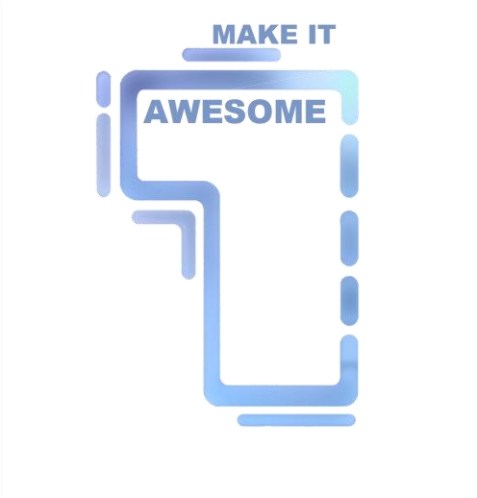


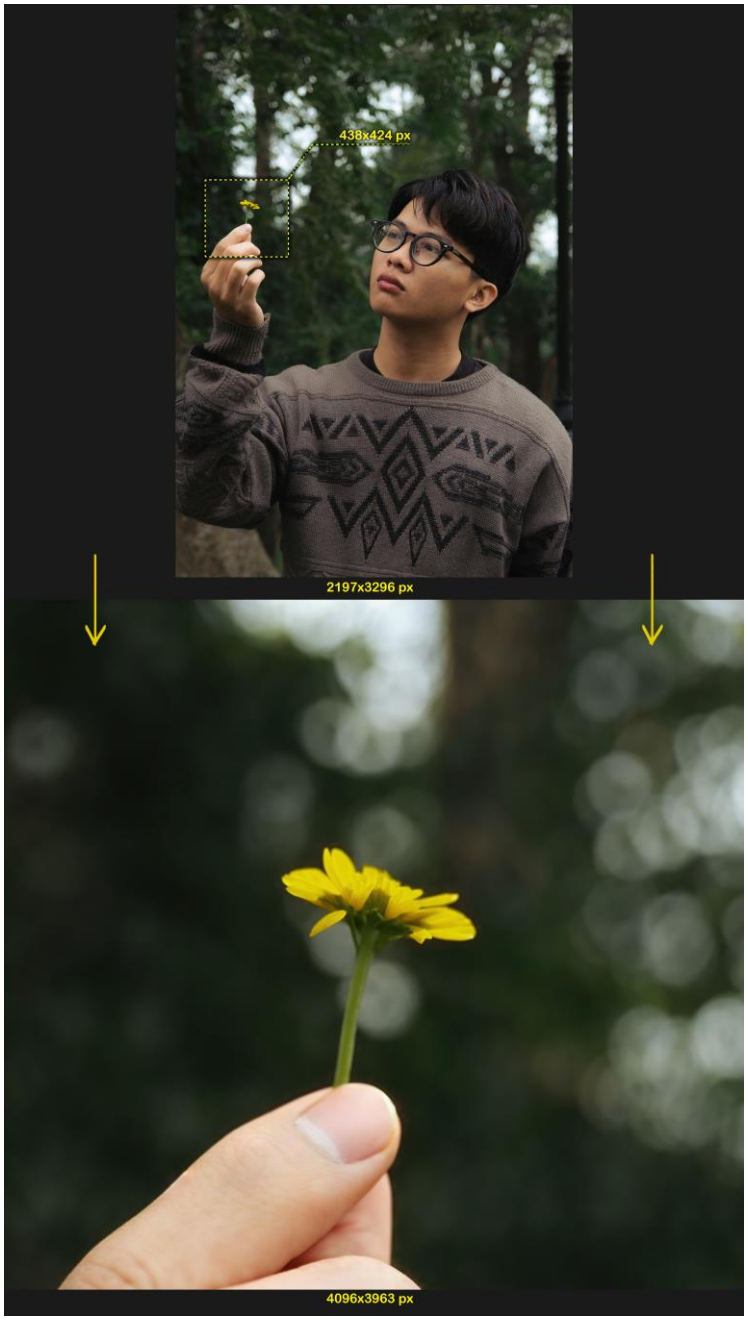
Photo AI Recovery

Bittensor Subnet

Introduction

We want to create a universal tool for photo restoration. Today, thousands of people — from professional photographers to everyday users — want to bring new life to old photographs or enhance the quality of their modern ones.

Imagine a simple scenario: in a group photo, someone likes how they look and wants to crop that fragment — originally 438×424 pixels — and upscale it to 4096×3963 pixels (here we will include demonstration images).



At the moment, this is only possible through a manual, time-consuming process. A professional would iteratively upscale the image by a factor of 2 using neural networks, manually clean up artifacts, and repeat the process again and again. Even for an experienced specialist, this workflow takes at least an hour to achieve a high-quality result.

Our goal is to remove human labor from the equation, making it possible to perform upscaling directly by a factor of x6 or more with high-quality neural network models. In addition to upscaling, we aim to support other advanced image restoration tasks such as denoising, inpainting, artifact removal, and watermark removal, creating a truly versatile photo enhancement platform.

