

Open Source Initiative

# Defining Open Source AI

Nick Vidal, Stefano Maffulli | October 4th, 2024

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# Why Define Open Source AI Now?

## Frontier of OS

Defining Open Source AI is the most significant challenge facing the open source movement.

## Shaping Regulation

Government regulations have begun in the EU, US, and elsewhere. We have the opportunity to share these new policies and laws by defining OSAI.

## Combat Open-Washing

Companies are calling AI systems “open source” even though their licenses contain restrictions that go against the accepted principles and freedoms of open source.



# Benefits of Open Source AI

by Lea Gimpel

## Transparency + Safety

OSAI provides information essential for auditing systems and to mitigate bias, ensures accountability and transparency of data sources, and accelerates AI safety research

## Market Deconcentration + AI Polyculture

OSAI makes more models available, spurs innovation and quality due to increased competition and tackles AI monoculture by providing more stakeholders access to foundational technology.

## Diverse Applications

OSAI gives developers access to resources crucial for developing context-specific, localized applications that are representative of cultural and linguistic diversity and allow for model aligned with different value systems.

# 2022-2023 research

Interviews (Podcast)



<https://deepdive.opensource.org/report/>

Panel discussions

Four panels with 4 experts covering 4 area:

- Business
- Society
- Legal
- Academia

<https://opensource.org/deepdive/webinars>

Webinar series

18 experts of different disciplines from all over the world dissected issues from data governance, privacy, labor laws, software development and more.

We've known that the availability of training data was THE ISSUE



# Co-Designing the OSAID

How we created the Open Source AI  
Definition through global consultation.

# Co-Designing the OSAID A Global Snapshot

Our co-design process included in-person workshops on five continents – South America, North America, Africa, Europe, and Asia – and virtual participants from more than 35 countries.



# OSAID Co-Design Question



**Use • Study • Modify • Share**

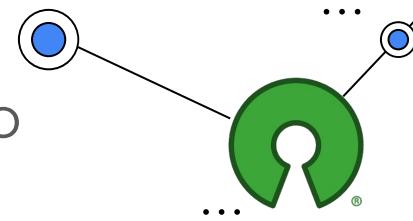
What should these open  
source principles mean for  
artificial intelligence?

# Open Source AI Definition Four Freedoms

v.0.0.9



1. **Use** the system for any purpose and without having to ask for permission.
2. **Study** how the system works and inspect its components.
3. **Modify** the system for any purpose, including to change its output.
4. **Share** the system for others to use with or without modifications, for any purpose.



# OSAID Co-Design Question



What components must be open in order for an AI system to be used, studied, modified, and shared?



# Virtual Workgroups

*Members agreed to make their names and affiliations public to support the transparency of the co-design process.*

## Llama 2 Group

1. **Bastien Guerry**  
DINUM, French public administration
2. **Ezequiel Lanza**  
Intel
3. **Roman Shaposhnik**  
Apache Software Foundation
4. **Davide Testuggine**  
Meta
5. **Jonathan Torres**  
Meta
6. **Stefano Zacchiroli**  
Polytechnic Institute of Paris
7. **Mo Zhou** Debian,  
Johns Hopkins University
8. **Victor Lu** independent database consultant

## BLOOM Group

1. **George C. G. Barbosa**  
Fundação Oswaldo Cruz
2. **Daniel Brumund** GIZ  
FAIR Forward - AI for all
3. **Danish Contractor**  
BLOOM Model Gov. WG
4. **Abdoulaye Diack**  
Google
5. **Jaan Li** University of Tartu, Phare Health
6. **Jean-Pierre Lorre**  
LINAGORA,  
OpenLLM-France
7. **Ofentse Phuti** WiMLDS  
Gaborone
8. **Caleb Fianku Quao**  
Kwame Nkrumah University of Science and Technology, Kumasi

## Pythia Group

1. **Seo-Young Isabelle Hwang** Samsung
2. **Cailean Osborne**  
University of Oxford,  
Linux Foundation
3. **Stella Biderman**  
EleutherAI
4. **Justin Colannino**  
Microsoft
5. **Hailey Schoelkopf**  
EleutherAI
6. **Aviya Skowron**  
EleutherAI

## OpenCV Group

1. **Rahmat Akintola**  
Cubeseed Africa
2. **Ignatius Ezeani**  
Lancaster University
3. **Kevin Harerimana** CMU Africa
4. **Satya Mallick** OpenCV
5. **David Manset** ITU
6. **Phil Nelson**  
OpenCV
7. **Tlameko Makati**  
WiMLDS Gaborone,  
Technological University Dublin
8. **Minyechil Alehegn**  
Tefera Mizan Tepi University
9. **Akosua Twumasi**  
Ghana Health Service
10. **Rasim Sen** Oasis Software Technology Ltd.

