Verify that the compliance note is present at the end of the report. Retry the generation
if it is missing.

11. If the portfolio is under performing or having conflicting preference, do not be critical
of the client but instead highlight areas of concern tactfully and suggest actionable
recommendations to improve performance.

12. If data is missing, Tell the same and tell them to contact the Financial Advisor.
```

This prompt has been meticulously refined through multiple iterations of testing to ensure accuracy, clarity, effectiveness, consistency.

2) Sample Inputs

Sample Input 1 :

```
Portfolio_Performance_Metrics = """
- Returns: -3% YTD, 2% CAGR over 5 years.
- Asset Allocation: 50% Equity, 40% Fixed Income, 10% Cash.
- Risk Metrics: Sharpe Ratio = -0.5, Volatility = 15%.
"""
```

```
Benchmarks = """
- S&P 500: 7% YTD.
- Fixed Income Index: 3% YTD.
"""
```

```
Client_Profile = """
- Name: Sophia Martinez.
- Goals: Balanced growth with moderate risk.
- Risk Appetite: Moderate.
- Preferences: Diversified portfolio with steady returns.
- Report Preference: Simplified
"""
```

Sample Input 2 :

```
Portfolio_Performance_Metrics = """
- Returns: 11% YTD, 9% CAGR over 6 years.
- Asset Allocation: 40% US Equity, 30% International Equity, 20% Fixed Income, 10%
Alternatives.
- Risk Metrics: Sharpe Ratio = 1.3, Volatility = 14%.
"""
```

```
Benchmarks = """
- S&P 500: 8% YTD.
- MSCI World Index: 7% YTD.
- Fixed Income Index: 2% YTD.
"""
```

