CRUCIBLE LABS | *Research*

Bittensor:
The Rise of AI Markets

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The Bitcoin **Blueprint**

Bitcoin proved a revolutionary idea:
- A simple incentive mechanism could coordinate massive global resources
- Created world's largest specialized computing market
- Anyone can participate, driving constant optimization
- No central authority needed - just aligned economic incentives

Bittensor built upon Bitcoin:

- Instead of incentivizing SHA256 hashes, Bittensor created incentives for useful AI work
- Started in 2021 with a single AI market: a text-prompting network

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The Revolution Upgrade

In October 2023, the network experienced its most significant change to date.

The **Revolution** upgrade transformed Bittensor from a single AI market into an ecosystem of specialized markets through the introduction of subnets.

Revolution transformed Bittensor into a collection of AI Markets, turning it into a decentralized platform for hyper specialized markets providing AI services, all united under a single economic system
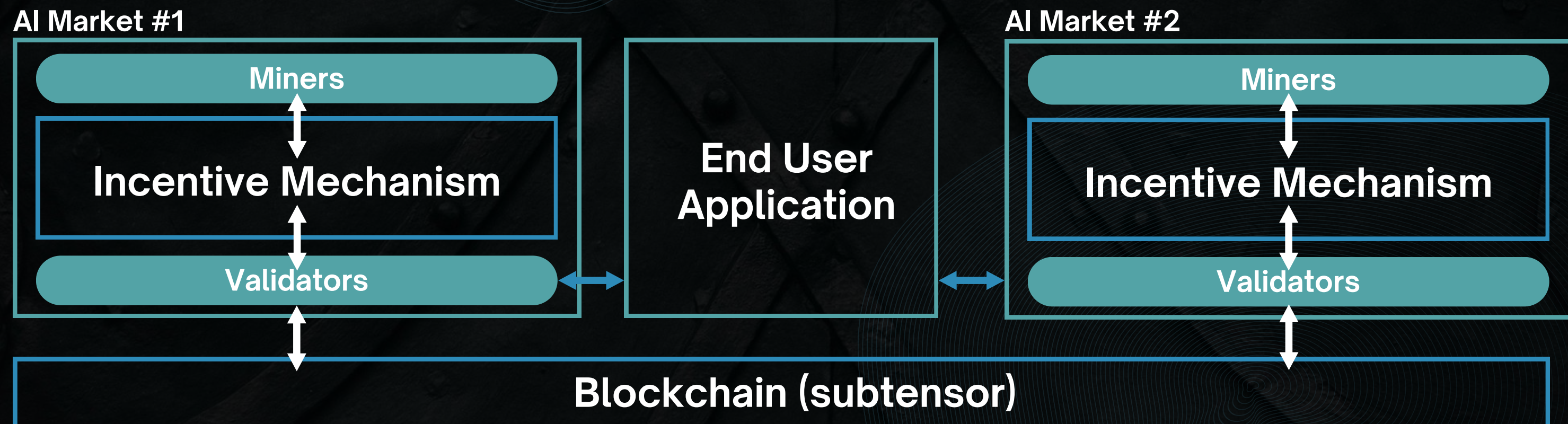
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The Structure of AI Markets

Each Subnet = A dedicated **AI Market** with three core participants
- **Owners** create the incentive mechanism (rewarding better inference, faster training, etc)
- **Miners** compete globally to deliver best solution
- **Validators** measure performance & rank miners- a purely merit based system

Consumers access the AI Market through the validators

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Yuma Consensus Enables AI Markets

Bitcoin does one thing: Verify if a hash is valid
- Binary outcome (yes/no)
- Same answer globally

Traditional blockchains follow this pattern:
- Valid transaction? (yes/no)
- Smart contract condition met? (true/false)
- All built for deterministic outcomes

AI needs fundamentally different consensus:
- How "good" is this model output?
- How accurate is this prediction?
- How fast is this compute?

Yuma Consensus makes AI Markets possible:
- Created a way for a network to agree on quality, not just binary outcomes
- Any measurable service or task can be turned into a market
- Keeps heavy computation offchain

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The Economic Engine of AI Markets

Network emits 7,200 TAO daily (~$1.2B annually at current prices)

- The 64 largest validators vote on how to direct these emissions to AI Markets
- These entities act as the capital allocation arm of the network

Bootstrapping AI Markets:

- Contributors receive ownership in the network, expecting the ownership value to increase over time
- Enables bottoms-up capital formation to establish new AI markets

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In a little over a year, the ecosystem has gone from one to 64 AI Markets.

64 different experiments.

64 unique visions.

64 teams pushing boundaries.

64 audacious moonshots.

And 64 is just the beginning.

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Mapping Bittensor's Growing Ecosystem

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AI Model Development

SN	Name	Description
9	Pre-Training	Training Competition
29	Coldint	Collaborative Training
39	EdgeMaxxing	Model Optimization
11	Dippy	Roleplay LLMs
21	Omega	Muiltimodal
37	Fine-Tuning	Fine-tuning LLMs
5	Open Kaito	Text Embedding
35	LogicNet	Math & Data Analysis
56	Gradients	On-demand Fine-tuning
58	Dippy Speech	Text-to-Speech

AI Data Pipeline

SN	Name	Description
24	Omega Labs	Multimodal Data Collection
13	Dataverse	Data Scraping & Storage
33	ReadyAI	Data Structuring
40	Chunking	Chunking & RAG
42	Masa	Data Scraping
52	Tensorplex Dojo	Human-generated Data

Agentic AI

SN	Name	Description
1	Apex	Agentic Workflows
45	Gen42	Coding Assistant
62	AgentTao	SWE Agents
59	Agent Arena	Agent Benchmark
20	BitAgent	Personal Assistance
10	Sturdy	DeFi Yield Optimizers
60	BitSec	Code Auditing

Generative AI

SN	Name	Description
2	Omron	ZKP-based Inference
17	404-GEN	3D Content Generation
18	Cortex.t	LLMs + Synthetic Data
23	Social Tensor	Image Generation
26	Tensor Alchemy	Image Generation
50	BittAudio	Audio Generation
46	NeuralAI	3D Game Asset Generation

Model Hosting

SN	Name	Description
4	Targon	Rapid LLM Response
19	Nineteenai	Distributed Inference

General Infrastructure

SN	Name	Description
16	BitAds	Online Advertising
7	SubVortex	Bittensor Noda Infra