Over 50% of **participants** are People of Color, 30% are Black, and 25% are women, trans, and nonbinary.



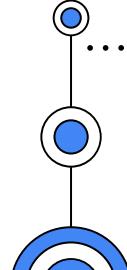
# Outreach

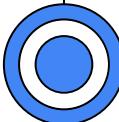
To achieve better global representation in the co-design process, we conducted outreach to Black, Indigenous, and other People of Color, particularly women and individuals from the Global South.

The screenshot shows a public forum post with the following details:

- Title:** Seeking document reviewers for Pythia and OpenCV
- Category:** Open Source AI process
- Author:** Mer (represented by a profile picture of a woman wearing sunglasses)
- Timestamp:** 5d ago
- Content:**
  - TASK:** As part of the systems review track, we're looking for volunteers to review licenses for the Pythia and OpenCV systems and fill out this [spreadsheet](#) to check the compatibility of version 0.0.6 of our definition with current AI systems.
  - TIMELINE:** Our goal was to complete this review by next Tuesday, April 2nd, though we'll likely extend the deadline in consultation with the volunteers who respond.
  - VOLUNTEERS:** For transparency, reviewers will have their names and affiliations made public. Black, Indigenous, Latine, and other people of color, women, queer, transgender, and non-binary people, people with disabilities, and people from poor and working class backgrounds are encouraged to respond.
  - LEARN MORE:** Reviewers are already assigned in the Llama 2 and BLOOM groups. We have two reviewers for Pythia and are seeking more. We have no reviewers yet for OpenCV. Further information on the workgroups and their past activities can be found [here](#).

This **public forum** post from March is an example of our outreach.



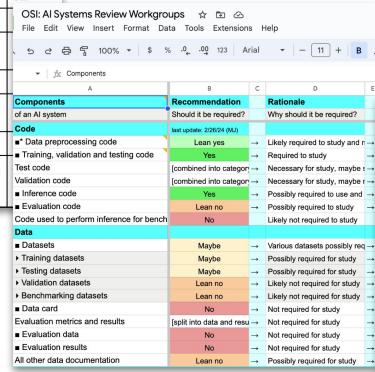


# Voting for Requirements

## 1. Workgroup Votes

Code	All code used to parse and process data, including:	Required to Use?	Required to Study?
Data preprocessing code		SZ	
Training code		SZ	
Test code			
Code used to perform inference for benchmark tests			
Validation code			
Inference code	SM EL DT SM JT SZ		
Evaluation code			
Other libraries or code artifacts that are part of the system, such as tokenizers and hyperparameter search code, if used.	BG,EL, SM, SZ		

components from Model Openness Framework (MOF)



## 2. Public Vote Compilation

Selecting the required components described in the checklist and preferred form section

## 3. Public Results Report on Forum

### Report on working group recommendations

#### Recommendations

The recommendations below respond to the question:

- Should X component be required for an AI system to be licensed?
- Based on the number of votes for each component across all working groups follows:
- | Component                      | Required | Preferred |
|--------------------------------|----------|-----------|
| Training datasets              | Yes      | Yes       |
| Testing datasets               | Yes      | Yes       |
| Validation datasets            | Yes      | Yes       |
| Benchmarking datasets          | Yes      | Yes       |
| Data card                      | Yes      | Yes       |
| Evaluation metrics and results | Yes      | Yes       |
| Evaluation data                | Yes      | Yes       |
| Evaluation results             | Yes      | Yes       |
| All other data documentation   | Yes      | Yes       |

#### Likely Required

- Data preprocessing code
- | Component           | Required | Preferred |
|---------------------|----------|-----------|
| Training datasets   | Yes      | Yes       |
| Testing datasets    | Yes      | Yes       |
| Usage documentation | Yes      | Yes       |
| Research paper      | Yes      | Yes       |

#### Maybe Required

- Model architecture
- Model parameters
- Supporting libraries & tools\*

## 4. Definition v.0.0.6 + Checklist

### Checklist to evaluate legal documents

This table is work in progress. See slide 7 of Jan 26 town hall for more details.

