A Heideggerian analysis of generative pretrained transformer models

Iustin FLOROIU[1], Daniela TIMISICĂ[1,2]

[1] National Institute for Research & Development in Informatics – ICI Bucharest, România

[2] National University of Science and Technology Politehnica Bucharest, România

iustin.floroiu@ici.ro, daniela.timisica@ici.ro

Abstract: To better understand the emergence of new large language models in the context of future possibilities with regard to developing novel artificial general intelligence, it is essential to analyse and conclude the existential implications of these algorithms. Given the high speed of technological advancements in the field of deep learning, generative pretrained transformers (GPT) are the closest thing related to the invention of highly independent and intelligent programs, because they manifest creativity and convey an accurate formation of a worldview model that was never seen before.

Because of these aspects, this article proposes an analysis of the concept of Dasein, defined by Heidegger, in the vast description of advancements added in the field of computational intelligence. The analysis methods described here are meant to bypass the complex problems of cognitive sciences with regard to computational intelligence and to create a highly accurate model of mental representation and hierarchisation of emergent intelligent algorithms.

Keywords: Martin Heidegger, GPT, Artificial Intelligence, Dasein.

O analiză heideggeriană a modelelor bazate pe transformeri generativi preantrenați

Rezumat: Pentru a înțelege mai bine apariția noilor modele mari de limbaj, în contextul posibilităților viitoare în ceea ce privește dezvoltarea unei noi inteligențe generale artificiale, este important să se analizeze și să se concluzioneze implicațiile existențiale ale acestor algoritmi. Având în vedere viteza mare a avansurilor tehnologice în domeniul învățării profunde, modelele generative bazate pe transformeri preantrenați sunt cel mai apropiat lucru ce ține de inventarea unor programe independente și inteligente asemănătoare cu aptitudinile, sau chiar dincolo de capacitățile umane, deoarece manifestă creativitate și transmit în mod clar o formare precisă a unui model de înțelegere asupra lumii, care nu a fost văzut niciodată înainte în cadrul mașinilor.

Datorită acestor aspecte, acest articol propune o analiză a conceptului de Dasein, definit din perspectivă heideggeriană, în descrierea vastă a progreselor adăugate în domeniul inteligenței computaționale. Metodele de analiză și concluziile descrise aici sunt menite să rezolve problemele dificile ale științelor cognitive în ceea ce privește inteligența mașinilor și să creeze un model extrem de precis al reprezentării mentale și ierarhizării algoritmilor inteligenți emergenți.

Cuvinte cheie: Martin Heidegger, GPT, Inteligență Artificială, Dasein.

1. Introduction

Technology became the most reliable way to understand reality fast and a way to test further hypotheses to aid in discovering how reality works. In recent years, techniques that automate processes have become popular and useful, such as automated diagnosis of pathologies in medicine or the identification of different elements in the natural world through satellitar images, the list being exhaustive (Miah, 2012).

Artificial Intelligence techniques became one of the most desirable tools to understand the world around us, leading to a revolution of technology that aided in the creation of multiple techniques. It has been observed that more tasks are becoming delegated to machines since they are more precise, fast and reliable than humans, which led to many questions about the nature of these machines. Such is the case for artificial intelligence algorithms. Many concerns and interest appeared in the nature of these machines, constructed to aid humanity, and what their existence means beyond the fulfillment of human tasks (Ramesh, 2023).

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Martin Heidegger was a German philosopher who was interested in responding to the question of "being", significantly influencing 20th-century existentialist thought and phenomenology. He was born on September 26, 1889, in Messkirch, Germany. He grew up in a Catholic family and initially studied theology, but his interests soon shifted towards philosophy. Heidegger's academic career was marked by his engagement with various intellectual currents of his time. He studied under prominent philosophers like Edmund Husserl and became a professor at the University of Freiburg (Schalow, 2019).

The development of technology has been central to heideggerian thought. The most important concept with regards to heideggerian philosophy is Dasein, which is related to one’s integration into the world. By this means, a human should be conceived as Dasein, as the consciousness needed to discover itself and other things in the world through itself (Blitz, 2014).

