Replicating ChatGPT-Style Chat AI with Elliptic Curve AI (EC-AI)

Steven Joseph

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Abstract

Elliptic Curve Artificial Intelligence (EC-AI) presents a deterministic alternative to probabilistic models like ChatGPT. Rather than relying on stochastic token prediction, EC-AI structures intelligence using elliptic curve cryptography and mathematical mappings. This document details the methodology by which EC-AI can replicate conversational AI, offering a provably secure, efficient, and deterministic system for structured knowledge retrieval and response generation.

1 Introduction

Traditional Large Language Models (LLMs) such as OpenAI's GPT-4 use transformer architectures and attention mechanisms to generate probabilistic text responses. However, these models suffer from hallucinations, computational inefficiencies, and centralized control.

EC-AI, by contrast, encodes structured knowledge onto elliptic curves, enabling deterministic retrieval and reasoning. This approach ensures cryptographically sound AI interactions without relying on massive neural networks or continuous retraining.

2 Mathematical Encoding of Knowledge

2.1 Elliptic Curve Representation

EC-AI maps structured knowledge onto elliptic curve points, ensuring efficient and deterministic operations.

$$y^2 = x^3 + ax + b \mod p, \quad 4a^3 + 27b^2 \neq 0 \tag{1}$$

where p is a prime number defining the finite field, and a, b define the curve. Each knowledge entry K_i is hashed and mapped onto a curve point:

$$P_i = H(K_i) \mod p \tag{2}$$

where H is a cryptographic hash function.

2.2 Retrieval and Chat Completion

Given a user query Q, EC-AI performs structured retrieval:

$$P_Q = H(Q) \mod p \tag{3}$$

Knowledge responses are identified via bilinear pairing:

$$\hat{e}(P_Q, P_K) = e \tag{4}$$

where e is a deterministic pairing function ensuring verifiable AI responses.

3 Generating Conversational Output

Unlike GPT models, which sample probabilistic token sequences, EC-AI constructs responses deterministically.

3.1 Sentence Construction

A response is formed by structured knowledge synthesis:

$$R = P_Q + \sum_{i=1}^{n} P_{K_i} \tag{5}$$

This ensures coherent, knowledge-grounded text rather than stochastic predictions.

3.2 Grammar and Linguistic Structuring

Linguistic rules are applied via structured mappings:

$$T = F(R) \mod p \tag{6}$$

where F is a deterministic grammar function.

4 Advantages Over Transformer-Based AI

- **No hallucinations:** Responses are verifiable, not probabilistic.

- **Efficient computations:** No need for billions of parameters.

- **Deterministic retrieval:** No reliance on stochastic sampling.

- **Decentralized intelligence:** No dependency on centralized data servers.

5   Conclusion

EC-AI presents a paradigm shift from probabilistic language modeling to deterministic, cryptographically structured AI. By leveraging elliptic curve cryptography, it enables verifiable, efficient, and decentralized conversational AI.