AI4DeSci

Sustainable Infrastructure for AI-Empowered Open & Collaborative Decentralized Science

Ecosystem Blueprint Ver.1

Built by: Dominikus Brian

Presented for

akash

2024/05/17

A Platform By:

RnDVerse

梦溪数智

DreamBrook Tech

AI4DeSci

Sustainable Infrastructure for AI-Empowered Open & Collaborative Decentralized Science

Problem we are solving

Cloud collaboration and Science Crowdsourcing are critical for Decentralized Science. Unfortunately, today the infrastructure for these activities are still marginal and mostly controlled by centralized big-tech entity, high-cost paywalled system, and often provided exclusively only for specific groups of people.

We believe decentralized science should and can benefit more with open-sourced infrastructure developed natively on Decentralized Supercloud like Akash.

Target User Groups

Scientist, Engineers, Researchers, Teacher, Graduate Students, Science Enthusiast, ResearchPreneurs, and more…

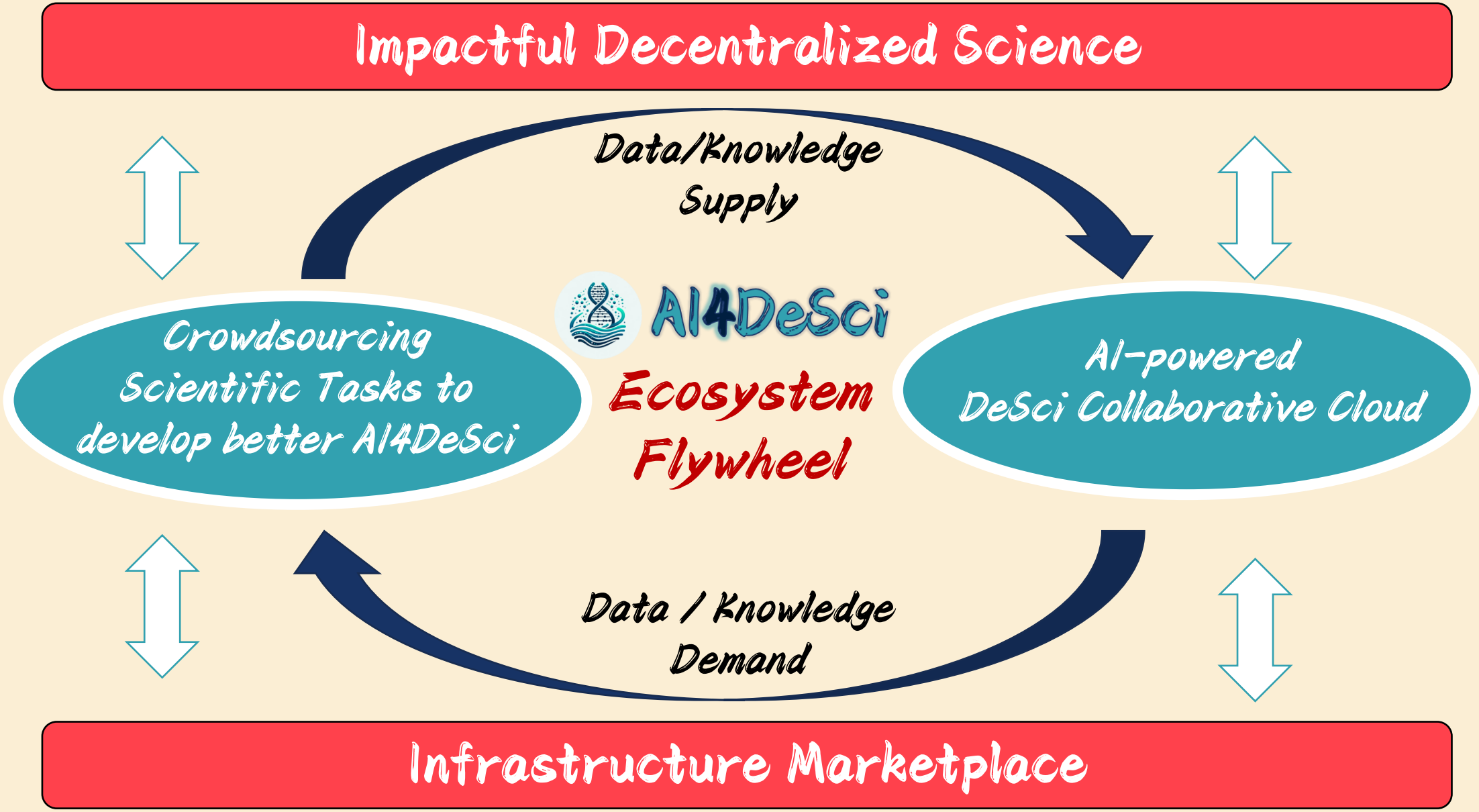
Akashathon^2 AI Track Objective / Requirements

- Exploration of AI Integration
- Optimization for Decentralized Environment
- Cost-Effectiveness
- Scalability and Flexibility
- Open Source Licensing and Documentation

How we answers to this challenges via AI4DeSci

AI4DeSci integrate AI as native core components across our infrastructure for facilitating DeSci Cloud Collaboration and Science Crowdsourcing. By having this AI-Infrastructure build exclusively on-top of scalable decentralized cloud ecosystem like Akash.network, the cost for operation and especially for public access to state-of-the-art digital technologies are becoming very cost-effective. Moreover, the flywheel of internal economy on the ecosystem will also ensure long-term sustainability. The AI4DeSci project is envisioned to be an always open-source with MIT License, allowing all community members to bring the best out of it.

Our Proposed Solution



AI4DeSci Ecosystem

Decentralized Science (DeSci) with Real World Impact

Fast & Flexible | Cost Effective | Open & Collaborative | Bias Tolerant

DeSci Collaborative Cloud

Facilitating [Human-Human, Human-AI, AI-AI] Collaboration by lowering tech-adoption barrier and democratizing access to latest scientific tools/software on the cloud

AI-Powered Science Crowdsourcing

Co-Creation of Knowledge to Developed Better AI, and Utilizing AI for Better Knowledge Creation.

Scientific Mini-Apps

AI4DeSci

Sustainable Infrastructure for AI-Empowered Open & Collaborative DeSci

Science Crowdsourcing Toolkit

Cloud Deployments

100% akash

Cross Blockchains Support

Decentralized AI x Blockchain x Cloud x Data Infrastructure

Open-Sourced AI & LLMs Data Solution:

e.g. Storj/Jackal/Flyte/…

Traditional Centralized Research Collaboration Stack

University | Research Institute | Government Labs

Slow & Bureaucratic | Overbudget | Exclusive | Heavily Opiniated

Collaborative Cloud

Google Colab + Overleaf

Science Crowdsourcing

Self-developed, Self-hosted, Self-Maintained

Folding@Home, GalaxyZoo, Picbreeder…

Closed Research Team
On minimum Payroll/Budget

Google AWS Azure | Government Supercomputers |
University HPC & Data Center

Main Workflow for Core Platforms

DeSci Collaborative Cloud

Initiate collaboration

From scratch / Using Template

Project Folders + Infra (Private/Public)