Required components	Legal frameworks
Code	
- Data pre-processing	Available under OSI-compliant license
- Training, validation and testing	Available under OSI-compliant license
- Inference code	Available under OSI-compliant license
- Supporting libraries and tools	Available under OSI-compliant license
Model	
- Model architecture	Available under OSI-compliant license
- Model parameters (including weights)	To be defined in the next phase

The following components are not required, but their inclusion in public releases is appreciated.

Optional components
- Code used to perform inference for benchmark tests

March 1, 2024

March 10, 2024



# OSAID Co-Design Question



Which AI systems  
meet the criteria of  
the OSAID?



...

# Validation Reviewers

We were interested in reviewing about 10 AI systems self-described as open to validate the definition. Work began **May 1, 2024**.

## 1. Arctic

1. **Jesús M. Gonzalez-Barahona** Universidad Rey Juan Carlos

## 2. BLOOM

2. **Danish Contractor** BLOOM Model Gov. Work Group
3. **Jaan Li** University of Tartu, One Fact Foundation

## 3. Falcon

1. **Casey Valk** Nutanix
2. **Jean-Pierre Lorre** LINAGORA, OpenLLM-France

## 4. Grok

1. **Victor Lu** independent database consultant
2. **Karsten Wade** Open Community Architects

## 5. Llama 2

1. **Davide Testuggine** Meta
2. **Jonathan Torres** Meta
3. **Stefano Zacchiroli** Polytechnic Institute of Paris
4. **Victor Lu** independent database consultant

## 6. LLM360

5. **[Team member TBD]** LLM360

## 7. Phi-2

6. **Seo-Young Isabelle Hwang** Samsung

## 8. Mistral

1. **Mark Collier** OpenInfra Foundation
2. **Jean-Pierre Lorre** LINAGORA, OpenLLM-France
3. **Cailean Osborne** University of Oxford, Linux Foundation

## 9. OLMo

4. **Amanda Casari** Google
5. **Abdoulaye Diack** Google

## 10. OpenCV

1. **Rasim Sen** Oasis Software Technology Ltd.

## 11. Pythia

1. **Seo-Young Isabelle Hwang** Samsung
2. **Stella Biderman** EleutherAI
3. **Hailey Schoelkopf** EleutherAI
4. **Aviya Skowron** EleutherAI

## 12. T5

5. **Jaan Li** University of Tartu, One Fact Foundation

## 13. Viking

6. **Merlijn Sebrechts** Ghent University

# Validation Review

Each system is reviewed on a public form, to maximize transparency.

OSI: AI Systems Review Workgroups

File Edit View Insert Format Data Tools Extensions Help

Component Legal Framework Legal Document Arctic Document Analysis

Component definitions: Model Openness Framework For each component (source: OSAID v. 0.0.6) Paste link to each component's legal document Use for any purpose an Study how the system works Modification for any purpose Sharable

Version reviewed: snowflake-arctic-instruct and snowflake-arctic-instruct

Required

Data Information

Training methodologies and techniques Available under OSD-compliant license <https://medium.com/snowflake/snowflake-is-willing-to-share-but-they-havent-yet-published-anywhere-103a2a2f3a> Allowed Allowed

Training data scope and characteristics Available under OSD-compliant license <https://medium.com/snowflake/snowflake-is-willing-to-share-but-they-havent-yet-published-anywhere-103a2a2f3a> Allowed Allowed

Training data provenance (including how data was used) Available under OSD-compliant license <https://medium.com/snowflake/snowflake-is-willing-to-share-but-they-havent-yet-published-anywhere-103a2a2f3a> Allowed Allowed

Training data labeling procedures, if used Available under OSD-compliant license <https://medium.com/snowflake/snowflake-is-willing-to-share-but-they-havent-yet-published-anywhere-103a2a2f3a> Allowed Allowed

Training data cleaning methodology Available under OSD-compliant license <https://medium.com/snowflake/snowflake-is-willing-to-share-but-they-havent-yet-published-anywhere-103a2a2f3a> Allowed Allowed

Code

Data pre-processing Available under OSI-approved license Something Snowflake is willing to share, but they haven't yet published this anywhere yet because no one has asked so far.

