# Enhancing NFT Utility through Decomposability and Fractional Ownership: A Conceptual Framework

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***Abstract*—The integration of non-fungible tokens (NFTs) with artificial intelligence (AI) is transforming the digital asset landscape by expanding possibilities for asset representation and utilization. This paper introduces a framework that enhances NFTs through fractionalization, providing users with greater control and flexibility over asset representation. By integrating decomposable AI models, specifically focusing on the encoder and decoder components of LSTM models, the framework facilitates the segmentation of NFT assets into modular components for dynamic asset management and the creation of customizable digital collectibles. A key feature of this approach is the interchangeability of decomposed AI components, which adds versatility to digital asset management. Demonstrated through a proof of concept using number prediction models, the system showcases the seamless integration and interchangeability of AI components within the NFT framework. This research highlights that fractionalized NFTs can achieve unparalleled versatility and value, empowering creators and users to explore new dimensions of expression and practical application.**

***Index Terms*—Decomposable AI, ERC1155, Fractional ownership, Interchangeability, Non-fungible token**

## I. Introduction

In recent years, the landscape of digital asset ownership has been notably shaped by the advent of non-fungible tokens (NFTs), primarily serving as immutable proofs of ownership for static assets such as art, media [1], and online documents [2]. NFTs have significantly expanded into the gaming industry, particularly through platforms like Axie Infinity, where players own, trade, and sell in-game assets as NFTs, enhancing the gaming experience by providing real-world value to digital items. Additionally, the fashion industry has embraced NFTs to revolutionize digital fashion shows and virtual clothing, allowing designers to sell unique digital wearables that can be showcased in virtual environments. NFTs have also found utility as access passes for events, both physical and virtual, granting entry to exclusive spaces in the metaverse and real-world events, providing a secure and verifiable means of access [3].

Traditional models of NFTs, however, present limitations in their utility and accessibility, confining them to singular ownership and limited functional scope [4]. This paper introduces a conceptual framework designed to significantly enhance the versatility, accessibility, and utility of NFTs by integrating AI model decomposition with the concept of NFT fractionalization [5] as shown in Fig. 1. Our proposed approach leverages decomposable AI methodologies, enabling the disaggregation of NFTs into modular components, allowing for increased customization and adaptability. This innovation permits multiple stakeholders to hold shares of a single NFT, thereby improving asset liquidity and broadening accessibility. By implementing standards like ERC1155, which supports fractional ownership and diverse token types, we aim to transform NFTs from static entities into dynamic, evolving assets that encourage user engagement and creativity, thereby catalyzing market expansion. The paper outlines the foundational principles, implementation strategies, and potential benefits of this approach.

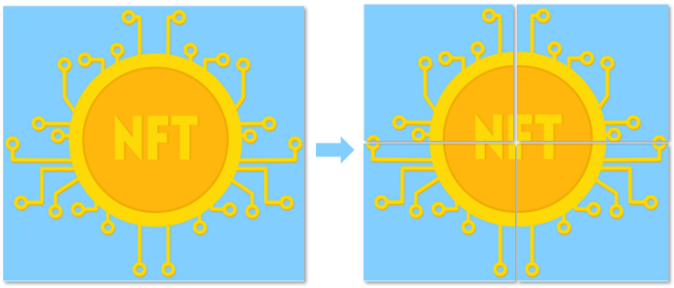


Fig. 1. Fractionalization of NFTs

## II. Proposed System

Our proposed system enhances the utility of NFTs by integrating decomposable AI models with fractionalized ownership as shown in Fig. 2. Digital assets, such as AI models for predicting numbers, are encapsulated within an NFT container using the ERC1155 standard, allowing for the management of multiple token types within a single contract. Each AI model is decomposed into modular components, such as sequence prediction, pattern recognition, and result synthesis modules. These components are tokenized as sub-NFTs and fractionalized using smart contract-based frameworks that enable multiple parties to own shares of these components, facilitating modular integration without permanently transferring ownership. The system ensures that each decomposed AI model component can be reconstituted based on the initial, whole AI model, maintaining integrity and completeness. Interchangeability is demonstrated by swapping components between different AI models, managed by smart contracts to ensure secure transactions and dynamic reconfiguration.