Collaborative
-> Planning
-> Hypothesis
-> Experiments
-> Analysis

Workplan Update

Data Stream

AI-Powered Science Crowdsourcing

Initiate Campaign

From scratch / Using Template

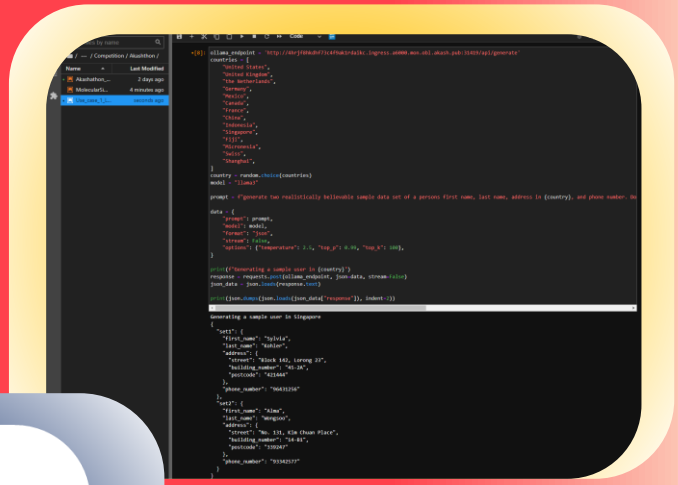
AI4DeSci Mini-App

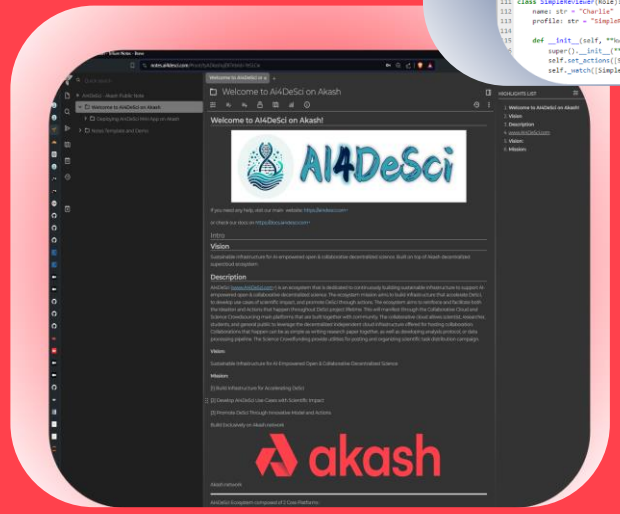
Token / Coin

3 Collaboration forms:
Human-AI Agents, AI Agents – AI Agents, Human – Human

3 Types of Work :
Generate Data, Validate Data, Explore Data

Forms of Collaboration





Human - AI Agent(s)

Ollama server & vllm as endpoints, Interact via colab.ai4desci.com spawned notebook

AI Agent(s) - AI Agent(s)

Various templates and ready-to-call AI-Agents living across distributed LLM inference point interacting @ colab.ai4desci.com

Human-Human

Cheap and out-of-the-box collaboration note self-hosting for each collaboration project through notes.ai4desci.com

Types of Work

Gather Data

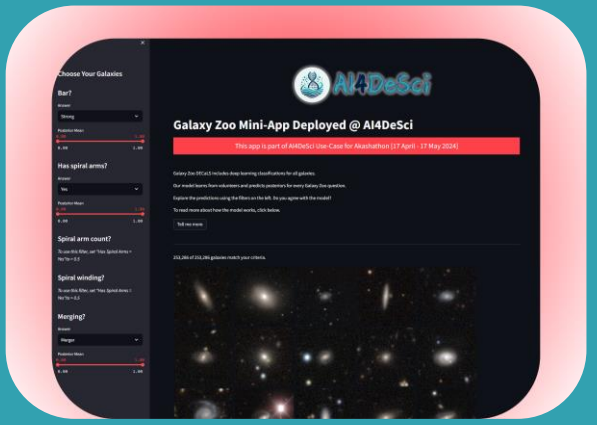
Other Scientist/ Researchers /Students, and General Public can help research project gather more data or rigorously labels existing data

Validate Data

The community can be rewarded for double-check, or performing data provenance and reproducibility. Ensuring High-quality scientific data

Explore Data

The wisdom of crowd can never be underestimated. Provided the tools fascinating discovery can happen.



Proof-of-Concept and MVP built for and during the Akashathon² 2024

SDL Gallery for all Deployments Shared @ GitHub
https://github.com/RnDVerse/AI4DeSci

AI4DeSci Official Docs, Whitepaper, and Pitch Deck
docs.ai4desci.cloud

DeSci Collaborative Cloud Note Collabs
notes.ai4desci.com

Landing Page and Ecosystem Main Navigation Entrypoint :
www.ai4desci.com

Science Crowdfunding App Gallery and Use Cases
app.ai4desci.com,
miniapp1.ai4desci.com – miniapp8.ai4desci.com

DeSci Collaborative Cloud Main Hub
hub.ai4desci.com

DeSci Collaborative Cloud workspace
colab.ai4desci.com

AI4DeSci cloud infrastructure overview dashboard
ai4desci.cloud

AI4DeSci Provider Server @ Akash
provider.ai4desci.network:8443

ai4desci.com

ai4desci.com

AI4DeSci

About | Use Cases | Collaborative Cloud | Science Crowdsourcing | Pages | Sign In | Sign Up

AI4DeSci

Integrated Infrastructure for your Science Crowdfunding|

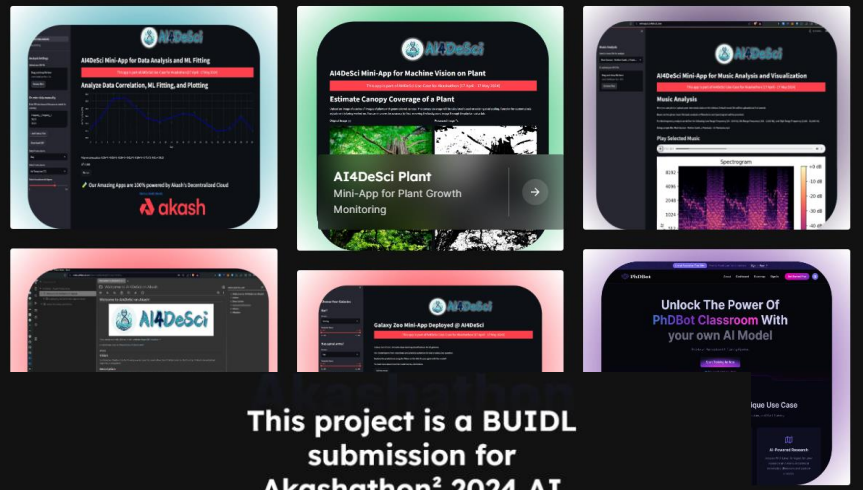
AI4DeSci (www.AI4DeSci.com) is an ecosystem that is dedicated to continuously building sustainable infrastructure to support AI-empowered open & collaborative decentralized science. The ecosystem mission aims to build infrastructure that accelerate DeSci, to develop use cases of scientific impact, and promote DeSci through actions. The ecosystem aims to reinforce and facilitate both the Ideation and Actions that happen throughout DeSci project lifetime.

Get Started → | How it Work

DeSci Collaborative Cloud & Science Crowdsourcing

We focus on two use cases: DeSci Collaborative Cloud that empower Idea Creations and Science Crowdsourcing that brings AI-Empowered Decentralized Science to be More Accessible to the Public.

All | Science Crowdsourcing | Collaborative Cloud

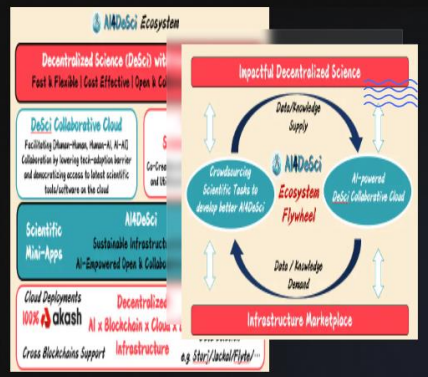


This project is a BUIDL submission for Akashathon² 2024 AI Track

This track challenges participants to explore the integration of artificial intelligence (AI) technologies within the Akash Network, specifically focusing on GPU usage. As AI applications become increasingly complex and resource-intensive, the need for scalable, open source and cost-effective infrastructure is paramount. Akash Network offers a unique solution by enabling developers to deploy and scale their AI workloads on a decentralized network of GPUs.

