HSBC Global Research

20 February 2024

Can AI do my job?

Hmmm…

Free to View
Data Science - Artificial Intelligence

- AI tools now exist which are designed to automate data analysis tasks
- Here we investigate OpenAI's Advanced Data Analysis module…
- … and ask how close tools like this are to replacing human analysts

Artificial Intelligence (AI) tools can now perform a variety of tasks which used to be impossible for computers. Here we investigate the performance of cutting-edge AI technology on a complex data-analysis project.

For this experiment, we gave the Advanced Data Analysis module of ChatGPT an open source dataset and asked it to perform an Exploratory Data Analysis (EDA). Performing an EDA is a common activity performed by Data Scientists whenever they are first given a dataset. It is also a good challenge for AI since performing an EDA is a multi-step process so it's more complex than simply doing one single task.

Rather meanly, we also asked a human analyst to perform the same work to give a comparison point. See inside this piece for an in-depth analysis of the performance of AI on this task.

How did AI do?

Worryingly well. The tool is still some way from being able to do a full Data Scientist's job but the performance at this challenging task was excellent.

The AI system needed quite a lot of babysitting in order to make it complete the task. Thus, from the perspective of a manager delegating a task, this is currently far less efficient than simply asking a competent human to go off and independently do the analysis and then report back.

However, from the perspective of the person performing the analysis using this or other similar tools is going to lead to dramatic productivity improvements. The AI tool was able to produce a thorough EDA in less than an hour of interacting with the tool. Furthermore, unlike a human, the AI does not get bored and so writes code which is consistently documented, it discusses the findings with detailed explanation throughout the analysis, and the charts and visualisations produced along the way are formatted professionally.

So can AI do my job? Thankfully not yet, but it's getting rather close for comfort.

This is a Free to View version of a report with the same title published on 20-Feb-24. Please contact your HSBC representative or email AskResearch@hsbc.com for more information.

Mark McDonald
Head of Data Science and Analytics
HSBC Bank plc

I, Data Scientist

Huge changes

Generative AI (GenAI) models have seen amazingly fast improvements over the last year. Unlike previous improvements in automation technology, these GenAI models are most immediately helpful for knowledge work tasks. This has resulted in vast amounts of hyperbolic commentary about the coming robot jobs apocalypse[1].

We do not believe that GenAI will lead to large-scale job losses (see *Will AI take your job* or *Generative AI: The rise of the machines* for more detail on this point). Artificial Intelligence tends to automate specific tasks rather than roles so it is more likely that GenAI will also take a range of tasks from knowledge workers, but not their entire role. What is clear, however, is that the day-to-day activities of many knowledge workers are likely to see dramatic shifts over the coming years.

Feeling brave

At the risk of talking ourselves out of a job, in this piece we report the results of an experiment in which we compared the performance of Chat GPT's "Advanced Data Analysis" module to the equivalent performance from a human analyst. Details are below, but the short summary is that the performance of AI is already very good and is steadily improving. It's still a long way from being able to replace the role of a Data Scientist, but it's already performing at the level that will significantly improve the productivity of a human analyst.

The experiment

We took a publically available dataset – the Zillow Home Value Index data at state level – and asked both a human Data Scientist and ChatGPT to perform an Exploratory Data Analysis (EDA) on this dataset.

This is a good challenge for the AI tool since:

- The instruction is a bit vague
- To do a proper EDA requires a multi-step analysis
- The data is given in an atypical format[2]

There is, however, one issue whereby this challenge might give an unfair advantage to ChatGPT: the dataset is publically available and relatively well known so it's possible that previous code examples which analysed this dataset were part of the training data for ChatGPT.

1 For example, searching for this term on Google currently returns over 40-million results
2 The timeseries data is given in rows (where each timestep is a new column) whereas it would be more typical when analysing a dataset using pandas (the python package which ChatGPT used) to consider a dataframe where the indices were timesteps.

Areas where AI struggled

Long periods of activity

Our first attempt at getting AI to perform this task was simply to load the dataset into the chat and ask it to perform an EDA on the dataset. This did not work well. This approach typically ended with ChatGPT performing several bits of exploratory analysis before crashing. It is unclear whether these issues were caused by the length of the text response or the intensity of code calculations being performed in a short period of time. Either way, this approach always led to frustration.