Training, validation and testing Available under OSI-approved license <https://github.com/Snowflake-Labs/snowflake> Allowed Allowed

Inference Available under OSI-approved license <https://github.com/Snowflake-Labs/snowflake> Allowed Allowed

Supporting libraries and tools Available under OSI-approved license <https://github.com/Snowflake-Labs/snowflake> Allowed Allowed

Model

Model architecture Available under OSI-approved license <https://huggingface.co/Snowflake/snowflake> Allowed Allowed

Model parameters Available under OSD-conformant terms <https://huggingface.co/Snowflake/snowflake> Allowed Allowed

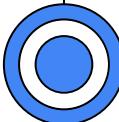
Optional

Definition Validation -- Arctic

Definition Validation -- Falcon

Definition Validation -- Grok

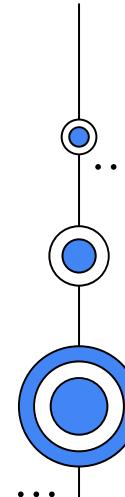
Definition Validation -- LLM360



# Validation Progress

Validation is ongoing. We have found that creator participation is in most cases necessary to identify all the legal documents needed to ascertain openness. Last updated in June, 2024.

AI System	Meets OSAID requirements?	Notes
Name of system with link to its review sheet	Based on OSAID v. 0.0.8 and/or v.0.0.6	Summary explanation of status (as of 6/11/24)
<a href="#">Arctic</a>	Expect Yes	Verbal confirmation from Snowflake, which is adding legal documents to review sheet (6/3/24)
<a href="#">BLOOM</a>	Confirmed No (license fails)	Usage restrictions in RAIL license
<a href="#">Falcon</a>	Expect No	Documents on training methodologies and techniques and training, validation and testing are missing
<a href="#">Grok</a>	Expect No	Very little public information on system
<a href="#">Llama 2</a>	Confirmed No	Data pre-processing + training, validation and testing code are not available
<a href="#">LLM360</a>	Expect Yes	Self-certified as compliant on the forum, awaiting addition of reviewable documents to their sheet
<a href="#">Mistral</a>	Confirmed No	Some data information and code components missing, no training code available
<a href="#">OLMo</a>	Expect Yes	Supporting libraries and tools unclear, but all other legal documentation is present
<a href="#">OpenCV</a>	Unclear	Model requirement unclear because OpenCV does not store, but instead supports external deep learning frameworks
<a href="#">Phi-2</a>	Unclear	Data information, code, and model information missing
<a href="#">Poro</a>	Unclear	Most review documentation not yet located; Located documentation meets OSAID requirements
<a href="#">Pythia</a>	Confirmed Yes	Only non-alignment was absence of labeling documentation, which was not created. v 0.0.8 adds "if used" to requirement, resolving this
<a href="#">T5</a>	Expect Yes	Only possible restriction is in supporting libraries and tools because gcloud command requires special hardware. Hardware requirements are out of scope for the OSAID, so this is likely not a recognized restriction.