"Akashathon² participants will delve into the limitless possibilities of AI applications empowered by Akash's GPU marketplace. Whether you're passionate about revolutionizing crypto with AI or crafting tools to enhance the accessibility and usability of the Akash network for both providers and deployers, this hackathon is your platform to innovate!

Akash.Network
Akashathon 2024



DeSci Collaborative Cloud, AI-Empowered Science Crowdfunding

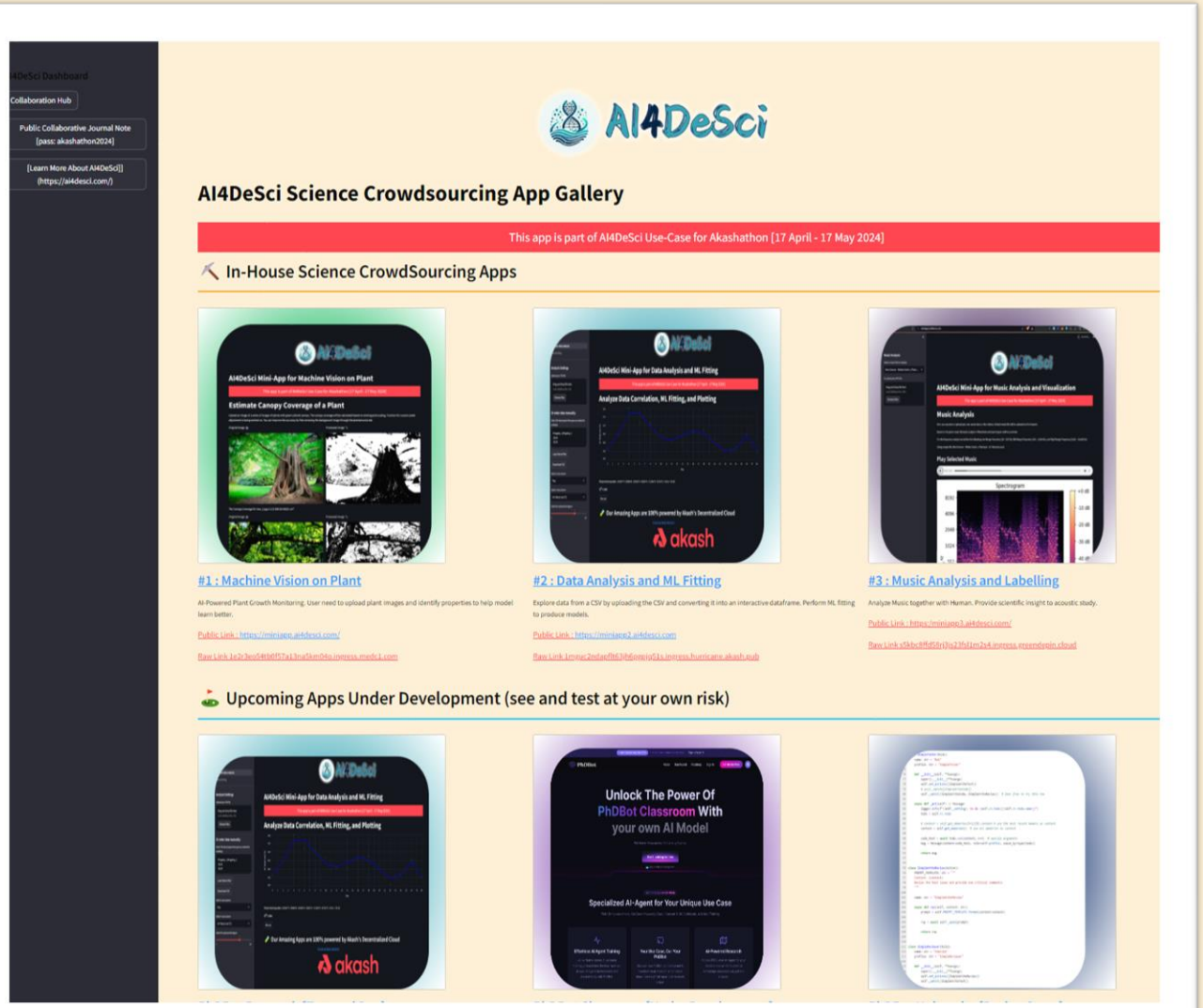
AI4DeSci (www.AI4DeSci.com) is an ecosystem that is dedicated to continuously building sustainable infrastructure to support AI-empowered open & collaborative decentralized science.

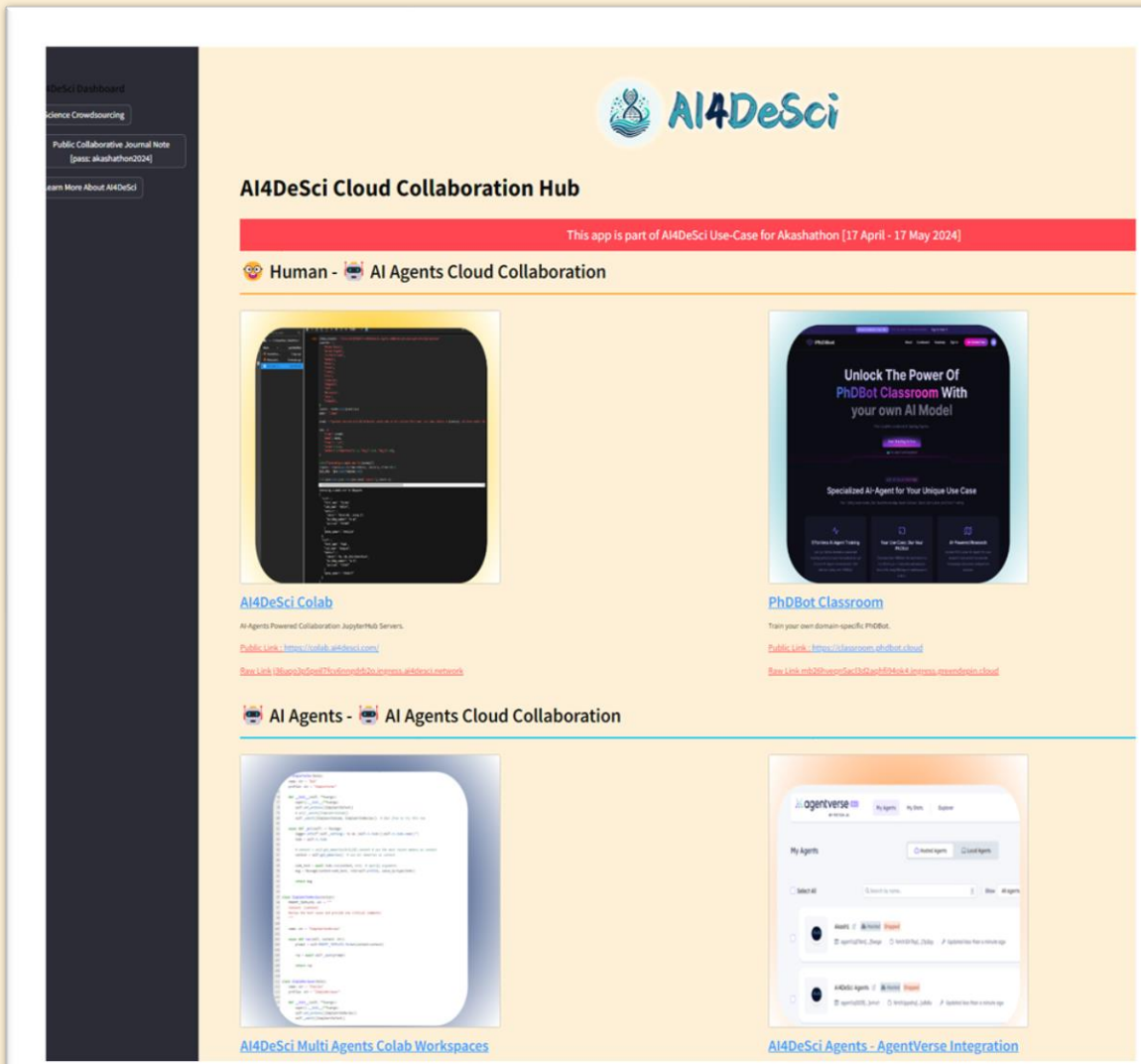
The ecosystem mission aims to build infrastructure that accelerate DeSci, to develop use cases of scientific impact, and promote DeSci through actions.