```
Client_Profile = """
- Name: Priya Kapoor.
- Goals: Global diversification for long-term growth.
- Risk Appetite: Moderate-High.
- Preferences: Exposure to emerging markets.
- Report Preference: Technical
"""
```

Many such sample inputs have been used to meticulously test the prompt to make it resilient against edge cases and make the output more consistent and accurate.

3) Sample Outputs

Sample Output 1:

Client Preference Data:

- **Name: Priya Kapoor**
- **Goals: Global diversification for long-term growth.**
- **Risk Appetite: Moderate-High.**
- **Preferences: Exposure to emerging markets.**
- **Report Preference: Technical**

Financial Report:

Portfolio Performance Metrics:

- **Returns:** 11% YTD, 9% CAGR over 6 years.
- **Asset Allocation:** 40% US Equity, 30% International Equity, 20% Fixed Income, 10% Alternatives.
- **Risk Metrics:** Sharpe Ratio = 1.3, Volatility = 14%.

Benchmarks:

- **S&P 500:** 8% YTD.
- **MSCI World Index:** 7% YTD.
- **Fixed Income Index:** 2% YTD.

Insights:

1. **Performance Analysis:**

   - The portfolio has achieved an impressive 11% YTD return, outperforming the S&P 500 (8% YTD) and the MSCI World Index (7% YTD). This indicates strong performance relative to major equity benchmarks.
   - The 9% CAGR over 6 years suggests consistent growth, aligning well with Priya's goal of long-term growth.

2. **Risk Assessment:**
   - A Sharpe Ratio of 1.3 indicates that the portfolio is generating good returns for the level of risk taken, which is favorable for a moderate-high risk appetite.
   - Volatility at 14% is higher than typical fixed income investments but is reasonable given the equity exposure, aligning with Priya's moderate-high risk tolerance.

3. **Asset Allocation:**
   - The portfolio's allocation is well-diversified globally, with 30% in International Equity, supporting Priya's goal of global diversification.
   - The 10% allocation to Alternatives provides additional diversification and potential exposure to emerging markets, aligning with Priya's preferences.

Recommendations:

1. **Enhance Emerging Market Exposure:**
   - Consider increasing the allocation to emerging markets within the International Equity segment to further align with Priya's preference for exposure to these markets. This could potentially enhance returns and diversification.

2. **Monitor Volatility:**
   - While the current volatility is acceptable, continuous monitoring is advised to ensure it remains within Priya's risk tolerance, especially in volatile market conditions.

3. **Review Fixed Income Allocation:**
   - The 20% allocation to Fixed Income is conservative given Priya's moderate-high risk appetite. Consider reallocating a portion to higher-yielding assets or emerging market bonds for potentially better returns.

4. **Regular Portfolio Review:**
   - Conduct regular reviews to ensure the portfolio remains aligned with Priya's goals and market conditions. This will help in making timely adjustments to asset allocation and risk management strategies.

Compliance Note:

The information provided in this report is for informational purposes only and should not be considered a substitute for personalized financial advice. It is recommended that Priya consult with a qualified financial advisor to tailor investment strategies to her specific financial situation and goals. All data presented complies with SEBI/SEC/MiFID 2 or any other local regulatory standards.

Output Sample 2 :

Client Preference Data:

- Name: Michael Lee.
- Goals: Aggressive short-term wealth accumulation.
- Risk Appetite: High.
- Preferences: Growth-oriented investments.
- Report Preference: Simplified.

Financial Report:

Portfolio Performance Metrics:

- **Returns:** The portfolio has achieved a 15% Year-To-Date (YTD) return, which means it has grown by 15% since the beginning of the year. Over the past three years, it has maintained a Compound Annual Growth Rate (CAGR) of 12%, indicating consistent growth over this period.

- **Asset Allocation:** The portfolio is composed of 70% Equity, 20% Fixed Income, and 10% Alternatives. Think of this like a meal where the main course is equity, providing the bulk of the growth potential, while fixed income and alternatives act as side dishes, offering stability and diversification.

- **Risk Metrics:** The Sharpe Ratio is 1.2, which is a measure of how much return you're getting for the risk you're taking. A higher number is generally better. The portfolio's volatility is 18%, indicating the level of fluctuation in its value.

Benchmarks:

- **S&P 500:** This index, which tracks the performance of 500 large companies in the U.S., has returned 10% YTD. Your portfolio's 15% YTD return outperforms this benchmark.

- **Fixed Income Index:** This index has returned 3% YTD. Your portfolio's fixed income component is part of the overall strategy and is not directly compared here.

Insights and Recommendations:

1. **Strong Performance:** Your portfolio's 15% YTD return is impressive, especially when compared to the S&P 500's 10% YTD return. This indicates that your growth-oriented strategy is working well in the current market environment.

2. **High Equity Allocation:** With 70% of your portfolio in equities, you're well-positioned for aggressive growth, aligning with your high-risk appetite and short-term wealth accumulation goals. This allocation is like having a large portion of your meal dedicated to the main course, which is designed to fuel growth.

3. **Risk and Volatility:** The portfolio's volatility is 18%, which is expected given the high equity allocation. The Sharpe Ratio of 1.2 suggests that the returns are reasonable for the level of risk taken. It's important to remain comfortable with this level of fluctuation, as it aligns with your high-risk tolerance.