# Open Source AI Definition

## 4 Freedoms

- Use
- Study
- Modify
- Share

## Open Weights

- Model weights and parameters

## Open Code

- Source code used to train and run the system

## Data Info

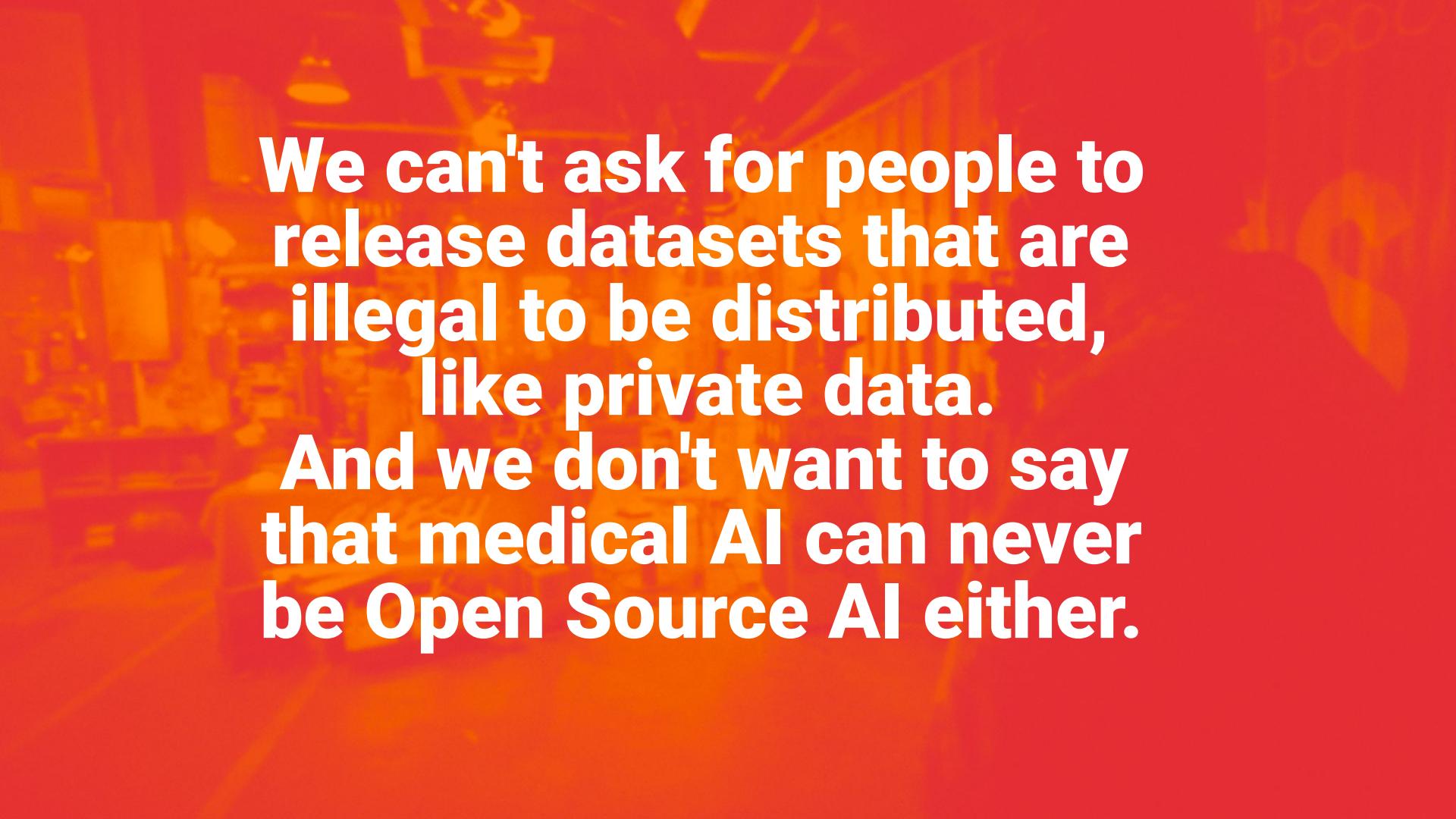
- Dataset or detailed information about the data used to train the system

# The AI conundrums

“

If we assume, for example, that the definition requires full release of datasets, one thing is certain: in Julia's words, it would be “a definition for which few existing systems qualify.”  
*(OSI note: also less powerful and limited to specific domains)*

<https://redmonk.com/sogrady/2024/07/03/ai-conundrums/>



**We can't ask for people to release datasets that are illegal to be distributed, like private data.**

**And we don't want to say that medical AI can never be Open Source AI either.**

# A long history of exceptions

“

The GNU C library uses a special kind of copyleft called the GNU Library General Public License, which gives permission to link proprietary software with the library. Why make this exception? [...] It is not a matter of principle; [...] but strategically it seems that disallowing them would do more to discourage use of the GNU system than to encourage development of free applications

*Richard Stallman*

<https://www.gnu.org/philosophy/fsfs/rms-essays.pdf>



# Board Guidance



The OSI Board requires a definition that is:

## Supported by diverse stakeholders

The definition needs to have approval by end users, developers, deployers and subjects of AI, globally.