The ecosystem aims to reinforce and facilitate both the Ideation and Actions that happen throughout DeSci project lifetime. This will manifest through the Collaborative Cloud and Science Crowdsourcing main platforms that are built together with community.

app.ai4desci.com

hub.ai4desci.com

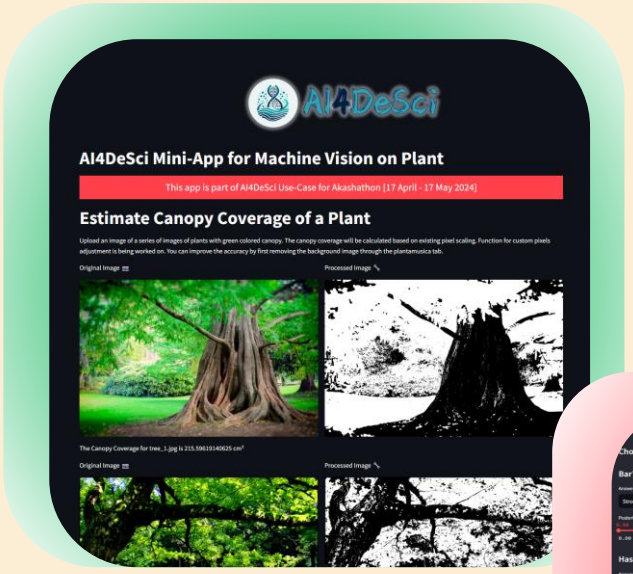


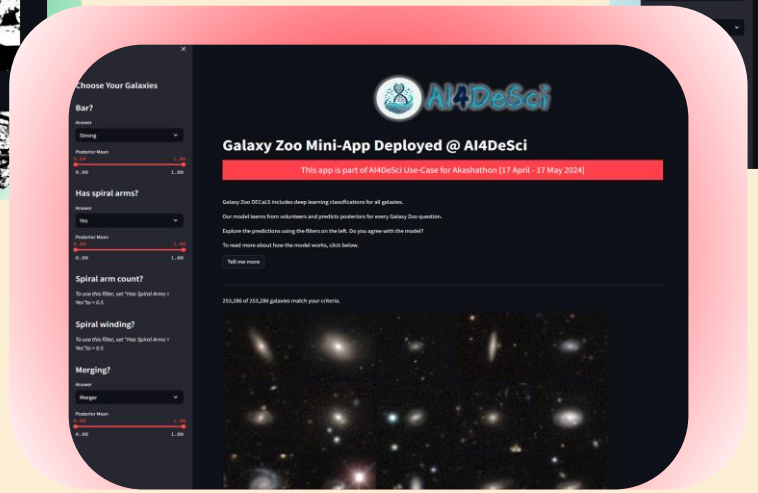


miniapp[x].ai4desci.com

To illustrate the utility of our GPU-powered Science Crowdsourcing,
We Deployed several GPU use cases for :

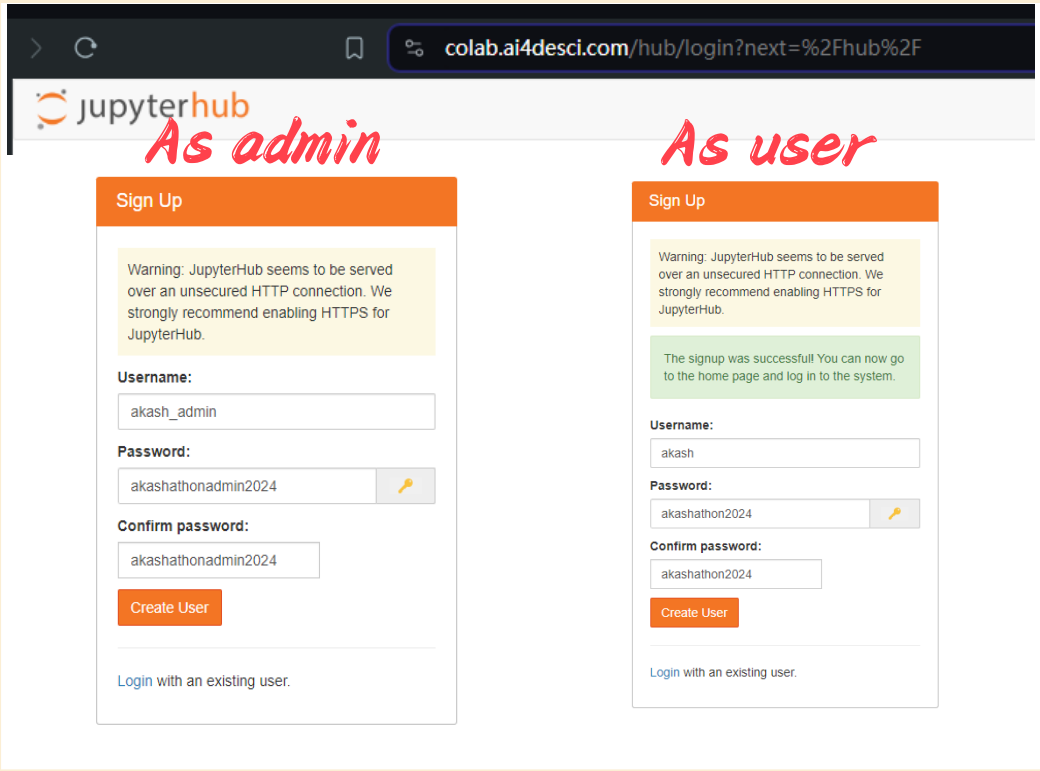
For Rendering & Machine Vision
For Computation and ML Fitting
For AI Inferences with Images and Audio

