VAM-RGB

Causal Teleportation: Sending Time Through Color

What if AI could see the future and the past in a single glance?

VAM-RGB encodes temporal causality into RGB channels, enabling AI to perceive motion without video streaming.

The Problem: AI is Temporally Blind

Current multimodal AI models process images frame by frame. They see **snapshots**, not **stories**. To understand motion, they need multiple images and explicit prompts about temporal relationships.

The bottleneck: Sending 30 frames per second to an AI API is expensive, slow, and wasteful. Most of that data is redundant.

The Solution: Causal Teleportation

VAM-RGB "teleports" causality across time by encoding **three moments** into a single RGB image:

Channel	Time	Meaning
R (Red)	T - 0.5s	The Past (where things were)
G (Green)	T	The Present (where things are)
B (Blue)	T + 0.5s	The Future (where things will be)

How It Works

```
// Causal Teleportation Algorithm
function teleportCausality(video, T0, deltaT = 0.5) {
    // Extract three temporal moments
    const past    = getFrame(video, T0 - deltaT);
    const present = getFrame(video, T0);
    const future  = getFrame(video, T0 + deltaT);

    // Convert to luminance (grayscale)
    const R = toLuminance(past);
    const G = toLuminance(present);
    const B = toLuminance(future);

    // Merge into single RGB image
    return mergeChannels(R, G, B);
}
```

The Magic: Reading Ghosts as Signals

A Paradigm Shift in Image Processing

In traditional video processing, motion blur and ghosting are **noise to be eliminated**.

In VAM-RGB, they are **signals to be decoded**.

We turned artifacts into information.

Decoding the Chromatic Aberration

Visual Pattern	Interpretation
Grayscale (R = G = B)	Static object - no motion
Red fringe on left, blue on right	Object moving right
Blue fringe on left, red on right	Object moving left
Wide color separation	Fast motion
Narrow color separation	Slow motion

> **Why "Teleportation"?**

> Because we're not just compressing data - we're **transmitting causality**. The image carries information about what *caused* the current state (past) and what it will *cause* (future). AI can now reason about temporal relationships from a single static image.

The Math: Information Density

$$\text{Compression Ratio} = 3{:}1 \text{ (three frames} \rightarrow \text{one image)}$$

But it's not just about compression. It's about **semantic density**:

- **Traditional:** 1 image = 1 moment = no temporal context
- **VAM-RGB:** 1 image = 3 moments = full causal context

Result: AI can infer motion vectors, predict trajectories, and understand scene dynamics - all from a single API call.

Applications: Where Causal Teleportation Matters

1. Video Understanding for LLMs

Send a single VAM-RGB grid image to GPT-4V, Claude, or Gemini. Ask: "When does the car start moving?" The AI can now answer by reading the chromatic aberration.

2. Autonomous Systems

Self-driving cars can use VAM-RGB to compress temporal sensor data for onboard AI inference, reducing bandwidth and latency.

3. Surveillance & Security

A single VAM-RGB frame captures motion events that would otherwise require video playback to detect.

4. Sports Analytics

Coaches can see player movement patterns encoded in color - no video scrubbing required.

Implementation

```
// Browser implementation (Canvas API)
async function createVAMRGB(video, timestamp, deltaT = 0.5) {
    const canvas = document.createElement('canvas');
    const ctx = canvas.getContext('2d');
    canvas.width = video.videoWidth;
    canvas.height = video.videoHeight;

    // Capture three frames
    const frames = await Promise.all([
        captureFrame(video, timestamp - deltaT),
        captureFrame(video, timestamp),
        captureFrame(video, timestamp + deltaT)
    ]);

    // Get image data
    const imageData = ctx.createImageData(canvas.width, canvas.height);
```

```
    for (let i = 0; i < frames[0].data.length; i += 4) {
        // R channel = past luminance
        imageData.data[i] = getLuminance(frames[0], i);
        // G channel = present luminance
        imageData.data[i + 1] = getLuminance(frames[1], i);
        // B channel = future luminance
        imageData.data[i + 2] = getLuminance(frames[2], i);
        // Alpha = full opacity
        imageData.data[i + 3] = 255;
    }

    ctx.putImageData(imageData, 0, 0);
    return canvas.toDataURL('image/png');
}

function getLuminance(frame, i) {
    // Rec.709 luminance
    return 0.2126 * frame.data[i]
         + 0.7152 * frame.data[i + 1]
         + 0.0722 * frame.data[i + 2];
}
```

The Philosophy: Noise → Signal

VAM-RGB embodies a deeper principle:

> **Every "artifact" is information in disguise.**
>
> Motion blur isn't noise - it's a record of displacement.
>
> Ghosting isn't corruption - it's temporal superposition.

The question isn't "how do we remove it?" but "what is it telling us?"

Try It Now

Open source. No server required. Works in your browser.

View on GitHub | Live Demo

VAM-RGB: Causal Teleportation

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Formal Documentation: For patent specification and technical details, see VAM-RGB Patent Specification (PDF)

This document uses "Causal Teleportation" as a conceptual metaphor for the technical process formally known as "Time-Series RGB Synthesis" (時系列RGB合成).