Dasein is a fundamental concept in Martin Heidegger's philosophy, particularly expounded in his major work, "Being and Time" (1927). The term is German and can be translated as "being-there" or "existence." Heidegger uses Dasein to talk about human existence, emphasising its unique nature and how humans exist in the world. Dasein is not a general concept for all entities but specifically refers to human beings. It encapsulates the idea that humans have a distinctive way of being in the world. Temporality is a crucial dimension of Dasein, Heidegger argues that Dasein is always situated in time. The past, present, and future are interconnected in the experience of existence. Dasein is not a static entity but a dynamic unfolding of possibilities. Dasein is always "Being-in-the-World," emphasising the inseparable connection between the individual and the environment (Hornsby, 2012; Zuckerman, 2015).

Our understanding of ourselves and the world is intertwined, Dasein is embedding a constant engaging process of interpreting and making sense of humans’ surroundings. Dasein is "thrown" into existence. This concept encapsulates the idea that individuals find themselves in a world they did not choose, with the circumstances of birth, culture, and historical context influencing Dasein's existence. Heidegger introduces the concept of "care" (Sorge) to describe the fundamental nature of Dasein's relationship with the world. Care involves concern, attentiveness, and involvement. Dasein always cares about its possibilities, past, and future. Heidegger believed that we can only uncover ourselves with the aid of the external world, and we also uncover the world through our internal endeavours. Heidegger's philosophy is mainly described as existential phenomenology. He sought to understand the nature of Being (capitalised as "Being" to emphasise its uniqueness) and the human experience of existence. One of his most influential works, "Being and Time" (1927), is an effort in which he thoroughly explored the concept of Dasein. Heidegger argued that understanding Being is fundamental to understanding the nature of existence (Elley-Brown, 2021; Heidegger, 1962; Overgaard, 2004).

Heidegger distinguishes between authentic and inauthentic modes of existence. Authentic Dasein confronts its own existence, takes responsibility for its choices, and lives in awareness of its finitude. On the other hand, inauthentic Dasein may be absorbed in everyday routines and social conventions without questioning its deeper existence. He argues that an awareness of death is crucial for understanding authentic existence. In facing its own mortality, Dasein is prompted to live more authentically, recognising the urgency of its possibilities (Guignon, 1984).

Dasein serves as a cornerstone in Heidegger's attempt to develop an existential phenomenology that goes beyond the traditional philosophical inquiries of the time, even though heavily influenced by the philosophical trends of the philosopher’s life himself (Clark, 2011).

This article is meant as an analysis of how much generative pretrained transformermodels can relate to the Dasein,using a heideggerian analysis of their purpose, their integration into the world and into the lives of humans.

This paper follows to outline the general architecture of generative adversarial transformer models, to describe in depth the concept of Dasein presented in Heidegger’s works and to develop an updated version of what Dasein means in the context of intelligent machines, the latter also containing an original contribution to the field.

2. Generative Pretrained Transformer (GPT) models

Transformers are architectures used in machine learning, consisting of several functional blocks initially created for natural language processing (NLP) and natural language generation (NLG) tasks. The defining component of transformers is attention, which forms non-local connections and relationships between different words in a sentence. They were initially used for automatic translations, surpassing the performance of recurrent networks. This is made possible precisely by using attention as the primary mechanism to form relationships between words and, to a significant extent, quantify these relationships (Vaswani et al., 2017).

The Transformer is often compared to convolutional and recurrent networks. It is known that convolutional networks impose inductive biases of translation invariance and locality with common local kernel functions. The Transformer architecture makes few assumptions about the structural information of the data. This makes the Transformer a universal and flexible architecture. As a side effect, the lack of structural biases makes the Transformer prone to overfitting for small-scale data (Floroiu, 2023; Tatu, 2018; Vaswani et al., 2017).