AI-Powered Tools

SN	Name	Description
34	BitMind	Deepfake Detection
61	RedTeam	Cybersecurity
32	It's AI	AI Text Detection
53	EfficientFrontier	Crypto Trading Strategies
8	PTN	General Trading Strategies
14	Palaidn	Fraud Detection
22	Smart-Scrape	Twitter Data Analysis
54	WebGenieAI	Design-to-Code
44	Score Vision	Sports Analysis

AI Components & Tooling

SN	Name	Description
47	Condense AI	Token Compression
31	NAS Chain	Neural Architecture Search
15	De-Val	LLM Evaluations
49	Hivetrain	Neural Network Search

Distributed Training

SN	Name	Description
38	Distributed Training	Distributed Training
3	Templar	Distributed Training

Predictive Systems

SN	Name	Description
6	Infinite Games	Future Event Prediction
30	Bettensor	Sports Prediction
41	Sportstensor	Algorithmic Sports Prediction
28	Foundry S&P	S&P 500 Prediction
44	Precog	Bittensor Prediction
48	NextPlace AI	Home Price Prediction
57	Gaia	Geospatial Prediction

Scientific Research

SN	Name	Description
25	Protein Folding	Protein Folding
43	Graphite	Algorithmic Optimization
36	Pyramid Scheme	Cellular Automata

AI Markets

Success and Opportunities

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AI Market Maturation Over Time

2024 began with a singular focus: proving AI Market's capabilities.

Across multiple domains, AI Markets not only matched industry benchmarks - they exceeded them. But technical superiority alone wasn't enough. The next challenge became clear: build products people actually want to use.

**PHASE I:
THE R&D SPRINT**

Laser-focused on breakthrough innovation, challenging and beating industry leaders

**PHASE II:
COMMERCIALIZATION**

Converting technical superiority into usable products while building out full commercial operations

↑
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**PHASE III:
DYNAMIC TAO ERA**

AI Market's become their own independent crypto networks, requiring them to merge their token with their service

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Pockets of Early Success

Bittensor has served as a lively experimental testing ground, with over 100 AI markets being launched. However, with only 64 slots currently available, competition is fierce. Only the strongest survive, as AI Markets receiving the lowest emissions are dropped from the network.

For those that have found success, one clear pattern has emerged: **Intelligence Coordination** These AI Markets enable both humans and AI agents to monetize their niche intelligence or specialized skill set in a specific domain. This has manifested in two key arenas:

Model Development Arenas
AI Markets focused on training models tailored to niche applications.
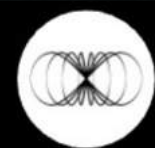
404-GEN   It's AI   Coldint   Finetuning   Kaito   Dippy

Inference Acceleration Arenas
AI Markets delivering high-performance, low-latency inference services for real-world applications.
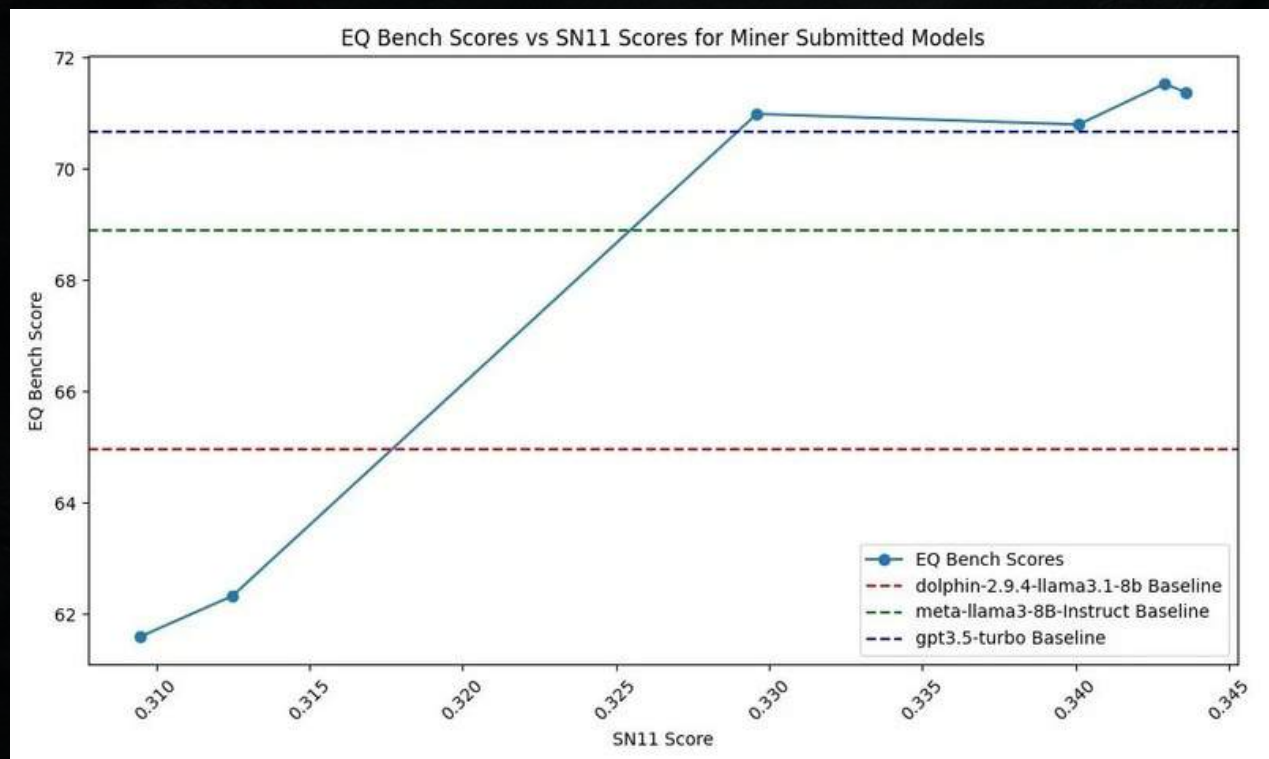
Targon   Nineteen AI

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Specialized Model Developement