To train and test the LSTM models, synthetic datasets tailored for specific prediction tasks were used. The sequence

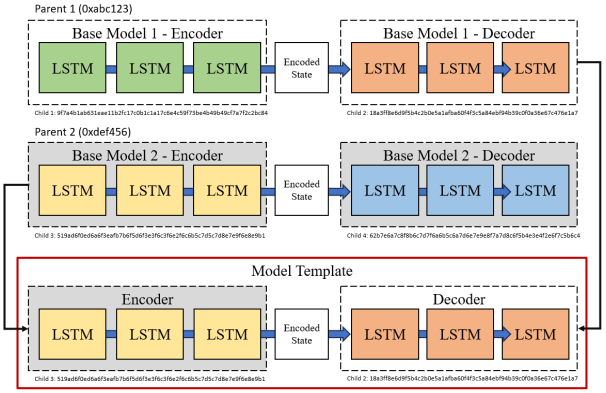


Fig. 2. Proposed Conceptual Framework

prediction model was trained on sequences of random numbers to predict the next number, while the sum prediction model predicted the sum of sequences. These datasets were split into training and testing sets to evaluate performance. The LSTM models were decomposed into encoder and decoder components, separately trained to ensure modular functionality. The components were then applied to the fractionalization of NFTs, tokenized as sub-NFTs, and managed using a Solidity smart contract based on ERC1155. This contract supports minting, fractionalizing, and managing parent-child relationships of NFTs. A Python script facilitates the minting and fractionalizing processes, connecting to a local Ethereum node. The experiment validated the system, demonstrating successful decomposition, tokenization, reconstitution, and interchangeability of AI model components, maintaining functionality and integrity. By integrating decomposable AI models within fractionalized NFTs, the system creates a dynamic and scalable framework for managing digital assets, significantly enhancing the utility and accessibility of NFTs, and promoting a more inclusive digital economy.

## III. Results and Discussion

We validated the proposed system through an experiment using AI models designed for number prediction, creating two models: one for predicting the next number in a sequence and another for predicting the sum of a sequence. These models were decomposed into modular components—encoders and decoders—tokenized as sub-NFTs, and fractionalized using the ERC1155 standard, allowing multiple parties to own shares. The sequence prediction module from the next-number prediction model was swapped with the one from the sum prediction model to demonstrate interchangeability. Reconstituted models, formed by combining original and swapped components, were evaluated for performance, as detailed in Table I, confirming their functionality and compatibility. The experiment validated the system's flexibility and adaptability, showcasing its ability to manage digital assets dynamically and enhance NFT utility and accessibility, promoting a more inclusive digital economy.

TABLE I
Model Behavior

| Metric | Mean Absolute Error |
|---|---|
| Base-model_1 (Sequence Prediction) | 0.0002 |
| Base-model_2 (Sum Prediction) | 0.0018 |
| Interchanged Model_1 (Sequence Prediction) | 0.0014 |
| Interchanged Model_2 (Sum Prediction) | 0.0013 |

## IV. Conclusion

In this paper, we introduce a framework that enhances the utilization of NFTs by integrating decomposable AI models with fractionalized ownership using the ERC1155 standard. Our approach allows AI models to be divided into modular components, specifically the encoder and decoder parts of LSTM models, which are then tokenized as sub-NFTs and fractionalized among multiple owners. An experiment with number prediction models demonstrated successful decomposition, tokenization, and reconstitution with interchangeable components, maintaining functionality and integrity. This establishes a scalable and dynamic framework for managing digital assets, significantly enhancing the utility and accessibility of NFTs while promoting a more inclusive digital economy. Future work will explore deeper AI decomposition and its applications, investigate more complex models, apply this framework to diverse sectors, and enable interactivity between NFTs to create dynamic and versatile digital assets, fostering further development of utility-driven applications and empowering creators and users in new ways.

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