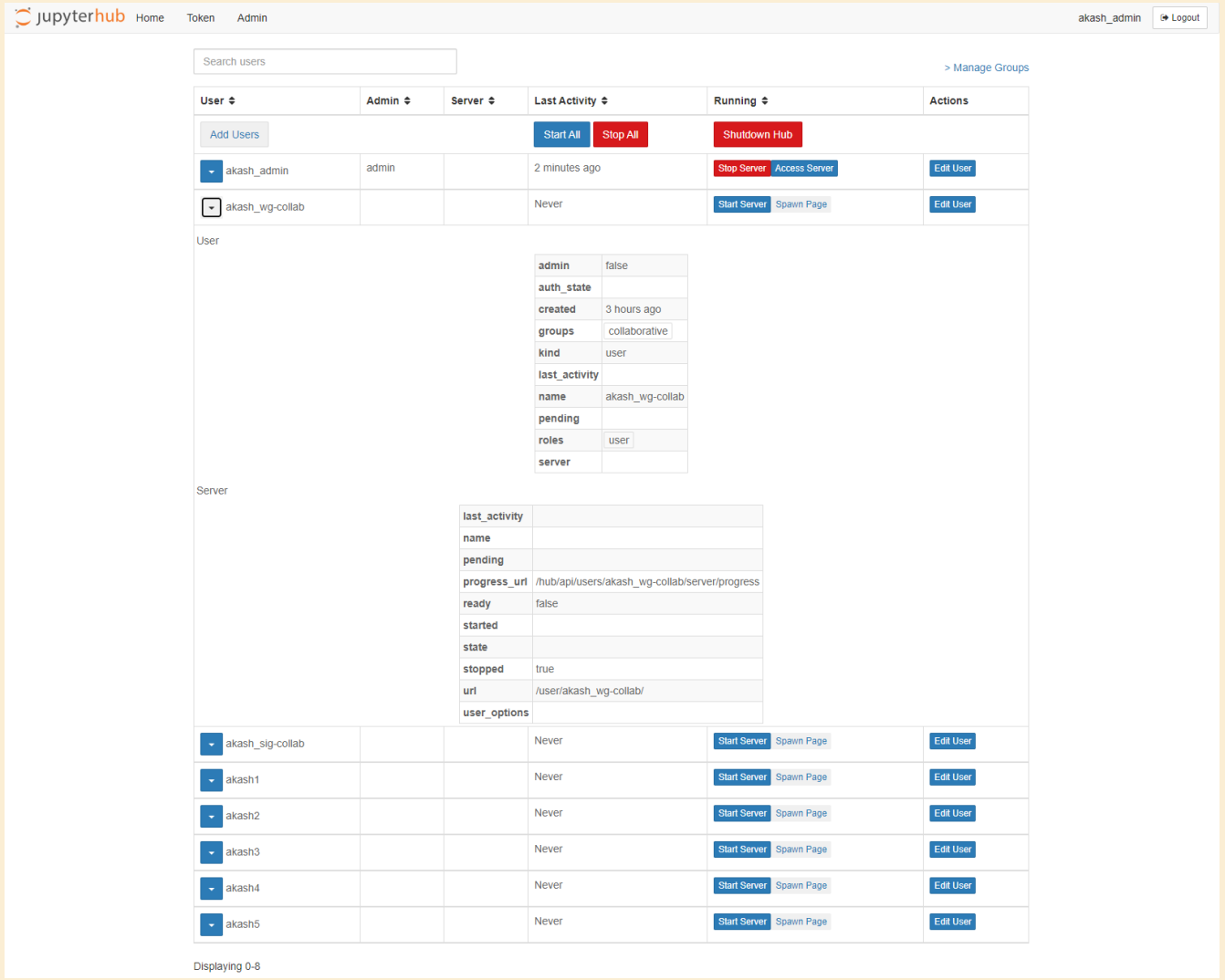




colab.ai4desci.com

Use-Case Examples with 2 Collaboration groups: akash_wg-collab and akash_sig-collab





Everyone can Sign-Up,
Colab initiator can manage group members

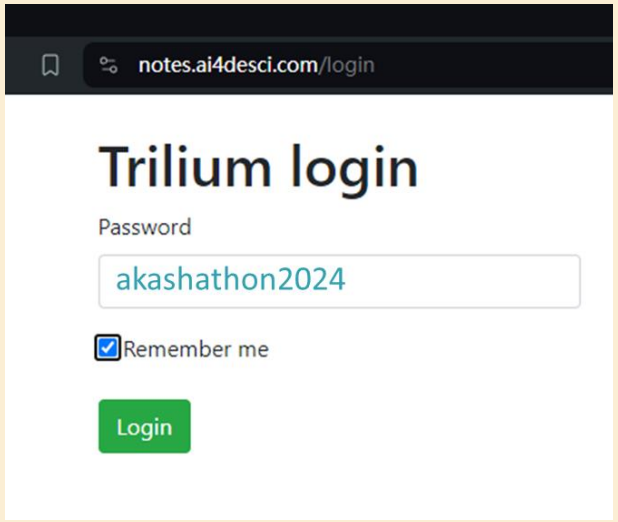
Each Collab Project can have their own colab server

Disclaimer : public version is still a bit faulty when generating spawn server

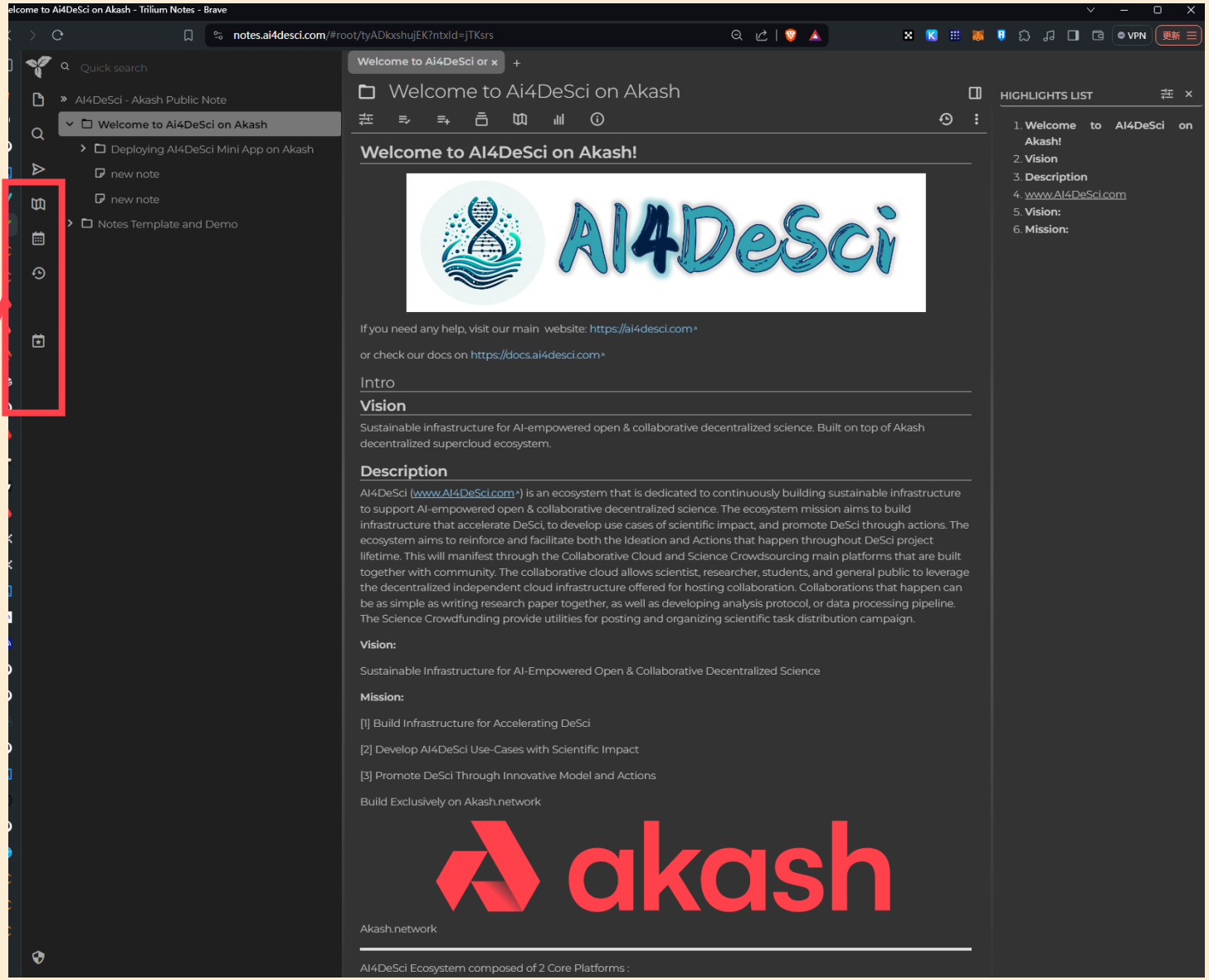
notes.ai4desci.com

Full-control of the self-hosted trillium note server.