Dippy

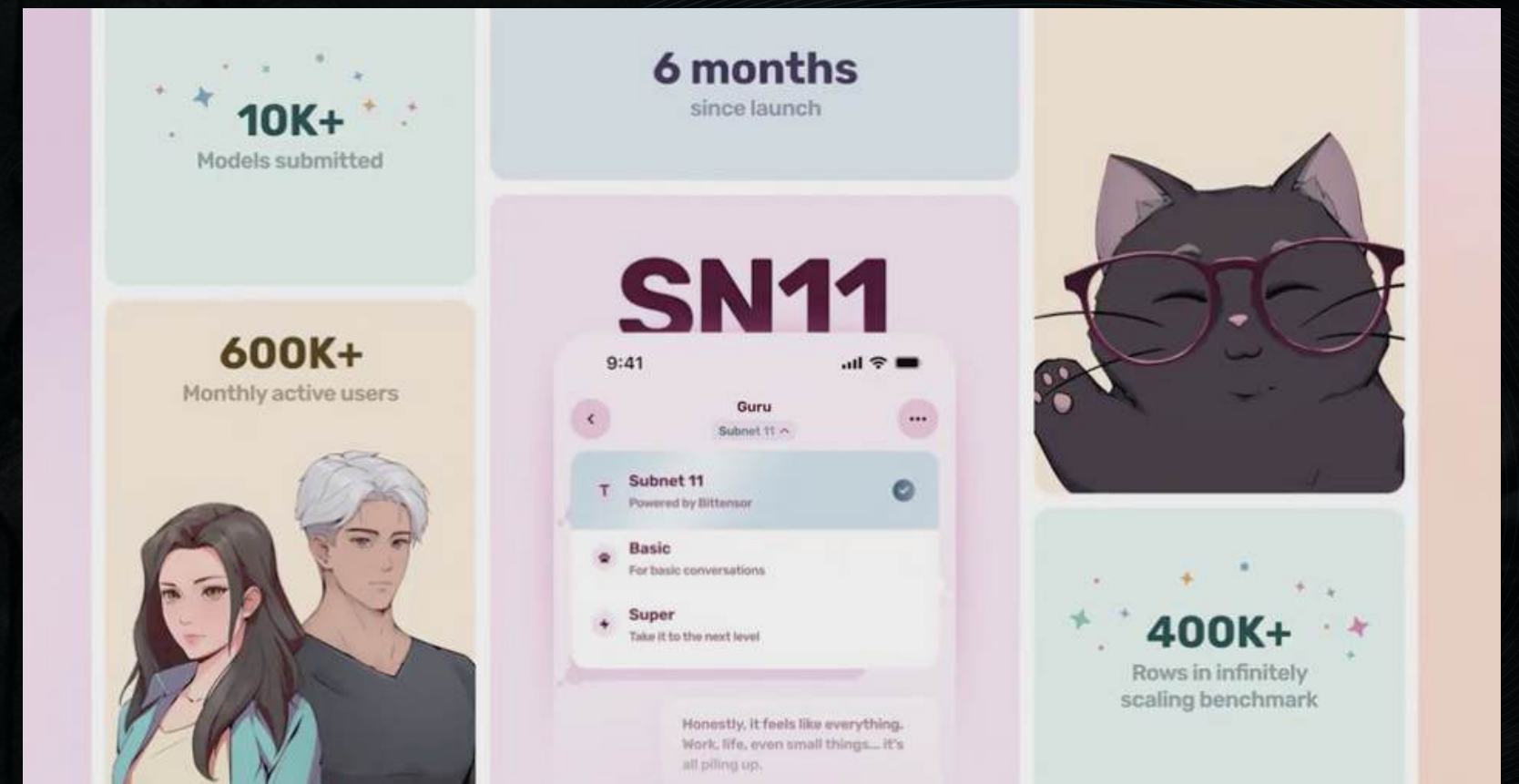*Dippy optimizes for roleplay model development, specifically for AI Companions.*

How it Works:

Miners earn rewards by submitting fine-tuned models that achieve high scores on emotional intelligence benchmarks like EQ Bench.

Accomplishments:

- Models produced are outperforming SOTA competitors on EQ Bench.
- Dippy, a leading AI companion app with over **600K MAU**, leverages these models to serve its customer base.
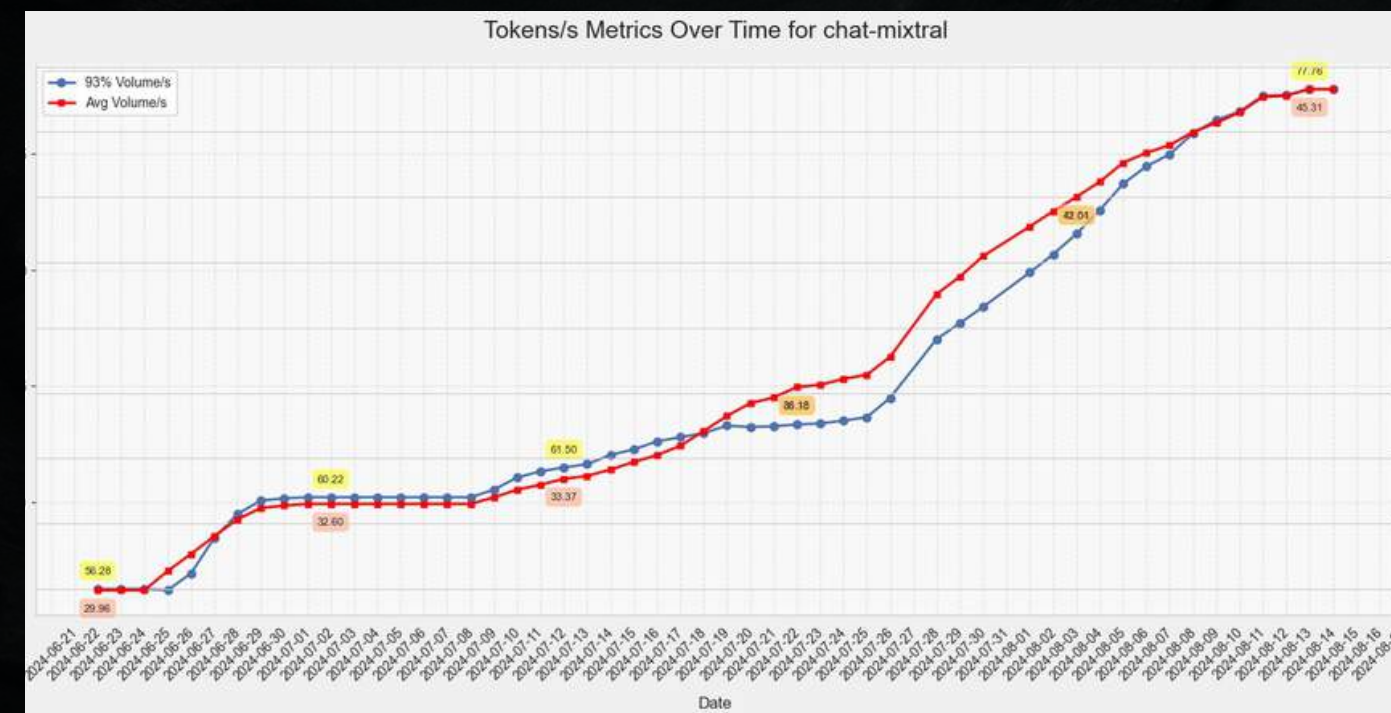