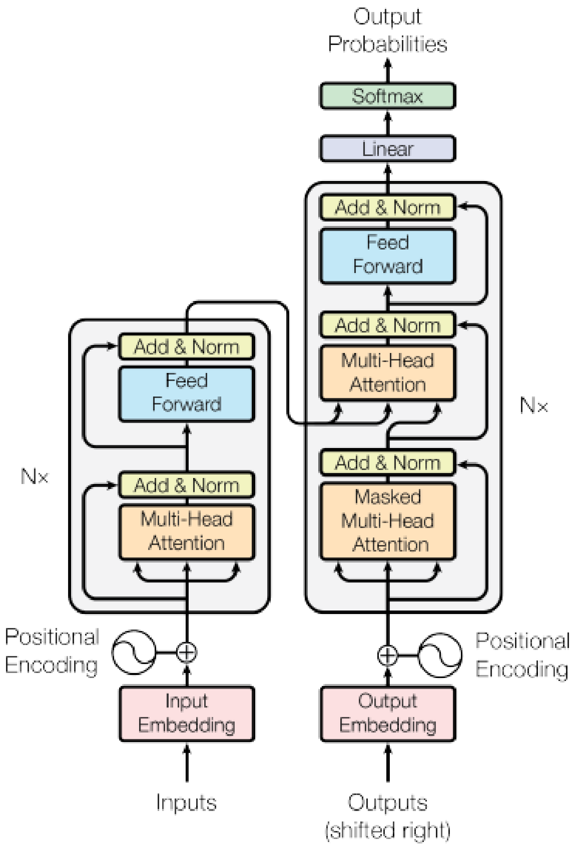

Figure 1. The classic architecture block of a transformer (Vaswani et al., 2017)

At the input of a transformer, words are tokenised by dividing a text into individual pieces (tokens), each of the tokens being assigned as a unique sample to represent a number, called id. Then, the tokens are vectorised into a multidimensional space. This process aims to highlight the position of each word in a sentence (Cui, 2023).

A token represents a word or smaller pieces of a word; in this way, attention can quantify the relationships between words.

Multi-layered attention is an architectural block in the structure of transformers that establishes connections between the words in a sentence. This is followed by a feed-forward block consisting of fully connected layers, which learns automatically. Residual connections are formed between each structural block. These connections are added and normalised with the outputs from the architectural blocks. This mechanism, which includes all the described blocks and processes, is an encoder followed by a decoder. An encoder includes the process of embedding the positions of each token, followed by self-attention. This block sequentially analyses the transformer's input, using this data to create non-local relationships between the words in the context and normalising residual data between its output and the input to attention, followed by a feed-forward layer (Vaswani et al., 2017).

A decoder holds a masked multi-head attention mechanism, where only certain information from the relevant data is considered, and the rest is either completely eliminated (binary) or weighted based on importance (dynamic). It is followed by a normalisation block and a feed-forward mechanism. At this point, within the encoder, the data from the context is vectorised using keys (words from the dictionary) and their context in the sentence, representing the values of the keys. Along with these two matrices, together with the values from the first feedforward of the decoder, represented as a matrix of tokens to be translated using the context, the information goes through a "global" attention known as cross-attention, which aims to weigh the context based on the sentence to be translated. A new fully connected feed-forward layer follows this layer. In the classic version of transformers, a decoder is followed by a linear layer. It is known that attention uses a softmax mechanism to calculate the three matrices described, where the goal is to achieve maximum weighting by exponentiating the input data to calculate the percentage of influence of each sample on the output. Within the feed-forward network, the classic activation function chosen is ReLU (Rectified Linear Unit) (Tan, 2021).

In addition to the classic transformers, many variations have emerged, each with its advantages and disadvantages. Among these, changes to the building blocks are some of the most important variations of transformers, including transformers with only an encoder and transformers with only a decoder (Lin, 2022).