After some experimentation, it was found that the best performance was achieved by asking ChatGPT to first list out the steps it would perform as part of the EDA[3] and then proceed step-by-step, but *waiting to proceed* from one step until receiving confirmation from the human to continue. This resolved the issues with crashing. But it did mean that far more human input was needed in order to get a good response from the AI tool.

Different behaviour from one run to the next

We performed multiple iterations of this experiment. In general, the performance improved in later iterations as we got better at prompting ChatGPT to perform this analysis. Notwithstanding this trend, we saw significant variation in the performance of ChatGPT at individual tasks in the EDA.

For example, on some iterations of the experiment ChatGPT noticed when loading the data that each column was a separate timestep and suggested reformatting the data to make it easier to analyse whereas on other iterations it struggled until we specifically pointed this out.

Similarly, at many points in the analysis the code generated would result in an error being thrown. ChatGPT would often do an excellent job at correcting such syntax errors – presumably many such examples were encountered in the training process. However, on some instances where the approach being taken was simply the wrong way to analyse the data and was thus leading to faulty analysis we found it almost impossible to correct the derailed train-of-thought. At such times it was easier to simply start a new chat and begin the analysis again from the beginning rather than continuing to argue with the AI system.

Areas where AI excelled

One area where the AI system was far better than the human was in documenting the code and in laying out a discussion of the plan of action. These documentation tasks are something that humans often find rather tedious. However, such documentation can make collaboration significantly easier since other people do not have to decipher your code to understand the steps in your analysis. Ironically, one area where AI code generation tools may help is in making code easier to read by other humans and thus improving collaborative efforts.

Areas where humans excelled

One area where the humans were better than the AI was in time series analysis / implementation. The AI seemed unable to critically assess the performance of candidate models here. In particular, the AI system seems to lack the appropriate degree of scepticism of the results of its analysis. However, even though the AI tool performed poorly here, the code and models it produced allowed the human analysts to understand potential shortcomings and gave a starting point on how to improve them, so this was still helpful to human analysts.

3 The response from ChatGPT is detailed in the Appendix.

Summary

The performance of this AI data analysis tool is already good enough that we were impressed. The performance is still some ways away from being able to replace human analysts since (i) the analysis tool still needs a lot of babysitting, and (ii) the output produced needs to be assessed by a human analyst who is competent enough to identify when the AI tool has taken the wrong path. Nonetheless, this tool is already at the level where it can dramatically increase the productivity of data scientists.

We provide more details of the analysis performed by both human and AI during this experiment. If you would like to see full details of the analysis performed by the AI tool, please contact the authors.

This is a Free to View version of a report with the same title published on 20-Feb-24.

The full note contains a section comparing the performance of AI and the human analyst on various specific parts of the analysis in order to assess the pros and cons of both approaches.

Please contact your HSBC representative or email AskResearch@hsbc.com for more information.

Disclosure appendix

The following analyst(s), who is(are) primarily responsible for this document, certifies(y) that the opinion(s), views or forecasts expressed herein accurately reflect their personal view(s) and that no part of their compensation was, is or will be directly or indirectly related to the specific recommendation(s) or views contained in this research report: Mark McDonald

This document has been issued by the Research Department of HSBC.

HSBC and its affiliates will from time to time sell to and buy from customers the securities/instruments, both equity and debt (including derivatives) of companies covered in HSBC Research on a principal or agency basis or act as a market maker or liquidity provider in the securities/instruments mentioned in this report.

Analysts, economists, and strategists are paid in part by reference to the profitability of HSBC which includes investment banking, sales & trading, and principal trading revenues.

Whether, or in what time frame, an update of this analysis will be published is not determined in advance.

For disclosures in respect of any company mentioned in this report, please see the most recently published report on that company available at *www.hsbcnet.com/research*.