1) Vision

To address these challenges and build a truly versatile restoration platform, we are developing a Bittensor subnet that leverages the network's decentralization, scalability, and incentive mechanisms. This foundation enables us to create a dynamic, self-improving ecosystem where restoration algorithms continuously evolve through competition and collaboration.

2) Problem Statement

- Current limitations: Existing solutions (e.g., Gigapixel AI, Waifu2x, Topaz) perform reasonably well in simple scenarios but often fail to deliver high-quality results when dealing with heavy compression, very small crops, or multiple layers of degradation.
- Manual workflow bottleneck: Human-driven restoration using neural networks combined with manual editing in Photoshop remains the most reliable method today — but also the most expensive, as it requires hours of skilled professional work.

3) Proposed Approach

A decentralized competition-plus-service model:
1. Competition Track (on-chain incentives): Validators generate complex, synthetic restoration tasks; Miners submit their solutions; Validators evaluate quality using PSNR, SSIM, and LPIPS metrics and assign a weight to each Miner based on their performance in the network.
2. Commercial Track (user-facing): Users upload images via web or mobile; the subnet routes jobs to higher-weighted Miners, ensuring the best available quality; users then receive their enhanced results automatically.

4) Subnet Roles & Flow

- Users: Submit images and specify the type of restoration (e.g., upscale x6, denoise, inpaint). Receive processed results.
- Miners (Model Providers): Run their own computer vision and deep learning models to perform the requested restoration tasks.
- Validators (Quality Scorers):
  - Evaluate the outputs from Miners using metrics such as PSNR, SSIM, and LPIPS.
  - Assign weights to Miners based on their performance.
  - Forward raw evaluation data and logs to the subnet maintainers for deeper analysis, enabling detection of cheating patterns or inconsistencies.

5) Competition: Synthetic Task Protocol

1. Original Creation (Создание оригинала): Several images from the dataset are combined and augmented to create a single reference image (the “original”).
2. Compression: The original is purely downscaled by a factor of x6, without adding noise, format conversion, or any other artifacts — just clean resolution reduction.
3. Task Delivery: Only the compressed image is sent to the Miners as the input for restoration. The original high-quality image remains hidden as the ground truth.
4. Evaluation: Validators evaluate the restored result strictly using PSNR, SSIM, and LPIPS metrics. No additional metrics or evaluation methods are currently applied.

6) Commercial Service Architecture

- Interfaces: Web and mobile applications where users can easily upload images and select the desired type of restoration (e.g., upscale x6, denoise, inpaint).
- Routing: Tasks are automatically routed to miners with the highest assigned weights, ensuring that users receive results from the most capable models available.
- Output Delivery: The enhanced images are returned to users through the same interface, with optional previews and side-by-side comparisons for convenience.

7) Technologies

- Network: Bittensor — decentralized computation and incentive framework.
- Models: Architecture-agnostic — Miners are free to use SR transformers, GANs, diffusion models, or hybrid pipelines.
- Metrics: Quality scoring is performed using PSNR, SSIM, and LPIPS.

8) Advantages

- Continuous quality improvement: Competition ensures rapid model iteration and higher performance over time.
- Lower barrier for users: Automated restoration becomes accessible to anyone, from professionals to casual users.
- Scalability: Decentralized design scales with the number of participating Miners and Validators.
- Versatility: Supports upscaling, denoising, inpainting, artifact cleanup, and watermark removal in a single platform.

9) Market & Competitors

- Existing solutions: Gigapixel AI, Waifu2x, Topaz Labs.
- Differentiator: A decentralized model marketplace that objectively assigns weights to Miners based on performance — fostering innovation and driving down costs while improving quality.

10) Monetization

- In-network incentives: Miners are rewarded in the subnet's alpha tokens, reflecting their contribution and performance.
- Paid Service: The commercial service will be priced at approximately $1 per 1,000 image enhancement runs, keeping it accessible for both individuals and professionals.
- Value Growth: Service revenue will be reinvested into the subnet's alpha token economy, driving token value growth and creating shared benefits for all participants in the ecosystem.

11) Roadmap

- Q3 2025:
  - Subnet code stabilization; improvements to task generation and scoring.
  - Monitoring and analysis for detection of inconsistencies or unfair practices.
- Q4 2025:
  - Expansion to additional tasks (denoising, inpainting, artifact removal, watermark removal).
  - Launch of the MVP commercial web service.
- Q1 2026:
  - Public testing of the commercial platform; onboarding of early users.
- Q2 2026+:
  - Full commercial launch; release of APIs for partners and enterprise integrations.

12) KPIs

- Benchmarking: Regular comparison of miners’ results against leading commercial solutions to ensure competitive or superior quality.
- Cost Assessment: Continuous evaluation of pricing fairness relative to delivered quality and user interest.
- Capacity and Load Management: Monitoring the workload of miners and adjusting mandatory performance thresholds — if a miner’s rewards are high, higher performance and reliability will be required.