Application Analysis of the Language Model

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Abstract. Language models(LM) like Claude3, ChatGPT and Llamas have prominent development recent years. However, with the rapid development of theses technology, how to better utilize them and avoid potential risks become an important research topic. Therefore, this paper aims to investigate how these LMs can be better utilized to serve humans and avoid potential risks. This paper mainly analyzes the use of LM in four fields, namely finance, healthcare, entertainment, and customer service to illustrate the usefulness of LMs. It is an emerging technology with considerable potential in various fields to help humans do their jobs better and faster. But at the same time, they may have problems about privacy, decision affectivity, ethics, and unemployment. This essay will hopefully provide a suggestion for the use and specification of LMs that will come later. These tools need to be used correctly, with reasonable avoidance of the risks it poses, to more fully utilize the strengths of LMs.

1 Introduction

Artificial intelligence(AI) refers to a computer system or program that simulates human intelligence. These systems can perform a range of tasks, including pattern recognition, natural language processing, decision making, and complex mathematical calculations. AI has been integrated into many aspects of our lives. For example, the ability to navigate and self-drive, which are quite popular recent years, are all made possible by AI.

LMs is a branch of AI. It is used to understand, process and even generate human language human language through learning. With the development of computer hardware technology these years, LMs are developing rapidly and has become relatively mature. ChatGPT is a popular large language model(LLM). It is a generative LM developed by openAI. ChatGPT can capture human complexity, nuance and human conversation pattern, and it relies on considerable data to do deep learning to process and generate natural language text[1]. It can assist us with various tasks, so the attention to LMs in life has sprung up. In the future, replacing tedious work with human is an absolute trend.

Even today, there is countless examples of humans working with LMs. They have been used and have made quite some achievements in justice, medicine, education, and business. In many fields, LMs are utilized to perform the first step of a task and obtain a preliminary result. And then human will modify and improve that result. This work process contributed both by human and AI can greatly save time, money, and labor costs. In addition, AI does well in large number of repetitive mathematical calculations. So for many problems that

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humans can not solve directly, LMs can analyze and solve them efficiently. In modern society, there have been some examples of people using ChatGPT to complete work. For LMs, the number of data sets can somehow reflect the model's performance. ChatGPT absorbs many data sets in various fields, so it has a high degree of professionalism and rigor in various academic fields. For example, in Columbia 2023, ChatGPT helped the judge make a judgment[2]. Also in 2023, ChatGPT successfully passed the MBA School Examination of Wharton School of Business and ther CPA Examination in US[2].

This essay aims to analyze several aspects which receive lots of attention in society, namely finance, entertainment, medical care, and business. Firstly, this passage will analyze the current deficiencies in these areas, and then introduce the role that LMs can play. Finally, it will explain where LMs currently need to be improved, and explore how to better use LMs to serve humans, including developing technical hardware and establishing or improving management systems.

2 The definition and introduction to LM

LM is part in AI which specialize in handling human language and generate logical text, it is used to accomplish various of natural language processing(NLP) tasks. Most LM in recent years are base on neuro network. N-gram, a statistical model, is one of the most earliest LMs. N-gram deal with NLP tasks with calculating the probability of each words in the data set and then selecting the word with the largest number of occurrences. The improvement to this model is to change the n value, using the Bayesian conditional probability to improve the accuracy of the prediction by adding some context words. But it can not handle a little more complex NLP tasks, such as the sentences with synonyms or large context.