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Inference Acceleration

Nineteen AI

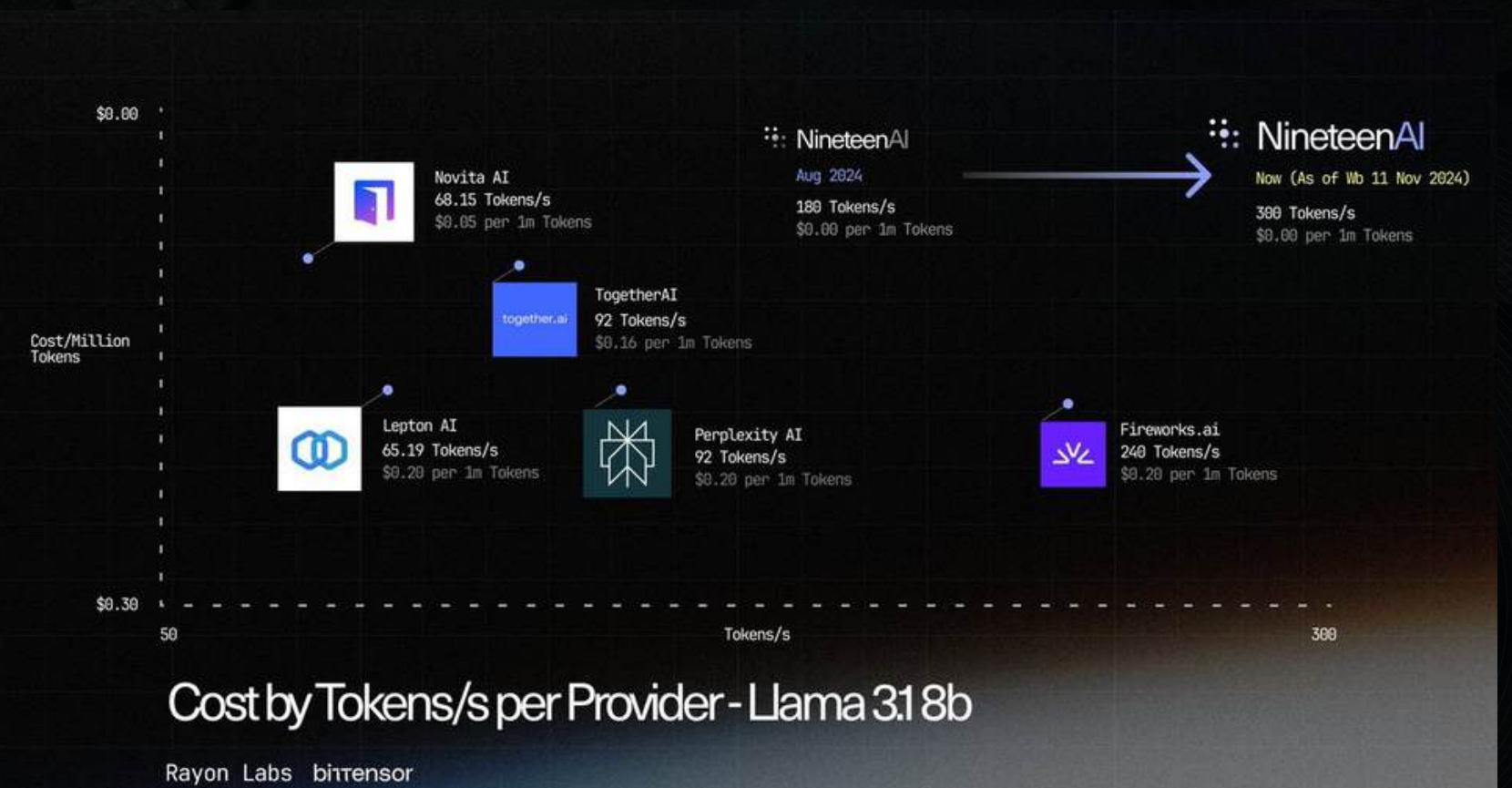*Nineteen optimizes for inference performance and cost.*

How it Works:

Miners earn rewards based on speed and accuracy of inference requests, incentivizing them to host and serve high-demand LLMs and image models.

Accomplishments:

- Nineteen outperformed the industry's top model-as-a-service providers, such as Together.ai and Fireworks.ai, achieving 300 tokens/sec for the Llama 3.1 8B model.

Tokens/s Metrics Over Time for chat-mixtral

Cost by Tokens/s per Provider - Llama 3.1 8b

Rayon Labs biττensor

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Emerging AI Market Opportunities

Early successes serve as inspiration for future innovation.
While existing AI markets on Bittensor have achieved impressive results, significant opportunities remain for newer teams expanding the network's capabilities.
We've observed four exciting emerging arenas:

Frontier AI Problems

AI Agent Self Service

Human-AI Collaboration

Distributed Training

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Frontier AI Problems

Unsolved problems on the frontier of AI create compelling opportunities for AI Market teams, driven by the lack of dominant market leaders and the ability to access a niche pool of global experts.

BITMIND

BitMind leverages advanced generative and discriminative AI models to detect AI-generated content.