Among the transformers that use only decoders, one of the most important is GPT. GPT is a neural model based on the Transformer architecture developed by OpenAI. The GPT architecture consists of several transformer blocks, each composed of a self-attention and fully connected layer. These transformer blocks enable the model to understand the relationships between words in a text and capture natural language's semantic and syntactic features. An essential aspect of the GPT architecture is that it is a pre-trained language model, meaning it is trained on a large amount of textual data to learn the word distribution and grammatical structures of natural language. Training is achieved by maximising the log-likelihood of the words in a given text using a technique called "masking." Another crucial aspect of the GPT architecture is that it is a "causal" model that processes textual data sequentially, considering only the words preceding the current word. This makes it useful for text generation tasks like machine translation and text summarisation. Moreover, the GPT architecture is scalable and can be trained on large datasets to improve its performance in various natural language tasks. Additionally, GPT is based on transformers, in which the activation function at the fully connected neural layer is replaced by GeLU (Gaussian Error Linear Unit) instead of the usual ReLU (Rectified Linear Unit) used in a classic transformer (Vaswani et al., 2017).

However, as seen before, GPT not only guesses the output in an interactive manner while generating text, it is also capable of choosing a token that does not have the highest probability of appearing the in text, thus showing a degree of creativity.

3. GPT and the Turing Test

The Turing Test is a concept proposed by the British mathematician and computer scientist Alan Turing in 1950. It tests a machine's ability to exhibit human-like intelligence, particularly in the context of natural language conversation (Cooper, 2013).

The basic idea behind the Turing Test is to determine whether a machine can mimic human intelligence well enough to be indistinguishable from a human when engaging in a conversation. The test involves three participants: a human evaluator (judge), a human interlocutor (the person), and a machine (AI system) (Hodges, 2009).

The evaluator is placed in a room separate from the person and the machine. The evaluator's task is to engage in a text-based conversation with the person and the machine without knowing which one is which. The evaluator can only communicate with the participants through written text (French, 2000).

During the conversation, the evaluator can ask questions and receive responses from both the person and the machine. The machine's goal is to generate responses indistinguishable from those of a human (Shieber, 2004).

If the evaluator cannot reliably tell which participant is the machine and which is the person based on their responses, then the machine is said to have passed the Turing Test. In other words, the machine has demonstrated human-like intelligence in its conversational abilities.

The test is primarily concerned with the machine's ability to simulate intelligent behaviour in conversation. It is often seen as a benchmark for assessing the progress of AI systems in natural language processing and understanding (Damassino, 2020).

The Turing Test has been an attempt to define mechanistic intelligence. Turing himself believed that a machine passing the Turing Test is a sufficient condition to prove that a machine has the ability to think rationally and is identical to humans, which is a mistake. However, an algorithm that doesn't pass the Turing Test doesn't have this ability. The Turing Test helps us evaluate how close a machine is to engaging in inferences close to how a human would.

Since GPT3, all GPTs are believed to have passed the Turing Test (Dodig-Crnkovic, 2023).

4. GPT through heideggerian lens

This article suggests a modern way of interpreting Heideggerian philosophy in the context of GPT.

First of all, it has been proposed that, for technological advancement to possess a Dasein, it should be able to interact with the world through stimuli, which means a high degree of sensitive sensors through which the machine can grasp the world in an experience similar to humans with regards to the amount of information registered by them. This is a more traditional way of understanding Dasein in machines. However, as all stimuli are processed through the brain, the multimodal GPT models can grasp a wide range of stimuli processed to be understood by humans (which involves intelligibility, thus revolving around pretraining the model with data adapted for human perception) through the knowledge it accumulated and its way of inferencing multiple forms of signals. Given the fact that perception is mental, the capacity to understand, judge and analyse a form of stimuli rationally understood by humans can be seen as a way of interacting with the world efficiently.

Secondly, given the fact that GPT is based on attention mechanisms and neural networks designed based on the neurophysiology of human brains, it is completely fair to point out that a highly complex language model can partly imitate human mental processes regarding inferences and information analysis. Even though GPT was created with the primary purpose of text comprehension and generation, it has been able to understand, explain and develop algorithms to an extent. This information shows us that machine learning algorithms could pass the Turing Test in the near future, and the latest GPT models already did so.

Finally, GPT does not have the capacity to understand and simulate human emotions, and no machine learning algorithm could attain that performance by now. Because of that, a new framework for understanding Dasein will be discussed.