RNN, LSTM, word2vec, ELMo, Transfomer, bert, and GPT are all more advanced LMs, they can process and generate the text which is more contextual logic and accurate. In 2017, Anish Vaswani et al, published a paper called Attention Is All You Need, which is absolutely a landmark in LM. They introduced a new mechanism called self-attention, which creates queries(Q), keys(K), and values(V) to calculate the correlation between the elements in the data. In the subsequent process, different weights are assigned to each parameter to make it adaptable to the context and thus optimize performance[3]. Unlike Rnn and LSTM which requires recursion in training, transformer is trained in parallel, which allow transformer to capture the correlation between words that are farther away. GPT and Bert also utilize the framework of transformer. Take GPT as example, GPT is the fundamental model of ChatGPT. Not like normal LM, it has considerable amount of parameter and is more complex than other LM, so it is also called large language model(LLM). it was built on 2018. From the initial version of GPT-1 with 117 million parameters, to GPT-2 with 1.5 billion parameters in February 2019, and finally GPT-3 with 170 billion parameters in June 2020. Thanks to the considerable investment from OpenAI and the improvement of computer hardware, it develops rapidly in recent years. Its success need both theory and empirical evidence[4]. Finally, ChatGPT is an application provided to public from GPT. The prototype of ChatGPT launched on November 30,2022, open to the public on January 30, 2023[1]. ChatGPT has received widespread attention since its first launch and officially brought the concept of LM to the public's attention. This essay will focus on exploring the application of LMs in life and their potential limitations. Fig. 1. shows part of the LLMs that some major technology companies built from 2018 to 2022. Different color represent different company. For example, the first blue one from left to right is the development history of GPT developed by OpenAI. Bard which is developed by Google, LLaMA developed by Meta, and Claude developed by Anthropic.

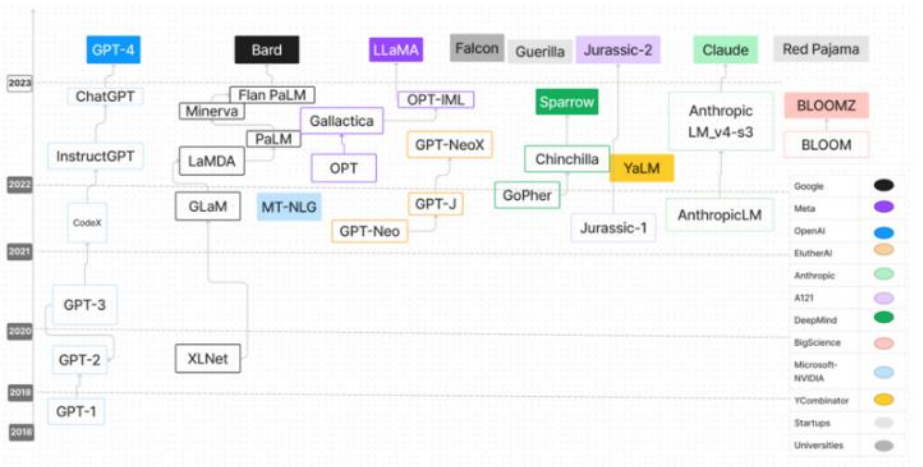

Fig 1. The development of LLM from 2018 to 2022[5].

3 The application of LM

People previously believed that the ability to understand and generate language should only belong to humans, but the emergency of LM breaks this traditional concept. Tasks that once requires considerable of labor can be accomplished by LM easily and even generate better results.

3.1 Finance

Finance service is a important part in public lives since it deals with how to use our money. Currently, most financial companies primarily provide services about investment, asset management, insurance, risk assessment, capital markets and loans. Amount them, they are either services for individuals such as risk assessment(you can not lean money to someone who are not able to pay it back), investment planning and insurance(everyone's financial situation is different, so it needs to be customized according to their own situation). For enterprises, the parameters that need to be referenced will increase exponentially. Market conditions, historical background, economic environment, etc. are all the things that need to be considered, which are too time-consuming and labor intensive for human processing.

Many companies have low-efficiency and low-customization problems in financial management. AI is considered an efficient tool to solve these problems since it can prepare and predict data based on personalized data. Recurrent Neural Network(RNN) is a good option for financial management. The main difference between RNN and Feedforward Neural Network(FNN) is that RNN can store memory, which this essay will explain later. RNN's basic structure consists of an input layer, a hidden layer, and an output layer. Its input is not only the output of the previous layer but also the output of its own layer at the previous time step, so it can store the memory of the previous context. So it is good at capturing the relationship in a long sequence data. Unlike some LMs based on Transfomer, the training of RNN is a recursive process, making it hard to grasp the very-long-distance data relationship well. But in financial module, outputs from nearby time periods often impact current predictions more, making RNN still suitable for the financial sector. Stock price prediction is always one of the cores of financial services. However, there are many market influences, so the stock price prediction is not simply. It requires professional knowledge, making its threshold extremely high and the corresponding fees much more expensive. In Stock Price

Prediction using Recurrent Neural Network (RNN) Algorithm on Time-Series Data, Israt Jahan and his group used the closing price of Advanced Micro Device(AMD) from May 2, 2017 to December 28, 2017 as the training dataset, and the last 12 days as the validation dataset. They successfully build a RNN model which has percentage of error below 5%. This result shows that RNN can perform well in predicting future closing prices, which is an important part of the stock market[6].