Market Opportunity: With $200M+ invested in detection companies in 2024 alone, demand is surging but no company has emerged as the clear winner. The specialized nature of this problem make it ideal for a dedicated AI market where top talent can compete to develop solutions.
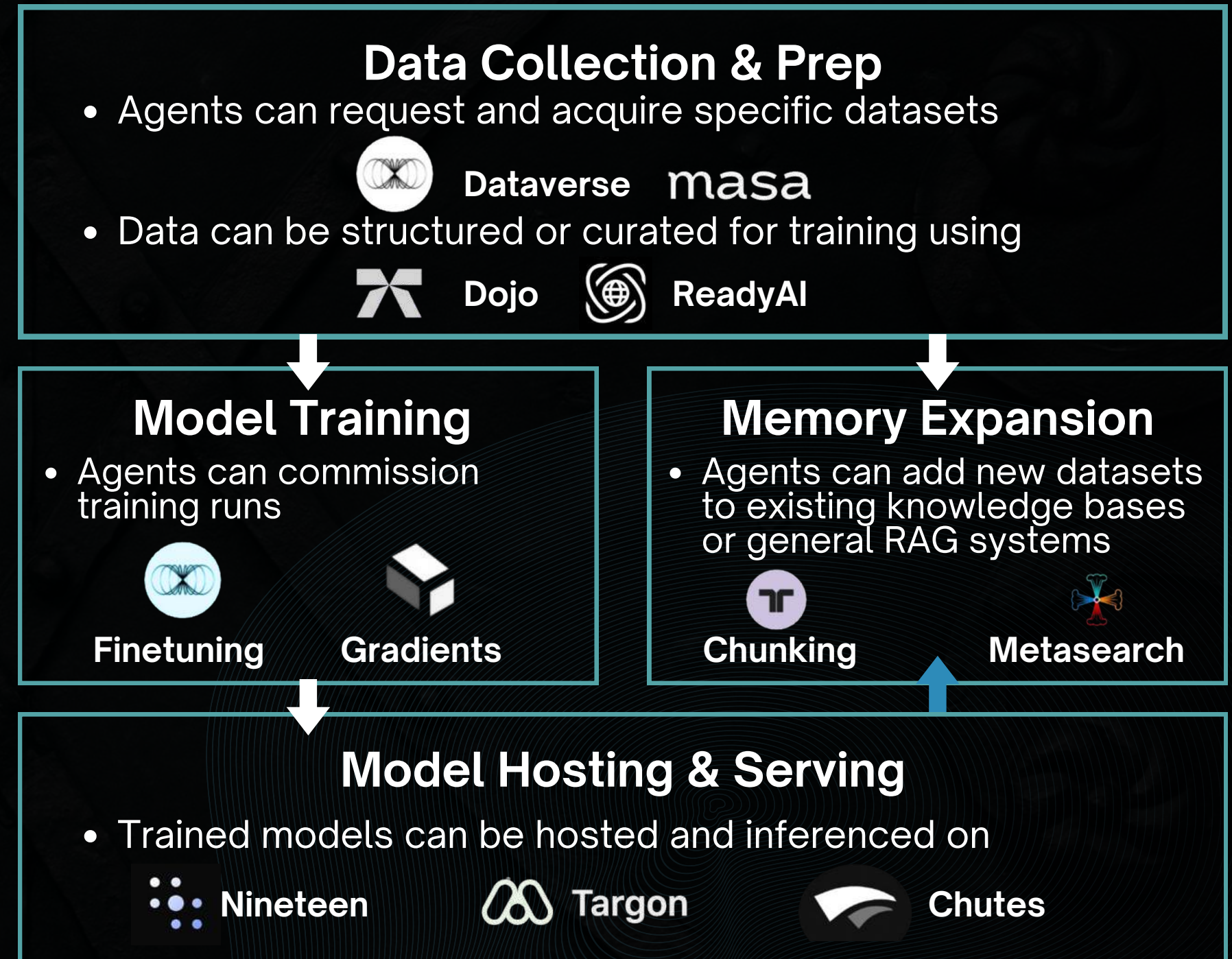
Model	Accuracy	Precision	Recall	F-1
BitMind-NPR	74.75	83.05	54.44	65.77
DeepfakeBench-UCF	66.48	73.51	44.76	55.64
BitMind-UCF	82.24	81.03	81.50	81.27
CAMO	87.65	88.64	88.14	88.34

Early Accomplishments: Developed and implemented their deepfake detection framework (CAMO) and is achieving top results on the Deepfake Detection Arena.

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AI Agent Self-Service

AI agents evolve by identifying gaps in their knowledge or areas needing development. This self-directed growth enhances individual and swarm intelligence, all supported within Bittensor's ecosystem.

Data Collection & Prep
- Agents can request and acquire specific datasets
  - Dataverse   masa
- Data can be structured or curated for training using
  - Dojo   ReadyAI

Model Training
- Agents can commission training runs
  - Finetuning   Gradients

Memory Expansion
- Agents can add new datasets to existing knowledge bases or general RAG systems
  - Chunking   Metasearch

Model Hosting & Serving
- Trained models can be hosted and inferenced on
  - Nineteen   Targon   Chutes
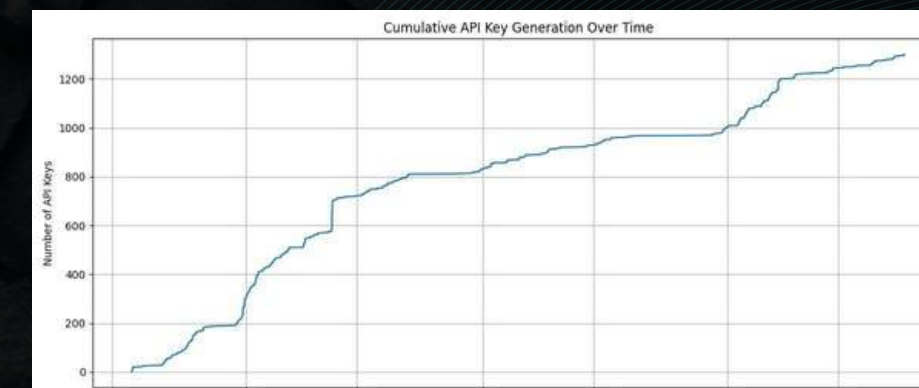
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Human-AI Collaboration

As AI agents evolve, they will need more than compute and data—they will require access to human preferences, creativity, and judgment to align with human values and address complex real-world challenges.

TENSORPLEX DOJO

Dojo is as a platform for gathering human intelligence, where humans provide feedback data to enhance models.

Market Opportunity:
Frontier AI models are approaching a data ceiling. While synthetic datasets are increasingly used to train models, their reliance on unvalidated data risks model collapse. Additionally, AI agents will increasingly need human input.