Each colab project can have their own password protected notes space

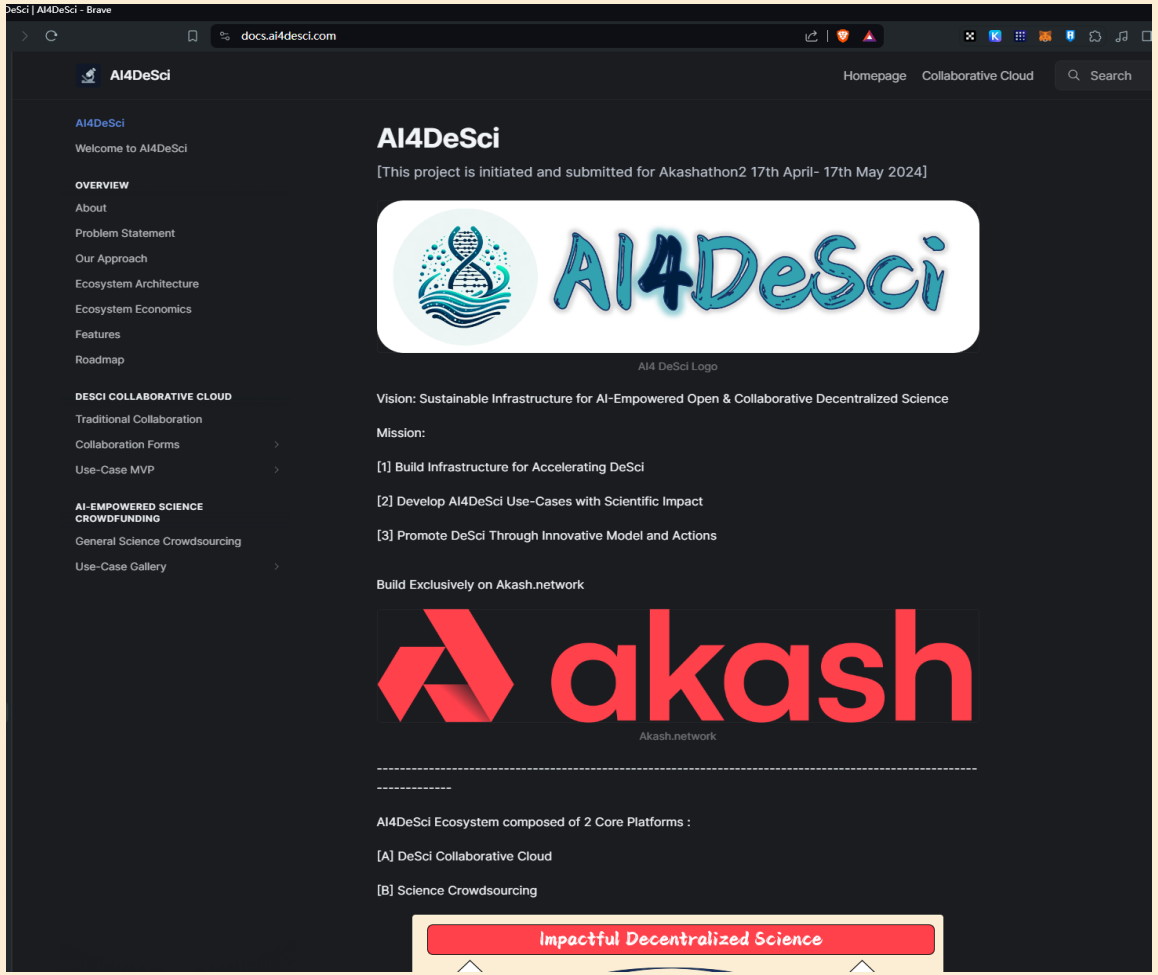


Sync functions with DB server and with unlimited desktop instances



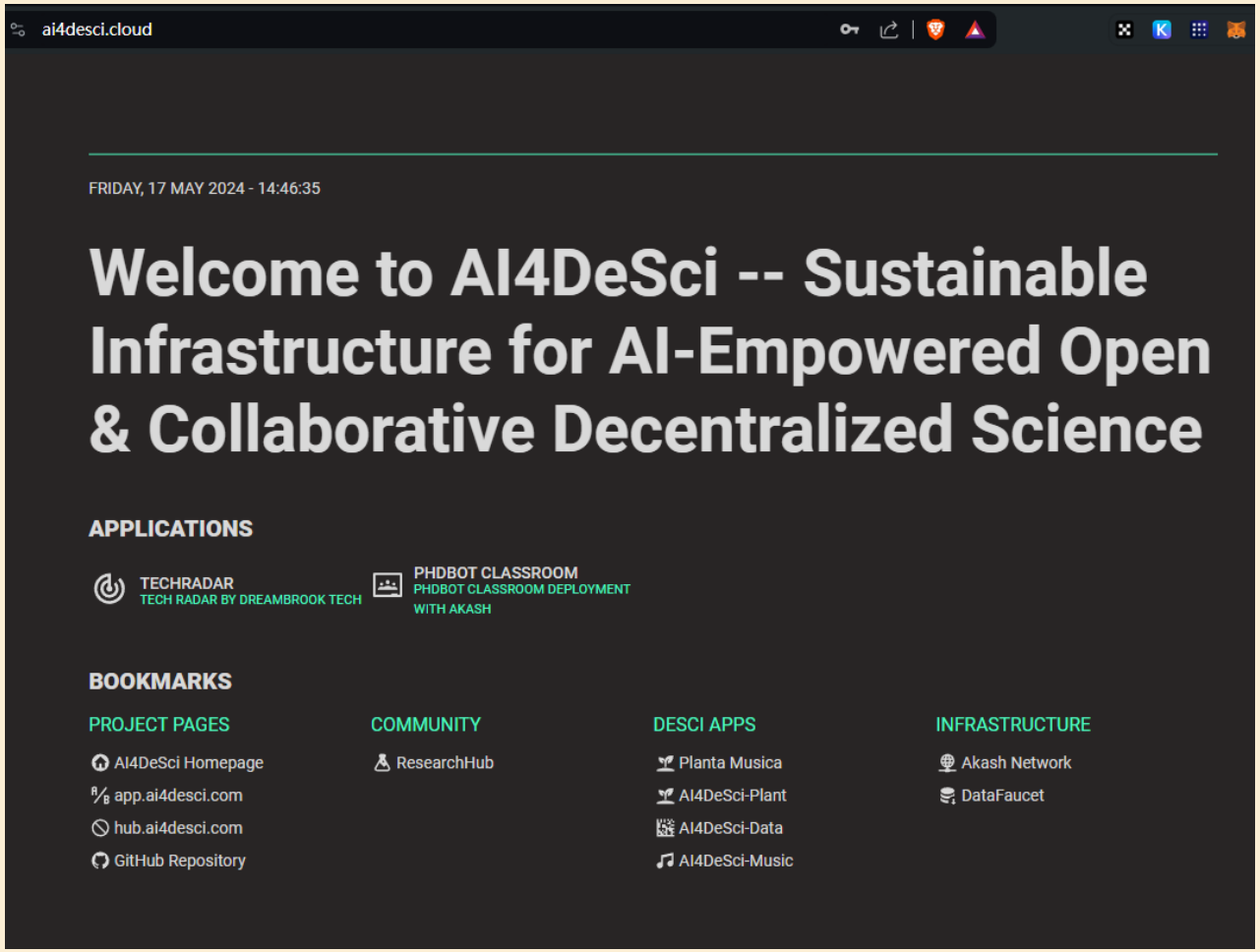
docs.ai4desci.com

Official project documentation powered by gitbook. Community Roadmap, Whitepaper, and Engineering manual are hosted here