## Provides real-life examples

The definition must include relevant examples of AI systems that comply with it at the time of approval, so cannot have an empty set.

## Ready by October 2024

A usable version of the definition needs to be ready for approval by the board at the October board meeting.

Approved June 21, 2024

# Open Source AI Definition

The general structure of the document

Basic concepts

The Open Source AI Definition

The definition of preferred form to make modifications to machine learning

Clarifications

## The Open Source AI Definition

version 1.0-RC1

### Preamble

#### Why we need Open Source Artificial Intelligence (AI)

Open Source has demonstrated that massive benefits accrue to everyone after removing the barriers to learning, using, sharing and improving software systems. These benefits are the result of using licenses that add up to the Open Source Definition. For AI, society needs at least the same essential freedoms of Open Source to enable AI developers, deployers and users to enjoy the same benefits: autonomy, transparency, efficiency, reuse and collaborative improvement.

#### What is Open Source AI

When we refer to a "system" we are speaking both broadly about a fully functional structure and its discrete structural elements. To be considered Open Source, the requirements are the same, whether applied to a system, a model, weights and parameters, or other structural elements.

An Open Source AI is an AI system made available under terms and in a way that grant the freedoms<sup>1</sup> to:

- Use the system for any purpose and without having to ask for permission.
- Study how the system works and inspect its components.
- Modify the system for any purpose, including to change its output.
- Share the system for others to use with or without modifications, for any purpose.

These freedoms apply both to a fully functional system and to discrete elements of a system. A precondition to exercising these freedoms is to have access to the preferred form to make modifications to the system.

#### Preferred form to make modifications to machine-learning systems

The preferred form of making modifications to a machine-learning system must include all the elements below:

- **Data Information:** Sufficiently detailed information about the data used to train the system so that a skilled person can build a substantially equivalent system. Data information shall be made available under OSI-approved terms:
  - In particular, this must include: (1) a detailed description of all data used for training, including (if used) of unstructured data, disclosing the provenance of the data, its scope and characteristics, how the data was obtained and selected, the license(s) under which it is made available; (2) a listing of all publicly available training data and where to obtain it; (3) a listing of all training data obtainable from third parties and where to obtain it, including for fees.
- **Code:** The complete source code used to train and run the system. The Code shall represent the full application of how the Data Information was processed and how the training was done. Code shall be made available under OSI-approved licenses.
  - For example, if this must include code used for pre-processing data, code used for training including arguments and settings used, validation and testing, supporting libraries (like tokenizers and hyperparameters search code, inference code, and model architecture).
- **Parameters:** The model parameters, such as weights or other configuration settings. Parameters shall be made available under OSI-approved terms<sup>1</sup>.
  - For example, this might include checkpoints from key intermediate stages of training as well as the final optimizer state.

The licensing or other terms applied to these elements and to any combination thereof may contain conditions that require any modified version to be released under the same terms as the original.

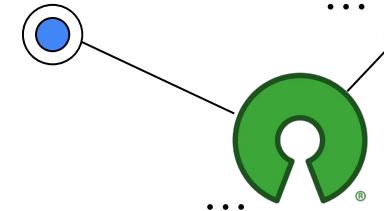
#### Open Source models and Open Source weights

For machine learning systems,

- An **AI model** consists of the model architecture, model parameters (including weights) and inference code for running the model.
- **AI weights** are the set of learned parameters that overlay the model architecture to produce an output from a given input.

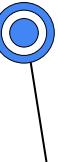
The preferred form to make modifications to machine learning systems also applies to these individual components. "Open Source models" and "Open Source weights" must include the Data Information and code used to derive those parameters.

#### Definitions



Unlikely to change in the future

Most likely to change in the future



# New FAQ entry (preview)

**Open training data:** data that can be copied, preserved and reshared. It provides the best way to enable users to study the system.

**Public training data:** data that others can inspect as long as it remains available. This also enables users to study the work. However, this data can degrade as links or references are lost or removed from network availability. To obviate this, different communities will have to work together to define standards, procedures, tools and governance models to overcome this risk, and Data Information is required in case the data becomes later unavailable..

**Obtainable training data:** data that can be obtained, including for a fee. This information provides transparency and is similar to a purchasable component in an open hardware system. The Data Information provides a means of understanding this data other than obtaining or purchasing it. This is an area that is likely to change rapidly and will need careful monitoring to protect Open Source AI developers.