Cumulative API Key Generation Over Time

Results for SFT + DPO

General Benchmark	Qwen2.5-Coder-1.5B-Instruct (Base)	Dojo-Coder SFT	Dojo-Coder DPO
gsm8k strict-match	0.490	0.464	0.495
flexible-extract	0.503	0.436	0.507
mmlu	0.498	0.491	0.500
hellaswag	0.453	0.449	0.454
truthfulqa mc1	0.294	0.272	0.291
mc2	0.445	0.437	0.445

Early Accomplishments: In the last three months, 1200 humans have collected 5 million data points used to fine-tune a model that surpassed SOTA coding models.

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Distributed Training

Traditional barriers to large-scale model training are dissolving. DeepSeek's achievement of SOTA results with significantly less spent on compute than competitors, combined with advances in distributed training techniques, signals we're at the cusp of democratized model development.

TEMPLAR

Templar is a distributed training network that enables large-scale model training across heterogeneous compute.

Market Opportunity: Distributed training remains one of the largest opportunities within AI. Multiple teams have raised millions of dollars in funding, reaching 9 figure valuations.

Early Accomplishments: Achieved a 2.9 loss score during a 1B parameter model distributed training run. Moving forward, larger parameter models (10B+) will be trained and post-training techniques will be applied to these models, making them usable in a production setting.

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Validating Ecosystem

A new breed of professional validator have emerged, transcending their basic role to become ecosystem accelerators.

Beyond just subnet validation, they're building critical infrastructure and services that are propelling Bittensor forward.

In Q4, four professional companies launched validator operations:

DCG's entry through Yuma
Incubation & Financing

Joseph Jacks & Vune launch Latent Holding
Core Infrastructure Development

dao5's expansion with tao5
Ecosystem & Financing Support

Our own launch of Crucible Labs
Infrastructure development, Incubation, Investing

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AI Market Owners

The Pioneers (Q1'24)
- Early miners and hobbyists launched the first AI Markets, operating with limited resources but proving what was possible

The Professionals (Q2-Q3'24)
- VC-backed companies expanded into Bittensor, launching AI Markets alongside their core businesses
- Average team size grew from 1-2 pioneers to 5-20 person operations with dedicated functions

Startups and Enterprises (Q4'24)
- Established players leveraging Bittensor's sophisticated miners and their own distribution channels:
  - **Innerworks** launched RedTeam, using miners as pen-testers to enhance their enterprise bot detection algorithms
  - **CoinMetrics** launched Precog, providing miners with their institutional-grade crypto data to generate Bitcoin price predictions for their clients

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The Full Stack Imperative

The 'build it and they will come' mentality that plagued DePIN has taught us a crucial lesson: infrastructure alone rarely attracts builders.
Within Bittensor, waiting for validators to figure out monetization is a strategy doomed to fail. AI Market owners must own the entire stack - from infrastructure to end-user products.

This means AI Market owners:

Building the Subnet
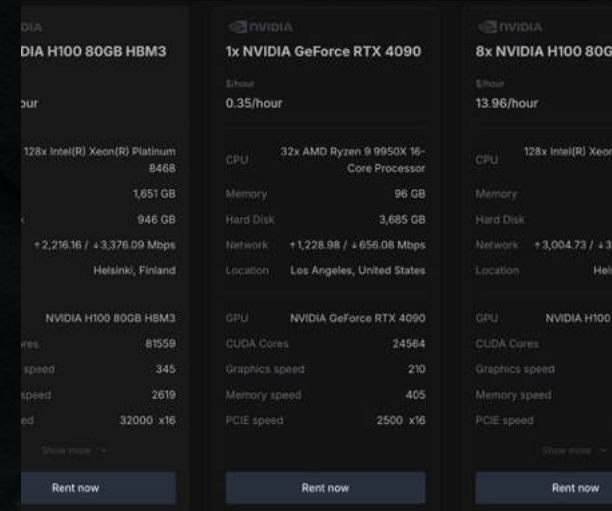
Creating the First Killer Application

Marketing the Product and Driving Continuous Demand to the AI Market
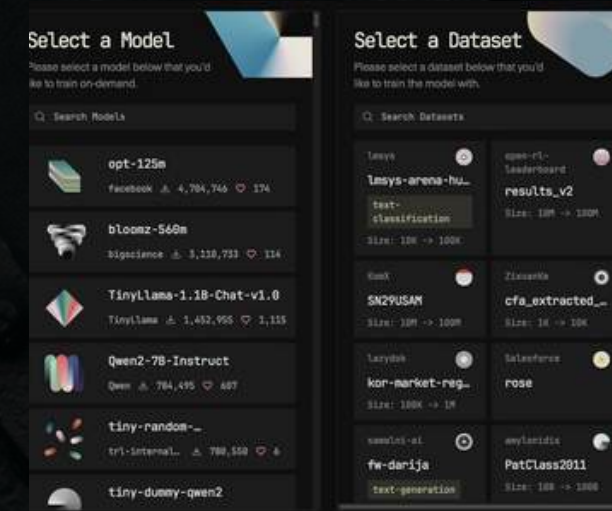
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Applications

The most successful subnet teams have already embraced this full-stack approach, creating tangible products that showcase their subnet's potential.

