

Chapter 2

Pushing the Limits of Creativity: A Brief Study of GenAI

Semra Erpolat Taşabat

 <https://orcid.org/0000-0001-6845-8278>

Mimar Sinan Fine Art University, Turkey

Tayfun Özçay

 <https://orcid.org/0000-0003-0011-7877>

Borusan Cat, Turkey

ABSTRACT

Generative Artificial Intelligence (GenAI) refers to Artificial Intelligent (AI) systems with human-like creativity and productivity capabilities. The most important difference between traditional AI and GenAI systems, which generally use algorithms and models designed to perform a specific task, is that GenAI systems can create new and original content. GenAI, which emerged as a product of technology and creativity and is a field that develops day by day, has been an important development that arouses interest and curiosity, as well as anxiety and uncertainty, for all segments of society with what it has done and what it can do in the future. GenAI's rapid development has begun to reshape business and living spaces by bringing admirable innovations. In this study, the past, present, and future of GenAI will be discussed and the landscape, applications, and tools of GenAI will be emphasized. In this way, it will be possible to understand this technological trend that will shape the future and help follow new developments and digital transformation.

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1. INTRODUCTION

GenAI is a class of AI systems that can generate text, images, audio, video, and synthetic data, among many other types of content. Unlike the more traditional AI, which can only perform a task for which it has been specifically designed, GenAI systems can create new, original content indistinguishable from human creativity. This innovation has drastically transformed industries, businesses, and daily life. The term might be modern, but as a concept, GenAI had first taken root in the 1960s and advanced up to the present times with quite a few technological leaps along the way.

The first major development to attract widespread attention in GenAI was the creation of chatbots in the 1960s. These very early AI systems were simple, rudimentary, and designed for simulating conversation in responding to basic prompts. A very early example is that of ELIZA, which emulated human conversation through pattern-matching techniques (Weizenbaum, 1966). The whole conversation was very limited, and far from intelligent-however, it marked the dawn of AI systems interacting with their human users in conversational style. Further interest in AI developed, as it would be used to build intelligent systems, simulating human-like interactions sparked, which would eventually help create more sophisticated and creative systems. It was not until the early 21st century, however, that the true creative power of GenAI began to be realized with the emergence of Generative Adversarial Networks (GANs).

The invention of GANs in 2014 by Ian Goodfellow and colleagues marked a critical turn for GenAI. For the very first time, it had become possible for machines to create something new-a new piece of content which was realistic. The GAN framework is comprised of two Neural Networks (NNs): the generator and the discriminator. The generator creates data, such as images, while the discriminator evaluates whether the generated data is real or fake. Through this adversarial process, the generator improves its ability to create highly realistic content that becomes increasingly indistinguishable from real-world data (Goodfellow et al., 2014). This allowed the GANs to unleash a creative power that hitherto allowed AI to create photorealistic images, art, and even videos. That opened more than just perspectives for AI in the entertainment and gaming industries but also potential areas of application for GenAI, such as fashion design, advertising, and architecture.

While GANs provided a major leap in creative AI applications, transformers and Large Language Models (LLMs) brought about a new revolution in GenAI. First proposed by Vaswani et al. in 2017, the transformer architecture resolved many of the limitations inherent in earlier models of Machine Learning (ML). Until the arrival of transformers, most of the models adopted sequential processing of data; this hindered their capability for understanding long-range dependencies within text. The introduction of the attention mechanism in transformers enabled the AI systems

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