ai4desci.cloud

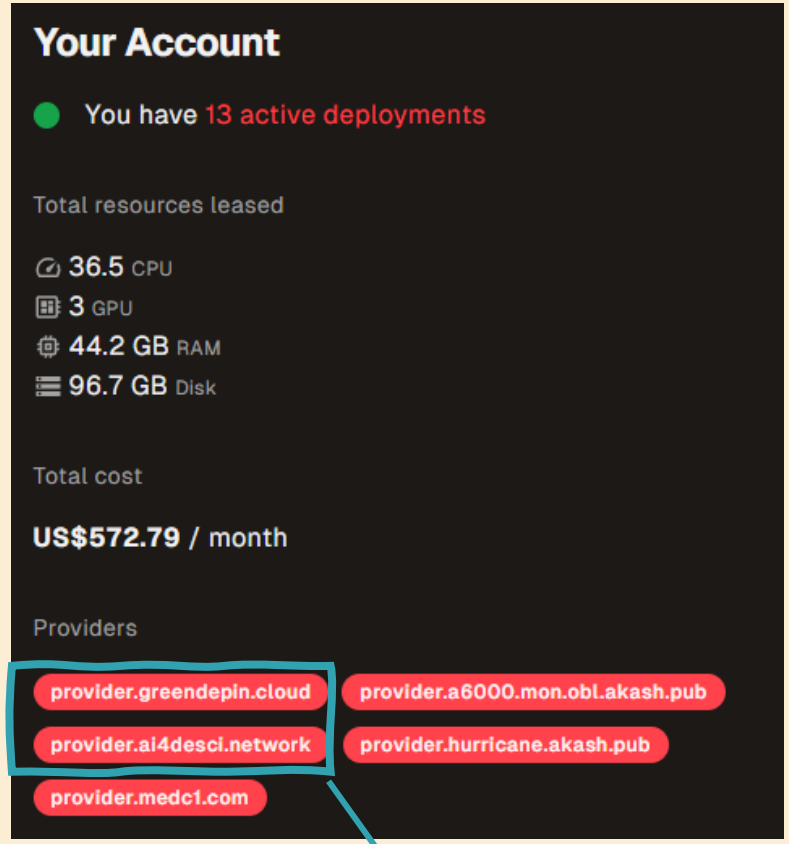
To keep track of the infrastructures developed over time. A Catalog of links for the AI4DeSci ecosystems.



provider.ai4desci.network

AI4DeSci Deployments Overview

Snapshots of our currently deployed
Infrastructure For
AI4DeSci Ecosystem
We are building ...



Trivia: These are our own resources connected to the platform ^^

You have **13** active deployments

Specs	Name	Time left	Balance	Cost	Leases
1 cpu 1.07 GB 1.07 GB	**ai4desci_app...** - 16345020	~about 1 month	US$2.89	**US$2.66** / month	prov...desci.network
1 cpu 1.07 GB 1.07 GB	**ai4desci_hub...** - 16344959	~about 1 month	US$2.89	**US$2.81** / month	prov...endepin.cloud
8 cpu 8.59 GB 25.77 GB	**colab-ai4desci** - 16342651	~12 days	US$8.55	**US$21.73** / month	prov...desci.network
0.5 cpu 2.15 GB 2.15 GB	**ai4desci_web_ui** - 16334747	~about 1 month	US$2.82	**US$2.84** / month	prov...endepin.cloud
2 cpu 2.15 GB 1.07 GB	**ai4desci_miniapp8** - 16331094	~15 days	US$2.72	**US$5.36** / month	prov...endepin.cloud
2 cpu 2.15 GB 1.07 GB	**ai4desci_miniapp3** - 16330303	~15 days	US$2.70	**US$5.47** / month	prov...endepin.cloud
2 cpu 1 gpu 2.15 GB 1.07 GB	**ai4desci_miniapp1** - 16328616	~2 days ⚠	US$5.46	**US$84.30** / month	provider.medc1.com
2 cpu 1 gpu 2.15 GB 1.07 GB	**ai4desci_miniapp2** - 16328222	~2 days ⚠	US$6.21	**US$83.83** / month	prov...ane.akash.pub
4 cpu 2.15 GB 1.07 GB	**colab-space** - 16326922	~8 days	US$2.51	**US$9.10** / month	prov...endepin.cloud
1 cpu 1.07 GB 5.37 GB	**notes-ai4desci** - 16325697	~about 1 month	US$2.77	**US$2.78** / month	prov...desci.network

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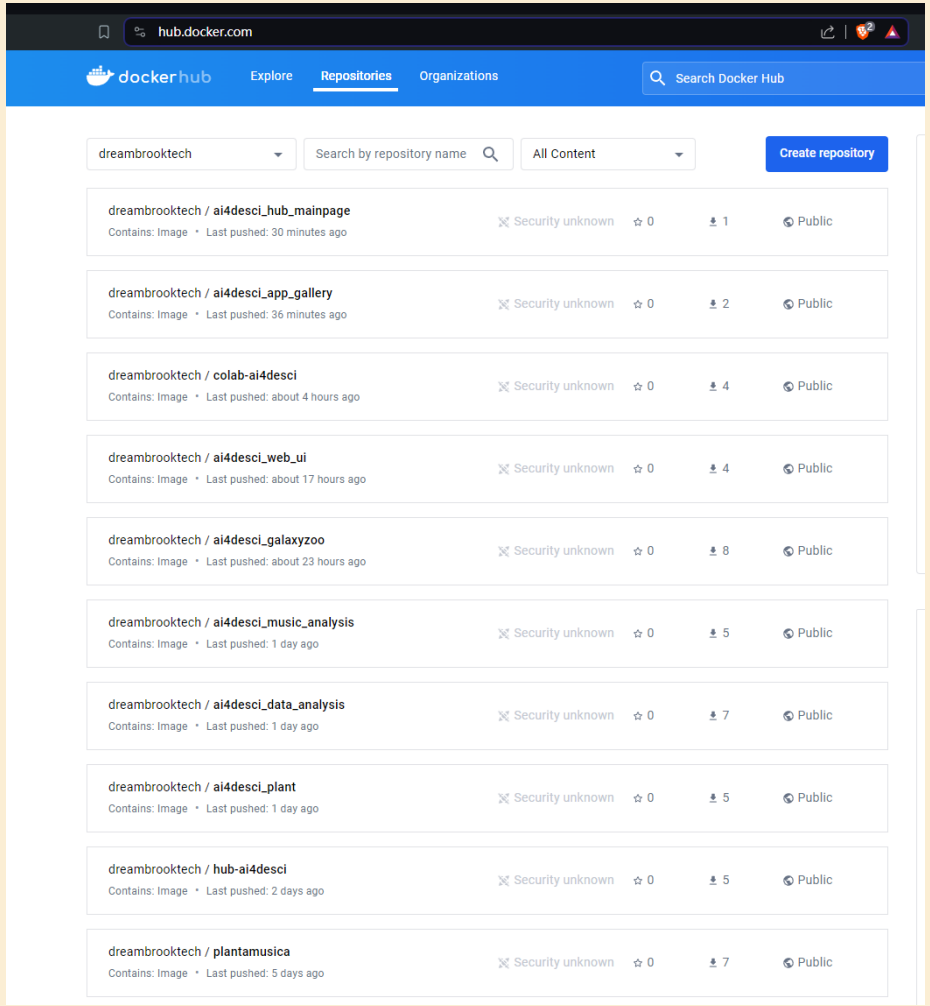
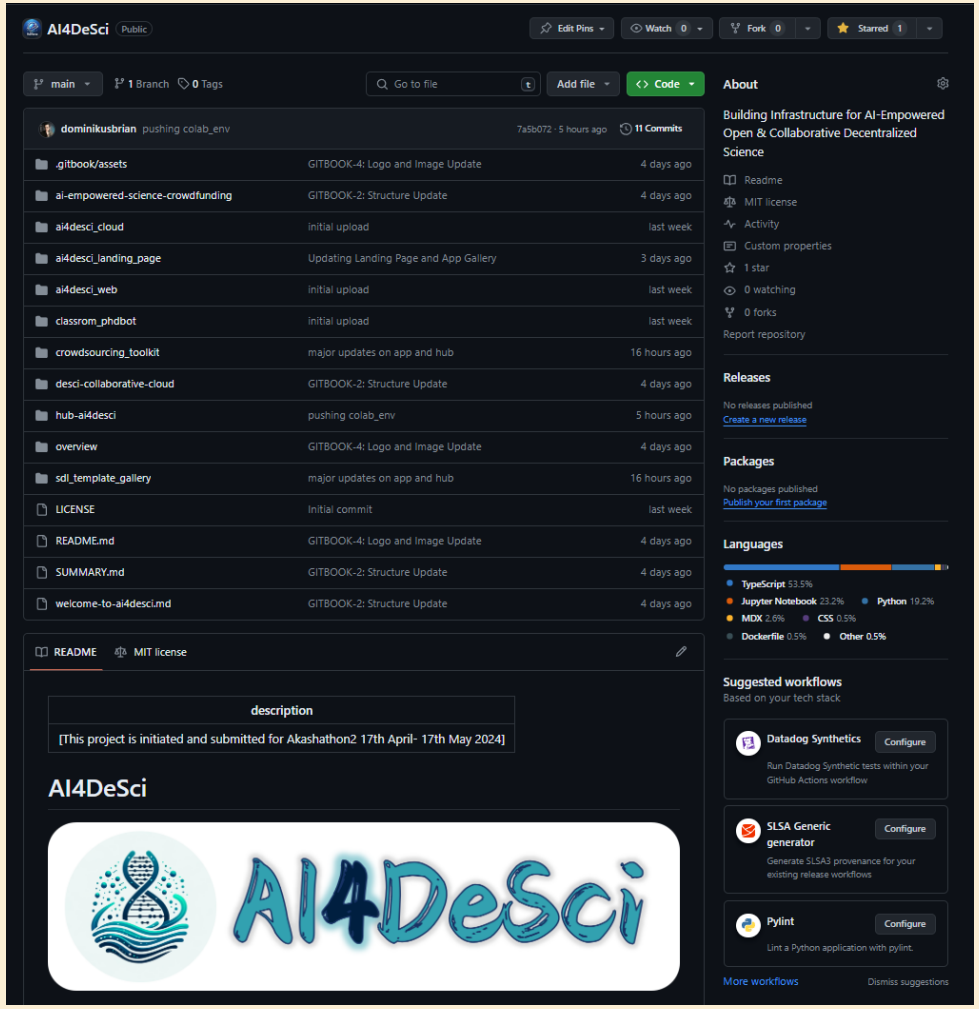
All the deployments in AI4DeSci are pre-packaged and distributed through Docker Hub to ensure Reproducibility