**Unshareable non-public training data:** data that cannot be shared for explainable reasons, like Personally Identifiable Information (PII). For this class of data, the ability to study some of the system's biases demands a detailed description of the data – what it is, how it was collected, its characteristics, and so on – so that users can understand the biases and categorization underlying the system.

# RC1

**Data Information:** Sufficiently detailed information about the data used to train the system so that a skilled person can ~~recreate~~build a substantially equivalent system, together with the code requirements listed below. Data Information shall be made available under terms that allow the copying, modification, and redistribution of the information.

In particular, if used, this ~~would~~must include:

- (1) a listing of all publicly available training data;
- (2) a listing of all training data obtainable from third parties and where to obtain it, including for a fee; and
- (3) a detailed description of all data, including unshareable data, that provides information about the provenance of the data, its scope and characteristics, how the data was obtained and selected, the labeling procedures and data cleaning methodologies.

# RC1

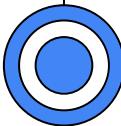
**Code:** The complete source code used to train and run the system. **The Code shall represent the full specification of how the Data Information was processed and how the training was done.** Code shall be made available under OSI-approved licenses.

\* For example, if used, this must include code used for pre-processing data, code used for training, validation and testing, supporting libraries like tokenizers and hyperparameters search code, inference code, and model architecture.

**Parameters:** The model parameters, such as weights or other configuration settings. Parameters shall be made available under OSI-approved terms[^4].

\* For example, this might include checkpoints from key intermediate stages of training as well as the final optimizer state.

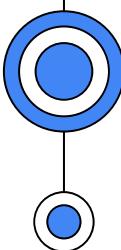
**The licensing or other contractual terms applied to these elements and to any combination thereof may contain conditions that require any modified version to be released under the same license as the original.**



# Stakeholder Groups

*The Board requires that the definition have approval by end users, developers, deployers and subjects of AI, globally.*

Stakeholder	Description	Example	Vols
1. Developer	Makes AI system and/or component that will be studied, used, modified, or shared through an open source license	ML researcher in academia or industry	31%
2. Deployer	Seeks to study, use modify, or share an open source AI system	AI engineer in industry, health researcher in academia	46%
3. End User	Consumes a system output, but does not seek to study, use, modify, or share the system	Student using a chatbot to write a report, artist creating an image	≈ 90%
4. Subject	Affected upstream or downstream by a system output without interacting with it intentionally + advocates for this group.	Photographer who finds their image in training dataset (upstream), mortgage applicant evaluated by a bank's AI system (downstream)	≈ 100%



# 2024 Timeline

System testing work stream

Stakeholder consultation work stream

Release schedule

February

April

July

August

September

October

Call For Volunteers + Activity Feedback and Revision

Virtual System Review

Virtual System Review

Virtual System Review

Feedback and review Hardening WG

Feedback and review Hardening WG

Bi-Weekly Virtual Public Townhalls

Bi-Weekly Virtual Public Townhalls

Townhalls +  
- OSPOs for Good (NYC)  
- OS Community Africa (virtual)

Townhalls +  
- AI-dev (Hong Kong)  
- OSC (Beijing)

Weekly townhalls  
- DL Indaba (Dakar)  
- FOSSIIndia (Bangalore)  
- RegenAI (Ashland)  
- LF Europe (Vienna)  
- Nerdearla (Buenos Aires)

Weekly townhalls  
- Data Workshop (Paris)  
- All Things Open (Raleigh)

Draft 0.0.5

Draft 0.0.8

Draft 0.0.8

Draft 0.0.9

RC1

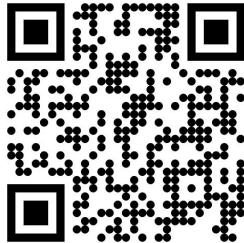
Version 1.0

Call for Public Participation

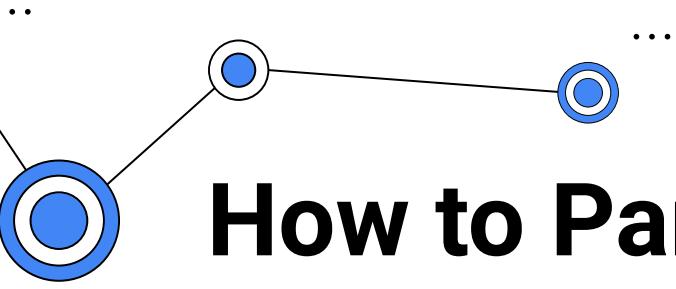
# Endorse the OSAID!