Additional disclosures

1. This report is dated as at 20 February 2024.
2. All market data included in this report are dated as at close 15 February 2024, unless a different date and/or a specific time of day is indicated in the report.
3. HSBC has procedures in place to identify and manage any potential conflicts of interest that arise in connection with its Research business. HSBC's analysts and its other staff who are involved in the preparation and dissemination of Research operate and have a management reporting line independent of HSBC's Investment Banking business. Information Barrier procedures are in place between the Investment Banking, Principal Trading, and Research businesses to ensure that any confidential and/or price sensitive information is handled in an appropriate manner.
4. You are not permitted to use, for reference, any data in this document for the purpose of (i) determining the interest payable, or other sums due, under loan agreements or under other financial contracts or instruments, (ii) determining the price at which a financial instrument may be bought or sold or traded or redeemed, or the value of a financial instrument, and/or (iii) measuring the performance of a financial instrument or of an investment fund.

Disclaimer

Issuer of report
HSBC Bank plc

This document has been issued by HSBC Bank plc, which has based this document on information obtained from sources it believes to be reliable but which it has not independently verified. Neither HSBC Bank plc nor any member of its group companies ("HSBC") make any guarantee, representation or warranty nor accept any responsibility or liability as to the accuracy or completeness of this document and is not responsible for errors of transmission of factual or analytical data, nor is HSBC liable for damages arising out of any person's reliance on this information. The information and opinions contained within the report are based upon publicly available information at the time of publication, represent the present judgment of HSBC and are subject to change without notice.

This document is not and should not be construed as an offer to sell or solicitation of an offer to purchase or subscribe for any investment or other investment products mentioned in it and/or to participate in any trading strategy. It does not constitute a prospectus or other offering document. Information in this document is general and should not be construed as personal advice, given it has been prepared without taking account of the objectives, financial situation or needs of any particular investor. Accordingly, investors should, before acting on it, consider the appropriateness of the information, having regard to their objectives, financial situation and needs. If necessary, seek professional investment and tax advice.

The decision and responsibility on whether or not to purchase, subscribe or sell (as applicable) must be taken by the investor. In no event will any member of the HSBC group be liable to the recipient for any direct or indirect or any other damages of any kind arising from or in connection with reliance on any information and materials herein.

Past performance is not necessarily a guide to future performance. The value of any investment or income may go down as well as up and you may not get back the full amount invested. Where an investment is denominated in a currency other than the local currency of the recipient of the research report, changes in the exchange rates may have an adverse effect on the value, price or income of that investment. In case of investments for which there is no recognised market it may be difficult for investors to sell their investments or to obtain reliable information about its value or the extent of the risk to which it is exposed. Some of the statements contained in this document may be considered forward looking statements which provide current expectations or forecasts of future events. Such forward looking statements are not guarantees of future performance or events and involve risks and uncertainties. Actual results may differ materially from those described in such forward-looking statements as a result of various factors.

This document is for information purposes only and may not be redistributed or passed on, directly or indirectly, to any other person, in whole or in part, for any purpose. The distribution of this document in other jurisdictions may be restricted by law, and persons into whose possession this document comes should inform themselves about, and observe, any such restrictions. By accepting this report, you agree to be bound by the foregoing instructions. If this report is received by a customer of an affiliate of HSBC, its provision to the recipient is subject to the terms of business in place between the recipient and such affiliate. The document is intended to be distributed in its entirety. Unless governing law permits otherwise, you must contact a HSBC Group member in your home jurisdiction if you wish to use HSBC Group services in effecting a transaction in any investment mentioned in this document.

Certain investment products mentioned in this document may not be eligible for sale in some states or countries, and they may not be suitable for all types of investors. Investors should consult with their HSBC representative regarding the suitability of the investment products mentioned in this document.

HSBC and/or its officers, directors and employees may have positions in any securities in companies mentioned in this document. HSBC may act as market maker or may have assumed an underwriting commitment in the securities of companies discussed in this document (or in related investments), may sell or buy securities and may also perform or seek to perform investment banking or underwriting services for or relating to those companies and may also be represented on the supervisory board or any other committee of those companies.

From time to time research analysts conduct site visits of covered issuers. HSBC policies prohibit research analysts from accepting payment or reimbursement for travel expenses from the issuer for such visits.

HSBC Bank plc is registered in England No 14259, is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority and is a member of the London Stock Exchange. (070905)

[1229795]