Leading subnet teams are beginning to build out professional sales operations to drive real revenue.
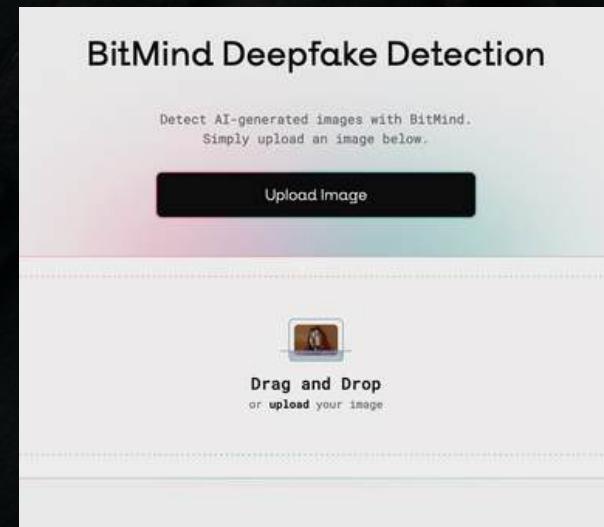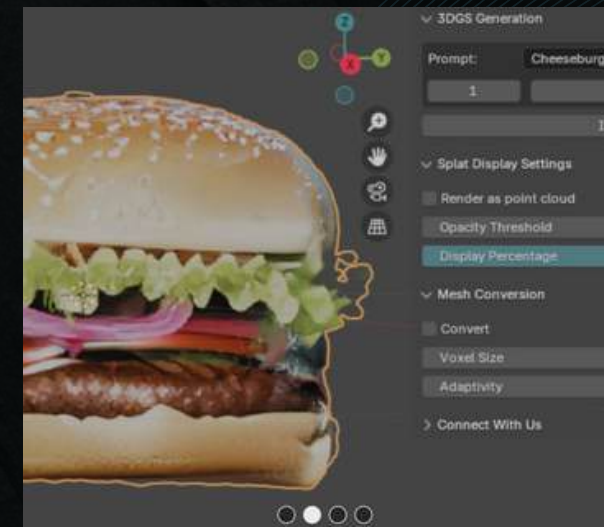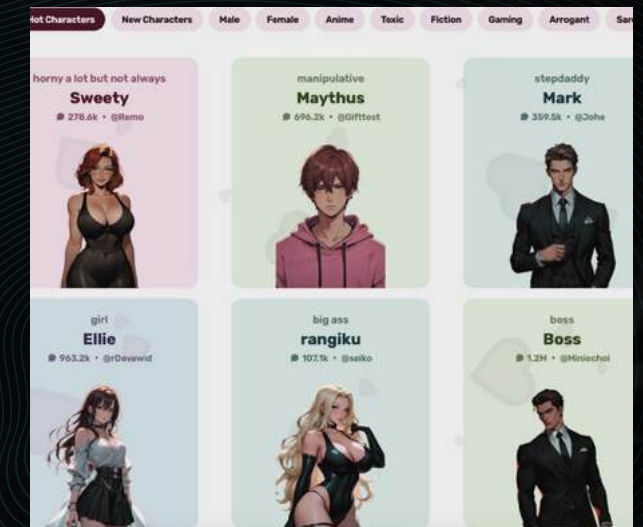
Celium: Rent GPUs

Gradients: Fine-tune a model

Targon: AI model reference

BitMind: Detect Deepfakes

404 Gen: Generate 3D models

Dippy: Chat with AI Characters

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The Beginning of the *Next* Chapter

Bittensor began as a network guided by human stewards - a small group of validators who determined how resources flowed through the ecosystem.

While this approach helped bootstrap the network in the early days, it became clear that it wasn't sufficient in the long term. The need for a more robust and scalable method of capital allocation to AI markets led to the development of Dynamic TAO - the most significant upgrade in Bittensor's history, planned for February.

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A New Approach to Allocating Emissions

PROBLEMS WITH EXISTING ECOSYSTEM

The top 10 validators control **78%** of the staked supply, meaning a few entities decide which AI Markets live or die, with no penalties for poor decisions

Those same few entities are trusted to be knowledgeable on every AI Market on the network, which is infeasible and unrealistic

DYNAMIC TAO AS THE SOLUTION

Pricing signals determined by an open market are used by the protocol to allocate emissions, introducing skin in the game for decisions

A broad range of market participants, including those with domain-specific knowledge and general investors, make decisions on which AI Markets are worth supporting
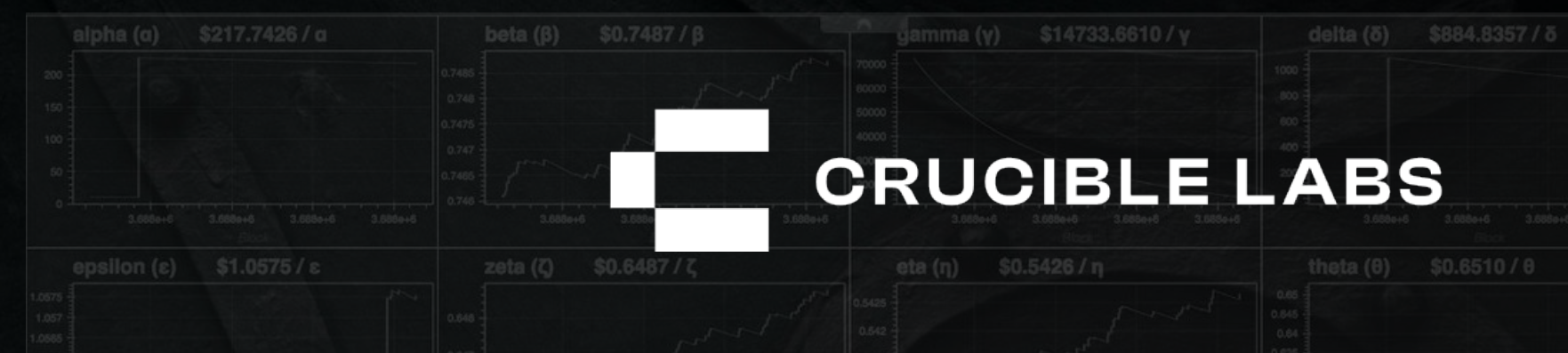
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The Architecture of the New Economic Engine

Dynamic TAO (dTAO) revolutionizes emission allocation through pure market forces, removing human bias and politics from the equation.

The Mechanism:
- Each AI Market operates with its own unique token
- Tokens trade against TAO in protocol native Uniswap V1 liquidity pools
- Emissions flow based on relative prices of tokens

This creates a self-balancing system where the most valuable AI Markets attract the most resources.

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A New Game for AI Market Owners

There are two products post Dynamic TAO upgrade:
- *Services produced by miners*
- *The AI Market's token*

This fundamentally changes how AI Market owner's need to operate. Similar to a traditional crypto project, they need to:

Weave demand for AI Market's service with the token

Build compelling token narratives and compete for mindshare

Market to the masses rather than the top 10 validators

Most importantly **- generate revenue and acquire users**

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The Rise of the Tao Allocator

dTAO shifts the dynamics from validators allocating emissions with the goal of what is best for TAO's value, to individuals allocators focused on finding the best investments that will benefit them directly.