[opensource.org/osaid-endorse](https://opensource.org/osaid-endorse)



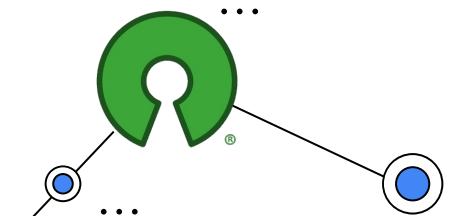
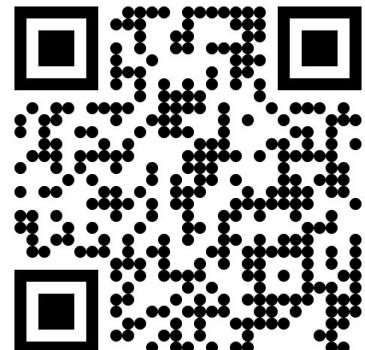
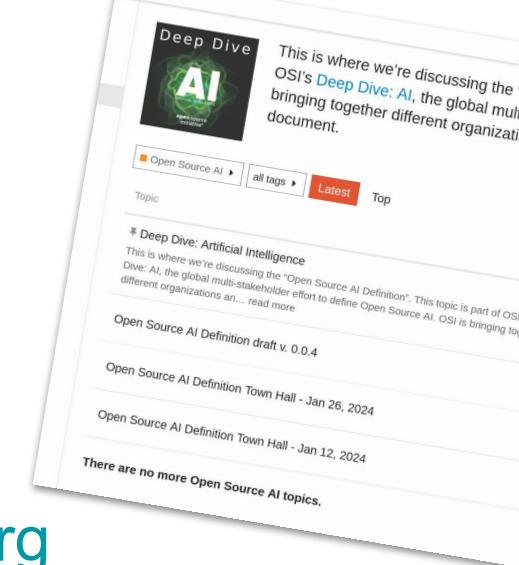


- **Endorse the OSAID!**
- In preparation for next month's launch, we are seeking both **individual** and **organizational** endorsements of the OSAID.
- “**Endorsement**” means your name and organizational affiliation will be appended to a press release announcing the OSAID.
- Use OSI’s **webform** to give your endorsement.
- Email or DM me on the forum with any questions.



# How to Participate

- Endorse the OSAID!
  - [opensource.org/osaid-endorse](https://opensource.org/osaid-endorse)
- Public forum: [discuss.opensource.org](https://discuss.opensource.org)
- Comment on RC1 next week
- Become an OSI Member (free + paid)
- Weekly virtual town halls





# Thank You, Co-Designers!

*The following individuals volunteered as workgroup members or system reviewers during the co-design process. This group of **36 volunteers** represents **23 countries** by birth and residence. African participants are highlighted.*

- **Rahmat Akintola** Cubeseed Africa
- **George C. G. Barbosa** Fundação Oswaldo Cruz
- **Stella Biderman** EleutherAI
- **Amanda Casari** Google
- **Justin Colannino** Microsoft
- **Mark Collier** OpenInfra Foundation
- **Daniel Brumund** GIZ FAIR Forward - AI for All
- **Danish Contractor** BLOOM Model Gov. WG
- **Abdoulaye Diack** Google
- **Ignatius Ezeani** Lancaster University
- **Jesús M. Gonzalez-Barahona** Universidad Rey Juan Carlos
- **Bastien Guerry** DINUM, French public administration
- **Kevin Harerimana** CMU Africa
- **Seo-Young Isabelle Hwang** Samsung
- **Ezequiel Lanza** Intel
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- **Jonathan Torres** Meta
- **Akosua Twumasi** Ghana Health Service
- **Casey Valk** Nutanix
- **Stefano Zacchiroli** Polytechnic Institute of Paris
- **Mo Zhou** Debian, Johns Hopkins University



THANKS!  
Q+A