SIMRAN ABHAY SINHA
002475433

Assignment 2: Data Analysis with AI_Analyse Function

Implementation Approach for the AI_Analyse Function

The function, which is named 'AI_Analyse', has been designed as an extension of an existing established function, AI_Reply, which dealt with the response aspect of data inputs, particularly when free text-based, as opposed to the overall analysis offered by the new function.

The parameters of the function require an API key, an excel range of the data to be used, an analysis prompt, an optional model specification, as well as an optional temperature setting. The function converts the chosen excel range to a well-structured, CSV-like text representation before including it in a well-defined instruction prompt for the analysis, which is later used to invoke the AI_reply function.

Such a design ensures modularity and reusability, reduces the occurrence of redundant code, and ensures the predictability of the results for both text-based and data-driven AI interfaces. It also provides an option for users to adjust the guidance for the analysis without needing to modify the data or the formulas used.

Comparative Results Across Different Analysis Prompts

Three real-life case examples have been developed to test the system's analytical capabilities. These case examples belong to different domains, namely Finance (Time Series Trend Analysis), Marketing (Categorical Comparison), and Operations (Anomaly Detection and Root Cause Analysis). For all these case examples, the data range was analyzed using three different increasingly refined query prompts. In the finance case, the first prompt resulted in an elementary explanation of how revenue patterns changed over time, while the second prompt elaborated on this explanation by specifying seasonal patterns and emphasizing months where unusual growth was observed, and finally, the third prompt resulted in an executive summary that tied all this together with business implications and recommendations.

Firstly, with regard to the marketing problem, the original prompt was with reference to overall channel performance. Secondly, the second prompt added efficiency criteria such as cost effectiveness and trade-offs between channels. Thirdly, the last prompt provided recommendations for budget reallocations using reasoning for the performance.

For the operations case, the first prompt was to identify anomalies in production output and defect levels. The second prompt was to identify the causes, and it involved analyzing the causes in relation to machines and time periods. Finally, the last prompt was to assess risk and develop corrective actions for the operations problem.

Moreover, the refined prompts were found to positively affect the quality, depth, and usefulness of the derived insights by the AI model in all cases.

Key Insights Difficult to Obtain with Traditional Excel Functions

While the current Excel formula and chart systems are aware of trends, averages, or outliers, they do not put results or recommendations in context. The presentation by AI_Analyse revealed various benefits that could be difficult to achieve by means of the conventional functions of Excel.

First, the AI could consider multiple metrics and patterns in combination, rather than in isolation. Second, it provided natural-language explanations that related numerical changes to plausible business causes-seasonality, operational disruptions, or marketing efficiency. Thirdly, the AI system generated prescriptions or suggestions which could have otherwise necessitated manual analytics, like suggestions on the best plan for the inventory, budget allocation, or maintenance strategies.

Most importantly, AI_Analyse supported rapid iteration. Because users were changing just the analysis prompt, rapid iteration from descriptive analysis to diagnostic and prescriptive analysis occurred without needing to modify formulas, charts, or data structures.

Insights Gained from AI-Assisted Range Analysis

The use of AI_analyze function gives more valuable insights which helps to improve of the traditional excel spreadsheet analysis .One of the most salient points that were gleaned from the AI system was the ability to analyze patterns by using more than one dimension. In short, AI took into account the relationships that existed between the numbers, categories, and time-based changes.

Another important insight that came from this process involved contextual interpretation. As discussed earlier, in the finance case study under the AI model, the AI did not just identify trends but also related sudden spikes and plateaus with possible causes such as seasonality or operations. In the same vein, with respect to marketing case study finance analysis, the AI did not just evaluate its effectiveness but also balanced efficiency, scalability, and trade-offs to better budget strategies. Such contextual interpretations are normally subject to human interpretation with the application of formulas.

Limitations Encountered and Potential Improvements

The limitation faced with this approach was seen when using VBA, which relies on external API calls, thereby creating a dependence on system configuration, permission, and connectivity. Furthermore, when working with the macOS, more attention was given to VBA References, as well as security configurations in Excel.

Another limitation lies in the fact that the level of reliability of the information gathered will depend on the information given to the algorithm, as inaccurate data may draw generic conclusions that are not as accurate. Moreover, it does not completely rule out statistical validation as a factor, as it can only be considered as a guide that can support decisions.

Possible improvements for future work include better error handling, automated data validation, as well as tighter integration with Excel visualizations. Inclusion of predefined templates for prompts is also a possible future improvement that could greatly reduce user efforts.

Conclusion

The AI_Analyse function greatly improves the analysis capabilities of Excel. It uses AI analysis based on a range, driven by highly optimized prompts. This assignment's exploration of AI analysis in financial, marketing, and operations scenarios, through structured experiment-based prompts, illustrated the potential for raw data to be interpreted into relevant business analysis. It was found that the AI_Analyse function excels over traditional formulas in terms of faster iteration, interpretation, and analysis