



# KREA: Real-time AI-Powered Creative Suite for Next-Generation Digital Art

Victor Perez\*  
v@krea.ai  
KREA.AI, Inc.  
San Francisco, California, USA

Erwann Millon\*  
e@krea.ai  
KREA.AI, Inc.  
San Francisco, California, USA

Mihai Petrescu\*  
m@krea.ai  
KREA.AI, Inc.  
San Francisco, California, USA

Titus Ebbecke\*  
t@krea.ai  
KREA.AI, Inc.  
San Francisco, California, USA

Tianpei Gu  
tianpei@krea.ai  
KREA.AI, Inc.  
San Francisco, California, USA

Diego Rodriguez Prado\*<sup>†</sup>  
d@krea.ai  
KREA.AI, Inc.  
San Francisco, California, USA

## ABSTRACT

KREA is a novel platform that integrates AI into the creative process, aiming to enhance how artists interact with artificial intelligence. This system combines recent advances in AI research, distributed systems, and human-computer interaction to facilitate real-time visual content creation. KREA's architecture, which we term an "inverted videogame" system, enables AI-powered creation through web browsers, addressing challenges in latency, state management, and reliability in dynamic GPU compute environments. This paper presents the key innovations of KREA, including its unique distributed architecture, real-time AI generation capabilities, and user interface designed for intuitive AI-assisted creativity.

## CCS CONCEPTS

• **Computing methodologies** → **Artificial intelligence**; • **Human-centered computing** → *Human computer interaction (HCI)*.

## KEYWORDS

real-time AI, creative tools, distributed systems, image generation, video generation

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## 1 INTRODUCTION

The integration of AI into creative industries is rapidly transforming artistic practices. KREA emerges as an innovative platform in this evolving landscape, offering tools that integrate AI into the

creative process. By combining recent advances in AI research with novel approaches to distributed systems and human-computer interaction, KREA aims to provide a real-time platform for visual content creation that expands the possibilities of digital art.

## 2 SYSTEM OVERVIEW

At the core of KREA's innovation are two key components: novel UX/UI interactions from a Human-Computer Interaction (HCI) perspective, and a unique distributed systems architecture we term the "inverted videogame" system. These components work in tandem to deliver a seamless, real-time AI-powered creative experience.

### 2.1 UX/UI and Human-Computer-AI Interaction

KREA introduces a paradigm shift in how users interact with AI in creative workflows. Traditional AI-assisted tools often require users to wait for results, breaking the creative flow. Our approach focuses on real-time interaction, allowing artists to see AI-generated results instantly as they work.

Key UX/UI innovations include:

- **Real-time Continuous Feedback Loop:** Users receive immediate visual feedback as they adjust parameters or input prompts, fostering a more intuitive and exploratory creative process.
- **Image-to-Image Workflow:** A novel interface where users place an input image on the left side of the screen and observe an AI "rendered" version on the right in real-time, offering an intuitive bridge between conventional and AI-assisted creative processes.
- **Weighted Multi-Modal Prompting:** An innovative UI that allows users to combine both text and image prompts with adjustable weights, providing fine-grained control over the AI's output without requiring technical expertise.

### 2.2 Distributed Systems Architecture: The "Inverted Videogame" System

KREA's architecture inverts traditional client-server paradigms, maintaining minimal server-side state while leveraging high-performance GPUs for rendering. This approach is tailored to the unique demands of real-time, AI-powered creative tools.

Key technical challenges and our innovative solutions include:

\*All authors contributed equally.

<sup>†</sup>Corresponding author.

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- **Latency Minimization and Stateless Processing:** Our system utilizes WebSocket-based communication for efficient binary image data transfer. An advanced frame-dropping strategy at the GPU level balances GPU usage and user experience, prioritizing the most recent user interactions while selectively processing intermediate frames.
- **GPU-Level Optimization:** Our GPU processing pipeline treats each frame as an independent unit of work, without maintaining persistent state across frames. This design allows for maximum flexibility and scalability, ensuring a fluid user experience even under varying network conditions.
- **Elastic Resource Allocation:** Our custom orchestration layer dynamically provisions and de-provisions GPU resources based on demand, reallocating resources to background tasks during low-demand periods.

### 3 KEY FEATURES AND INNOVATIONS

KREA's platform is built around several key features:

- **Real-time AI Generation:** Achieves multiple frames per second of AI-generated images
- **Image Enhancement:** AI-powered upscaling up to 4K resolution, with potential for 8K or higher
- **Novel UI/UX:** Intuitive interfaces for real-time AI interaction

These features are powered by cutting-edge AI research, including techniques such as Latent Consistency Models and Progressive Adversarial Diffusion Distillation (SDXL Lightning), along with standard ML acceleration techniques.

### 4 APPLICATIONS AND USE CASES

KREA caters to a wide range of creative fields, including concept art, illustration, photography, graphic design, motion graphics, and architectural visualization. Additionally, KREA opens up unique applications in VJ (Visual DJ) performances and film production, offering advanced chroma/screen projections for immersive environments (artists like Anyma or Grimes are already leveraging AI for their live-performances).

### 5 FUTURE RESEARCH

As KREA continues to evolve, several exciting research directions emerge:

- **Quality-Speed Trade-off:** Addressing the challenge posed by the "Bitter Lesson" in AI, where larger, more generalized models often outperform specialized ones. Our research focuses on optimizing the balance between model size, output quality, and real-time performance.
- **Cross-Modal and Multi-Modal Models:** Investigating whether video models can outperform image models in static image generation, and exploring the potential of multi-modal models to enhance creative outputs.
- **Consumer Hardware Optimization:** Developing models optimized for high-performance consumer hardware, such as Apple's M-series chips, to bring AI-powered creation closer to the edge or even client-side.
- **Holistic World Creation:** Expanding KREA's capabilities to generate comprehensive, multi-sensory virtual worlds. This

approach views all content as snapshots of a cohesive reality, allowing for the capture of various human-perceptible outputs (audio, video, images) from a single, rich virtual environment.

While our primary focus remains on individual creative workflows, we also recognize the potential value in exploring collaborative features for AI-assisted design tools.

### 6 CONCLUSION

KREA represents a significant step forward in creative tools, aiming to bridge the gap between imagination and creation. By enabling artists to generate complex visual content in real-time, KREA contributes to the ongoing evolution of digital art creation. As AI continues to influence the creative landscape, tools like KREA have the potential to empower artists with new capabilities, opening up novel avenues for artistic expression and exploration.