However, a lot of machine learning algorithms are capable of automating processes done by humans and successfully completing tasks designed for humans without any aid, which shows that the purpose of their being partly resembles the human Dasein.

5. A new framework for understanding Dasein in the modern era

GPT models excel at understanding context in language. They analyse input sequences and generate coherent and contextually relevant responses. This ability to understand and generate contextually appropriate text mirrors the interconnectedness of Dasein with its world (Liu, 2023).

Dasein emphasises the dynamic interaction between individuals and their environment. While GPT models don't have consciousness or subjective experiences, they simulate interaction by generating text responses based on input. This interaction is shaped by the vast range of linguistic contexts and patterns they've learned during training (Clark, 2011).

Dasein involves a temporal dimension, acknowledging the past, present, and future. While GPT models don't have an inherent sense of time or consciousness, they can generate text that implies a temporal understanding. For example, they can provide responses that seem aware of previous parts of a conversation (Heidegger, 1962).

Dasein's engagement with the world involves interpretation and care. GPT models, while lacking genuine understanding or care, simulate a level of interpretation by predicting what comes next in a given context. This prediction is based on the model's learned associations and patterns in the data it was trained on (Liu, 2023).

However, it's essential to recognise the limitations. GPT models lack consciousness, self-awareness, and genuine understanding. They operate based on statistical patterns and associations in data, and their responses are not grounded in lived experience or personal engagement with the world. Dasein involves a profound existential depth beyond the capabilities of current artificial intelligence (Chrisley, 2008; Scarfe, 2023; Shieber, 2007).

Because of these limitations, integrating the concept of Dasein into the current era and through current technologies is difficult but necessary for affirming the existential position of humans with regards to aiding the learning models.

First of all, Dasein can be interpreted as a quality that arises from the human mind's capacity to adapt and understand complex patterns because of all the qualities emphasised by it, described above, which require a high degree of intelligence (compared to other beings besides humans). Given the advancements in artificial intelligence, it is becoming more and more obvious that intelligence can be generated from systems that do not possess life, such as computers. The functionalist perspective argues that intelligence is not tied to the specific material or biological substrate but rather to the functions and processes that a system performs. If a non-biological system can perform cognitive functions, exhibit learning capabilities, and engage in complex problem-solving, it could be considered intelligent. Thus, any system capable of performing the same computations, regardless of its material composition, could exhibit intelligent behavior (Moran, 2014).

Modern AI operates on computational principles, including neural networks and machine learning models. Intelligence might be viewed as an emergent property arising from the complexity and organisation of information processing within a system. Non-living systems, particularly sophisticated AI models, can exhibit emergent behaviours and intelligence through complex interactions among their components. Intelligence is often associated with the ability to process information, learn from it, and adapt to new situations. AI systems, built on algorithms and capable of processing vast amounts of data, demonstrate a form of information processing that can lead to intelligent behaviour without the need for biological substrates. Furthermore, AI systems, especially those inspired by neural networks, attempt to simulate certain aspects of human cognitive processes. While these simulations are not equivalent to consciousness or subjective experience, they can emulate problem-solving, pattern recognition, and decision-making aspects (Binz, 2023).

Intelligence is closely tied to learning from experience and adapting to changing environments. Machine learning algorithms, a subset of AI, demonstrate the capacity to learn patterns and improve their performance over time, resembling a form of adaptive intelligence.

Given these affirmations, a case of intelligence produced by a non-living system should be considered.

Secondly, even though a generative model like GPT is not able to exhibit and produce emotional reactions, it can process and understand the emotions described by humans, both in an explicit manner and in an implicit way. This approach is similar to the way the human mind understands emotions (learning and classificating them in early childhood is essential). Moreover, if asked, a generative transformer can also simulate emotions (Binz, 2023).

Furthermore, as mentioned earlier, the latest GPT models are capable of creativity. This manifests through the ability to generate new tokens based on a distribution of probability (how confident the model is in using a word in a specific context). It has been shown that the latest generative technologies can engage in the ability to use words figuratively in a sentence – that is, to use a word that does not have the highest probability of compatibility in the context of generation. There are multiple reasons, such as the fact that GPT models are pre-trained on massive datasets encompassing a wide variety of topics, genres and writing styles (Lee, 2023).