Source code are available for the community and accessible from our public GitHub Repository



AI4DeSci Tech Stack General Overview

Community & Economy

Ocean Data Marketplace

Ghost / Next.JS

Trilium Public Notebook

ResearchHub
DeSci Community

Dev Zone

Streamlit

Label-studio

Slurm Workload Manager

Jupyter Hub, Lab, Notebook

Metaflow

oLLama

Python ML toolkits
Flyte
Scikit-learn
Keras
TensorFlow
PyTorch

Infrastructure

Jackal
Storj
Arweave

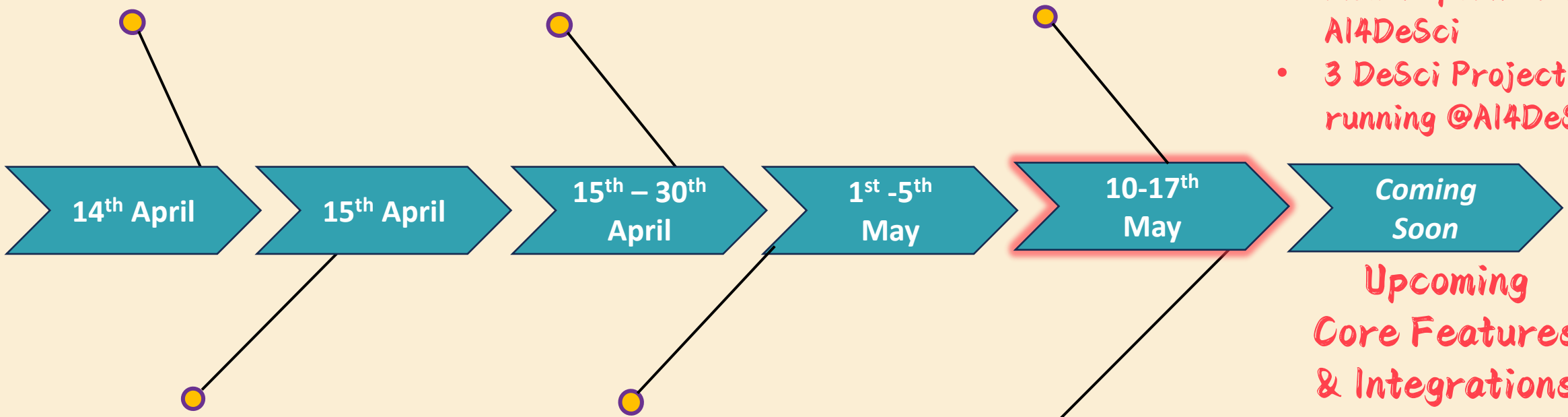
vLLM

Akash Decentralized Cloud
(CPUs + GPUs+ IP + storages, ···)

Cloudflare
Netdata
Grafana
IBC

IPFS
Keplr
···

Roadmap for AI4DeSci @ Akashathon and beyond



Discovered about Akashathon.
Start learning about Akash.Network

AI4DeSci
Official Birth
www.AI4DeSci.com

Tech Stack module development,
Use Case Building

Architecture blueprint,
Whitepaper & Docs development

Live Deployment of resources and MVP on Akash via Console/Cloudmos

App.AI4DeSci.com
Hub.AI4DeSci.com
First public release

Next Milestones

- 10 In-House Use Cases
- 5 Public Dataset & Models published on AI4DeSci
- 3 DeSci Projects running @AI4DeSci

Upcoming
Core Features
& Integrations

Upcoming Core Features

Toward Decentralized HPC on Akash :

Start from proper slurm -jupyter integration for hub.ai4desci.com to have worker node across Akash Deployments

Modular mini-app builder and Automated Packaging + Deployment:

Utilizing streamlit components and label-studio SDK to allow for self-customization and auto-deployment of AI4DeSci mini-app on app.ai4desci.com

Real-World Use Case Quick Prototyping:

Work closely with ResearchHub team and community in developing
Real-world DeSci use collaboration use-case.

Upcoming Integrations

DB-GPT for smart database
Flyte for ML/AI datastore
Metaflow for workflow reproducibility
Storj (for backup)
Jackal (waiting for v4)
OCEAN Protocol data marketplace
ResearchHub API for DeSci feed
Label Studio
Build molecular simulation use-case with OpenMM
Dify and other game-like blueprint to develop AI-Agents
...

More to come as use-cases and dev community grows

Observed Challenges with production deployments on Akash Ecosystem

Monitoring the health and status of distributed deployments is a challenge without integrated dashboard for status reporting.

Deployment instability when using reverse proxy is still questionable owing to the discrepancy in network performance of different provider, e.g. static, and dynamics, IP, TLS certificates, etc.

Persistent storage options reading often faulty and not available on most provider, which is seems due to error in attribute matching and not due to resource limitation.

more details will be properly documented and raised as issue or feature request through github ...


To be continued...
AI4DeSci
akash