However, using AI in financial services is also risky. The most important issue is security. AI has to process so much financial information. Once hackers find a way to steal people's privacy, the economy loss will be considerable. The second point is morality. It is morally controversial to allow AI to make decisions that affect the financial lives of the human community[7]. So in the future, not only the algorithm of the AI model itself needs to be improved, but also its algorithm transparency, privacy protection, etc. Moreover, the law also need to be improved in this regard to AI to better protect people's privacy and legal right.

3.2 Entertainment Chatbot

With the development of modern society, life has gradually become fast-paced, communication between people has become rare and shallow, meanwhile work has become busier. Moreover, due to the development of transportation, young people are either in the office or at home and will not take the initiative to leave the room let alone talking with others. As a result, the lack of in-depth communication, coupled with the increase in life pressure, will suppress young people's emotions. Many psychological problems cannot be discovered and properly solved in time, thus causing mental illness. Mental illness usually has subtle signs in the early stages. But in modern societies, expressing that one has emotional problems is often seen as cowardly and fragile, so they are not willing to communicate with others like psychological counselor. Not only in Japan in which suicide is a main cause of death amount young people aged 10 to 39, but also in the world, suicide is a leading cause of death amount the youngers, as World Health Organization report[8].

The emergence of LMs can effectively help young people solve psychological problems. LMs often provide advice on a professional level and patiently offer emotional feedback to those they interact with. A complicated training process accomplishes this. Like ChatGPT, they can not understand users' intentions or instructions if they are only trained with context datasets. ChatGPT uses Reinforcement Learning from Human Feedback(RLHF) to incorporate human feedback into the training process to better align the model output with user intent. This process can be split into three steps. Firstly, OpenAI will ask many experts to write their professional answer base on some prompts, and then these answers will be used to train GPT. Then OpenAI will generate a reward model to generate scores for the text that GPT generates. Finally, these text with high score will be used to fine-tune GPT. This RLHF process makes GPT generate the text that aligns with human's intentions and emotion, thus provide more positive guidance and moral advice during conversations with people. In the experiment of Michimasa Inaba's group, they used GPT-4 as a conversational counselling system. Then they compared the texts that GPT-4 generated with answer that third-party counsellors, and asked professional counsellors to evaluate the responses with a score of 0 to 2. Experiments show that the quality of responses from the counselors and GPT-4 is not much different. Moreover, data showed that GPT scores are more extreme than counselor scores, with more scores of 0 or 2, while more than half of counselor scores are 1[8]. Therefore, we know LMs can help teenagers support emotions and solve psychological problems. Moreover, teenagers may be more willing to communicate with LMs than with counselors because they will not worry about being judged or discriminated.

But in this part, privacy is still a serious problem. Some teens tell their private information about their private life to LMs chatbot to let them reply more personally. However, it may

lead to serious consequences once privacy is leaked and stolen by others, such as identity theft or secondary emotional damage. Moreover, the security of chatbot-generated content will also be a problem. LMs' datasets always contain knowledge from all aspects. A user can even use it to formulate a criminal plan if it is not restricted. This will undoubtedly give those who want to commit crimes lower costs and easier plans to implement. Future laws need to pay attention to the privacy protection of LMs chatbots and the limits of the security of their output content.

3.3 Healthcare

The medicine system currently established in society is relatively fragile. Its resources are actually quite limited and can never cover everyone. For example, during the COVID-19 period, quite a number of people were unable to receive timely treatment. Doctors simply could not take care of so many patients, let along screen them for their illnesses. However, even without the COVID-19, quite a number of people can not afford medical service, including physical examinations. However, many fatal cancers develop from early stage where no symptoms are seen. LMs are backed by a powerful database, so they are generally able to capture subtle signs and make reasonable suggestions.