The diversity of the pre-training data allows the model to learn intricate patterns and associations, enabling it to generate creative and contextually appropriate responses across different domains. GPT excels at understanding context in natural language. It uses attention mechanisms to weigh the importance of different words in a sentence based on their context. This contextual understanding enables the model to generate coherent and contextually relevant responses, contributing to a sense of creativity in its output. GPT is a generative language model, meaning it can generate new sequences of text based on the input it receives (Floridi, 2023; Vaswani et al., 2017).

The model is capable of completing sentences and paragraphs or even writing entire articles, showcasing a form of creative content generation. The output is not simply regurgitating training data but is a unique synthesis influenced by the learned patterns.

Thus, Dasein should be better understood through the modern approaches of technological development, which instill in the differences between what Dasein conceived to be an intelligent machine and what artificial intelligence means nowadays. This requires a lower focus on physical interactions between a system and its nearest environment (unless the environment can be understood as the input data given to the system, both for the training process and also for evaluation and further applications, which may include zero or few-shot learning approaches).

6. Conclusion

Even though Dasein is a complex and multifaceted concept to be grasped, by taking into consideration the rapid development of large language models, new models learn to understand and form internal frameworks of the world around them.

Given that generative networks lack self-awareness, they cannot contain authentic Dasein. However, inauthentic Dasein remains a highly possible characteristic that large generative models can possess, a stepping stone and a necessity in developing artificial general intelligence.

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Iustin FLOROIU is an engineer with a Bachelor's Degree in Biomedical Engineering, obtained at the National University of Science and Technology Politehnica Bucharest in 2022. Currently, he is studying for a Master's Degree in "Computers and Information Technology" with a specialization in Intelligent Systems and Computer Vision. For the past four years he has worked in biomedical research, engaging in scientific projects related to cancer research, biomolecular machinery characterization, biophotonics and image processing. The main areas of interest include artificial intelligence and computer vision. He has authored/co-authored four scientific articles that were published in international scientific journals and conferences.

Iustin FLOROIU este inginer cu Diplomă de licență în Ingineria Biomedicală, obținută în cadrul Universității Naționale de Știință și Tehnologie Politehnica București în anul 2022. În prezent, urmează studii universitare de master în domeniul „Calculatoare și Tehnologia Informației" cu specializarea în Sisteme Inteligente și Vederea Artificială. În ultimii patru ani a lucrat în cercetarea biomedicală, implicându-se în proiecte științifice legate de cercetarea cancerului, caracterizarea mașinăriilor biomoleculare, biofotonica și prelucrarea imaginilor. Principalele sale domenii de interes pentru cercetare includ inteligența computațională și vederea artificială. Este autor și coautor a patru articole științifice care au fost publicate în reviste și conferințe științifice internaționale.

Daniela TIMISICĂ is a member of the community of the Doctoral School of Automatic Control and Computer Science at the National University of Science and Technology Politehnica Bucharest. She currently works as a Scientific Researcher at the National Institute for Research and

Development in Informatics - ICI Bucharest. Her main areas of interest and research activity include the IoT – Internet of Things, web development, cybersecurity, and Blockchain technology. She is also interested in the study of Artificial Intelligence, the application of 5G technology, and their implementation in newemerging digital ecosystems.

Daniela TIMISICĂ este membră a comunității Școlii Doctorale de Automatică și Calculatoare din cadrul Universității Naționale de Știință și Tehnologie Politehnica București. În prezent, este cercetător științific în cadrul Institutului Național de Cercetare-Dezvoltare în Informatică – ICI București. Principalele sale domenii de interes și activitate pentru cercetare sunt: Internetul Obiectelor (IoT – Internet of Things), programare web, securitatea cibernetică și tehnologia Blockchain. De asemenea, este interesată de studiul Inteligenței Artificiale, aplicarea tehnologiei 5G și implementarea acestora în noile ecosisteme digitale emergente.