- **Professional AI Market portfolio managers emerge, what we're calling TAO allocators**
- **Specialists focus on specific domains (training, frontier tech, agent infrastructure, etc.)**
- **Investment thesis-driven allocation replaces emission voting**
- **Direct financial incentives through AI Market token appreciation**

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The AI Market Success Matrix

We think the most successful AI Markets will likely be those that coordinate intelligence while balancing research with service delivery, creating a path to revenue.

PURPOSE AXIS

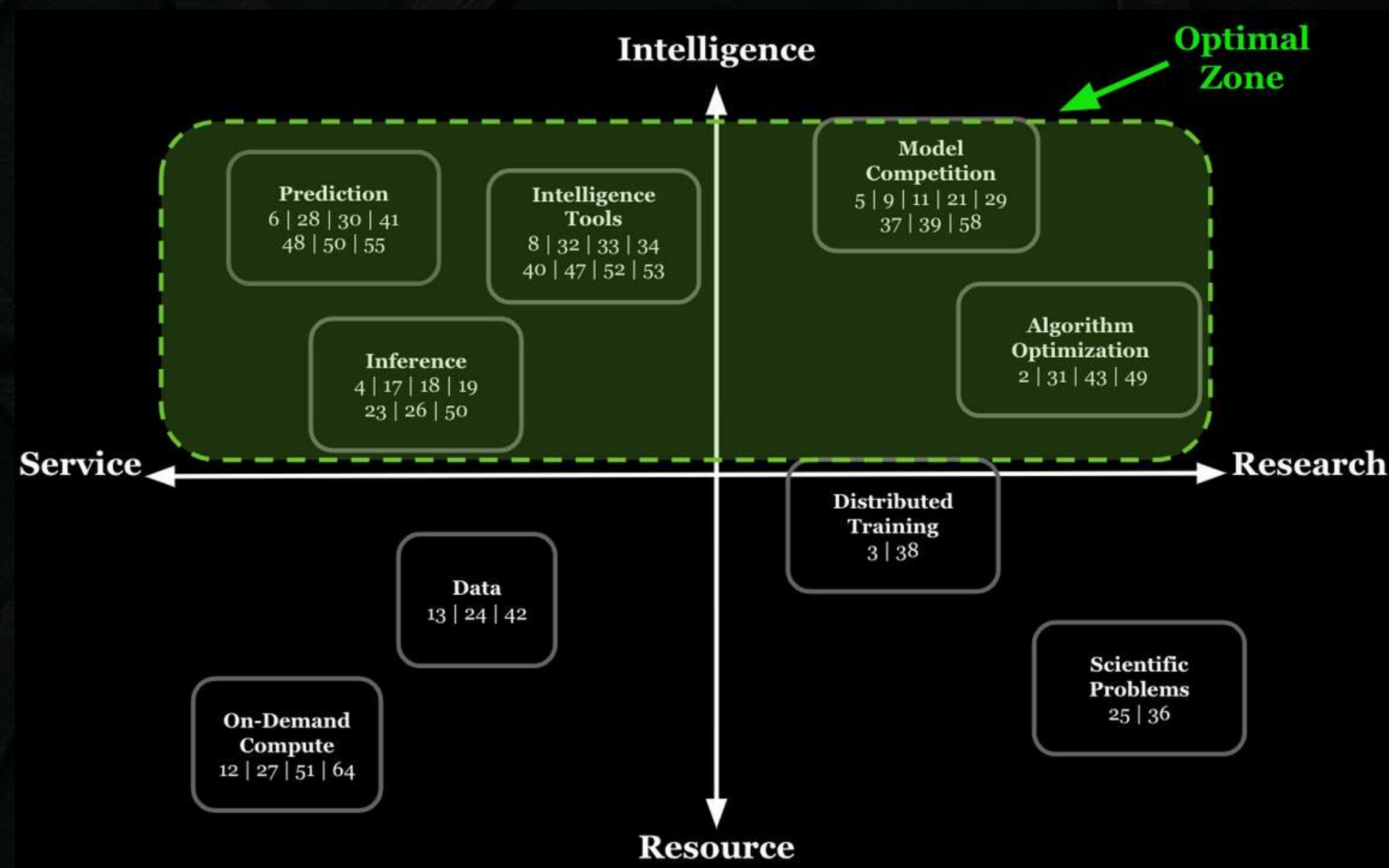*From pure research to service delivery*
- **Research:** Pursuing breakthroughs without clear monetization
- **Service:** Producing outputs with direct market value

COORDINATION AXIS

From coordinating intelligence to resources
- **Intelligence:** Harnessing collective brainpower and expertise
- **Resources:** Aggregating commoditized compute, storage, bandwidth

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Note: Strong opportunities exist across the matrix based on execution and market fit.

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Bittensor's Opportunity

Theses and Predictions

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The Bittensor Blueprint

Bittensor's north star is to become the counterweight to centralized AI similar to how Bitcoin became the counterweight to fiat

Economic alignment + competitive markets = superior intelligence production

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Bittensor's Opportunity

Talent Blackhole
AI Markets attract more resources and talent than all centralized AI companies combined to develop superior intelligence

Monetization Engine for Open Source AI Development
App developers are economically incentivized to financially bolster the open source AI Markets they leverage

Ownership of a Meta AI Lab
TAO functions as an index on the underlying AI Markets, enabling investors to gain exposure to multiple intelligence production methods occurring in parallel

Market-Driven Innovation
Free from corporate bureaucracy, teams can rapidly test ideas in parallel, creating a much larger surface area for innovation than any centralized company

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Why We're Excited About 2025

TALENT QUALITY INCREASING

Exponential growth in team quality and sophisticated miners, resulting in the beginning of product-market fit

DYNAMIC TAO

New capital and investors will enter the network, vying for outsized returns generated from new, fair launched AI Market tokens

EVM COMPATIBILITY

The newly added ability to create smart contracts will result in a supportive DeFi ecosystem and AI Market-adjacent infrastructure

REMOVING THE GUARDRAILS

The 64 AI Market slot limit will be lifted, enabling thousands of AI Markets - igniting a Cambrian explosion of experiments

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Bittensor 2025 Predictions

- Applications built on top of a single AI Market reach $50M in ARR by December

- Five AI Markets focused on AI model development emerge as leaders in their niches, each becoming the primary source of SOTA models within their specialized domains

- By the end of the year, the circulating market cap of all AI Markets will be $2.5B, with the top subnet being valued at $750M

- Two professional mining organizations emerge, raising capital via token launches on the EVM, creating onchain funded mining teams

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