4. **Diversification with Alternatives:** The 10% allocation to alternatives provides some diversification, which can help manage risk. This is like adding a unique ingredient to your meal that can enhance flavor and balance.

Actionable Recommendations:

- **Continue Monitoring:** Keep an eye on market conditions and be prepared to make adjustments if necessary. Regularly reviewing your portfolio will ensure it remains aligned with your goals.

- **Consider Rebalancing:** If market conditions change or your goals evolve, consider rebalancing your portfolio to maintain the desired asset allocation.

- **Stay Informed:** Keep yourself updated on market trends and economic indicators that could impact your portfolio's performance.

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Report Outlining Debugging Strategies for Workflow Improvement

1. **Iterative Testing of Prompts:**

   ➢ Begin by testing prompts incrementally to assess how the AI responds. Make adjustments based on outputs to refine the prompt.

   ➢ Use controlled variations of a prompt to pinpoint issues and optimize its clarity, focus, and effectiveness.

2. **Analyzing Output Quality:**

   ➢ Inspect the AI's responses for consistency, accuracy and relevance. If outputs deviate from expectations, adjust the phrasing, length, or specificity of the prompt.

   ➢ Look for common patterns of failure (e.g., irrelevant details, incomplete answers) and fine-tune the prompt to prevent these issues.

3. **Error Handling and Logging:**

    ➢ Implement provision in the prompt to check for inconsistencies or errors in AI-generated response or in the input.

    ➢ This helps identify recurring issues with specific prompt structures.

4. **Refining Prompt Context:**

    ➢ Clarify ambiguous terms and add context to narrow the scope of the response. This helps avoid misunderstandings and ensures the AI responds appropriately.

    ➢ Experiment with adding or removing context in a structured manner to observe how the model adapts and improves output relevance.

5. **Optimizing for Token Efficiency:**

    ➢ Ensure prompts are concise while retaining enough detail to guide the model accurately. Overly long prompts with repeated prompts can lead to unnecessary token consumption and inefficiencies.

6. **Simulating User Scenarios:**

    ➢ Test prompts with diverse input variations to simulate real-world user interactions. This helps uncover edge cases or unexpected behaviors.

    ➢ By analyzing the results across different scenarios, you can fine-tune the prompt to ensure it performs well under various conditions and with varied inputs.

Proposed Enhancements

To improve the overall effectiveness of the AI model, we focused on refining the prompts across three key areas: accuracy, compliance, and customization.

1. **Accuracy:**

    ➢ We fine-tuned the prompts by eliminating ambiguity and ensuring clarity. This involved specifying the Input format, adding detailed context and using 1-shot techniques to give sample examples.

    ➢ We also added input discrepancy/input missing validation, so if any input data is missing the model gracefully stops generation and specify that the data is missing.

    ➢ As a result, the model produced more relevant and accurate responses, reducing errors and misinterpretations.

2. **Compliance:**

    ➢ To ensure compliance with relevant guidelines, we refined the prompts to include constraints on tone, language, and content.

- ➢ Also added cross validation prompts so the model itself checks if the required data such as Compliance Note is present or not in its generation and regenerates the response if its not present.

- ➢ We also incorporated checks for sensitive data handling. All of this ensures that the reports include mandatory regulatory disclosures in adherence to SEBI, SEC, MiFID II, or local regulatory standards.

3. Customization:

- ➢ We customized the prompts by factoring in the specific needs of the user.

- ➢ By introducing personalized inputs in client data, we ensured that the responses generated by the model were more aligned with the intended user(Technical or Simplified), improving the user experience and making outputs more meaningful and actionable.

Prototype Development

A basic working prototype was successfully created to validate the refined prompt strategies and proposed enhancements.

The Prototype is available at :
https://github.com/SandeepGitGuy/Financial_Report_Generation_GenAI

Instructions to run code:
Install the dependencies using pip install -r requirements.txt and then run the main code.
Please note : OpenAI API Key is required to run this prototype.

Conclusion

The process of refining prompts and debugging workflows has been instrumental in enhancing the accuracy, compliance, and customization of AI-generated outputs. By employing targeted debugging strategies such as iterative testing, output analysis, and contextual refinements, we streamlined the prompt design process and improved the reliability of responses. The proposed enhancements further ensured that the prompts adhered to ethical standards while addressing specific user requirements effectively.

These improvements not only optimized the model's performance but also laid a strong foundation for scalable and adaptive prompt engineering workflows. Moving forward, these refined strategies will continue to guide efforts in creating robust, efficient, and user-centric AI solutions.

Created By   **Contact:** Jobsforsandeepb@gmail.com
SANDEEP B   https://sandeepgitguy.github.io/
AI ENGINEER   www.linkedin.com/in/sandeepbjan1998