In modern society, Today, LMs are being used in patient care to improve the health of users by identifying risks, making suggestions, and providing personalized guidance. They can remember your personal health condition and keep an eye on it. For example, kidney stones are one of the most common urinary diseases, and the main component of the stones is calcium oxalate stones. Base on study, one way to prevent calcium oxalate stones is to limit the intake of food that contain oxalate. This kind of oxalate is commonly found in plants. In the study of Noppawit Aiumtrakul et al., they utilized a LM to make a reasonable oxalate diet plan. They used ChatGPT, BardAI, Bing Chat to classify food into high, medium, and low oxalate content. The results showed that bardAI could reach an astonishing 84%, so it has a good function in some maintenance or maintain health[9]. Moreover, LM can not only help with preventing illness, but also give assistance and suggestions after you realize yourself sick. Base on the study of Gabriel Zúñiga Salazar's study, they first selected 176 questions and made judgments on them, and then used ChatGPT, Google Bard, and Microsoft Bing to make a decisions about whether this situation is emergency or not. The results show that LMs identify 12% to 15% more emergencies than real emergencies, while non-emergencies are about 35% less[10]. They still need to be improved in order to be able to identify emergencies more accurately in the future.

Although LMs still have limitations, most of which are limited of technologies, which is completely unacceptable in medicine because medical misjudgments can have extremely serious consequences, undoubtedly putting higher demands on the future development of LM. Recently, hospitals are often overcrowded, and crowded environments and untimely treatment often lead to delayed treatment of illness. After LMs mature, using LMs for the first level of disease screening will undoubtedly reduce the pressure on hospitals.

3.4 Customer Service

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4 The suggestion to future AI

AI can help human complete large part of work with its excellent computing power and extensive knowledge. In addition to the issues of privacy and accuracy, ethics, etc. mentioned above, there is another issue that deserves attention: the unemployment rate of the people. Technology innovation always get three effects involved, which are productivity effect(productivity increases), job creation effect(new jobs brought by the innovation) and displacement effect(some jobs are eliminated). In previous technology invocation, these effects will form a balance and keep the society stable. However, under the impact of AI, this balance could be broken since AI not only takes human's daily repetitive tasks, but also changes the skills required for other occupations, thus having a significant negative impact on while-collars[12].

Unemployment rate has strong association with the society stability. Research shows that the increase of unemployment will lead to an increase of social discontent and then the crime rate will rise, finally cause social unrest. Base on the study, 47% of the US labor market and 55% of the Japanese labor market have jobs most vulnerable to AI automation. And markets such as Italy, Norway, and the UK, where robots are concentrated, have seen serious unemployment. One study showed that adding one robot per thousand workers would reduce the employment rate by 0.16 to 0.20 percentage points[12]. Therefore, in a free market, the impact of AI on the market employment rate can not be ignored. From the perspective of the government, it should keep an eye on this innovation and establish laws to regulate company to deal with the labor market contradiction brought by the AI. The original intention of AI design should be to enhance human welfare and complete some tedious and dangerous tasks for humans, rather than simply replacing humans and bringing greater profits to companies. People should consider how to properly regulate and use AI in this era.

5 Conclusion

This essay analyzes and summarizes the application of LM in public lives in recent years. LMs like ChatGPT are tested to perform well in finance, medicine, entertainment, and customer service and show high potential. Meanwhile, privacy, the accuracy of LMs, and the impact on human work are also issues we should consider. Generally speaking, LMs are double-edged sword. They can indeed bring welfare to people, but if they are not used properly, they will also cause negative impacts on society. This passage aims to summarize previous experiments to explain the application of LMs in various fields, including its shortcoming and advantages, and point out the direction for future improvement. In the future, people should focus on research and development of LM technology and be careful of how to better utilize and regulate its use. Just as we can not only know how to build a car, we should also focus on how to drive it. So experiments on the practical application of LMs are needed to prove that LMs can help people's lives.

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