Aya

Accelerating multilingual AI through open science

The Aya Movement at a glance.

cohere.com/research/aya

Aya

The word Aya is derived from the Twi language meaning “fern” - a symbol of endurance and resourcefulness. Aya embodies our dedication to advancing multilingual AI.

3
Models

513M
Total Release Dataset Size

3K
Independent Researchers

250+
Language Ambassadors

119
Countries

204K
Original Human Annotations

101
Languages

81K
Discord Messages

The Aya models and datasets cover 101 languages with enhanced performance for 23 of them

Achinese · Afrikaans · Albanian · Amharic · **Arabic** · Arabic · Armenian · Azerbaijani Balinese · Banjar · Basque · Belarusian · Bemba · Bengali · Bulgarian · Burmese · Catalan Cebuano · **Chinese** · Croatian · **Czech** · Danish · **Dutch** · **English** · Esperanto · Estonian Filipino · Finnish · Fon · **French** · Galician · Georgian · **German** · **Greek** · Gujarati · Haitian Creole · Hausa · **Hebrew** · **Hindi** · Hungarian · Icelandic · Igbo · **Indonesian** · Irish · **Italian** · **Japanese** · Javanese · Kannada · Kanuri · Kashmiri · Kazakh · Khmer Kinyarwanda · **Korean** · Kurdish · Kurdish · Kyrgyz · Lao · Latvian · Ligurian · Lithuanian Luxembourgish · Macedonian · Madurese · Malagasy · Malay · Malayalam · Maltese Manipuri · Maori · Marathi · Minangkabau · Mongolian · Nepali · Ngaju · Northern Sotho · Norwegian · Pashto · **Persian** · **Polish** · **Portuguese** · Punjabi · **Romanian** · **Russian** · Samoan · Scottish Gaelic · Serbian · Shona · Sindhi · Sinhala · Slovak · Slovenian · Somali · Southern Sotho · **Spanish** · Sundanese · Swahili · Swedish · Tajik · Tamasheq · Tamil · Telugu · Thai · Toba Batak · **Turkish** · Twi · **Ukrainian** · Urdu · Uzbek · **Vietnamese** · Welsh · Wolof · Xhosa · Yiddish · Yoruba · Zulu

*(Languages in **bold** have better performance coverage in Aya Expanse models)

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01 The Story of Aya

A global initiative led by Cohere For AI to advance the state-of-art in multilingual AI and bridge gaps between people and cultures across the world.

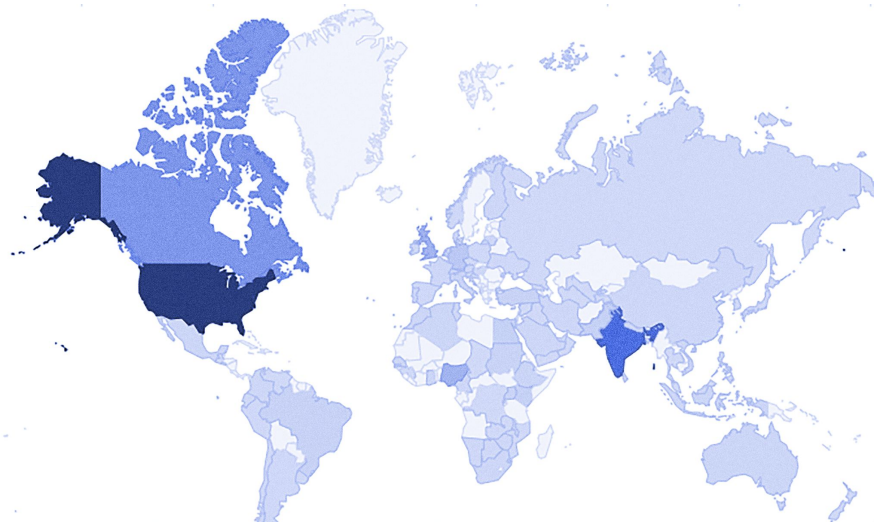
Aya is an open science project to create new models and datasets that expand the number of languages covered by AI, involving over 3,000 independent researchers across 119 countries.

But how did we get here? It all started with a vision to solve complex machine learning problems and an ambitious goal to increase access to language technology for all.

A community, ready to collaborate

The impetus for Aya came out of the Cohere For AI Open Science initiative - a community that supports independent researchers around the world connect, learn from one another, and work collaboratively to advance the field of ML research.

Starting in January, 2023, members worldwide were keen to leverage the strengths of their diversity and collaborate on something brand new - an open science project to accelerate multilingual AI, and increase access to this technology for the people of their regions.



Join our Open Science Community

Involving 3000+ researchers around the world

Aya is as much a protest against how research is done as it is a technical contribution. Most breakthroughs to-date have come from a small set of labs and countries. Aya instead started with a revolutionary premise: working with independent researchers, engineers, linguists, language enthusiasts around the world to defy expectations and build a breakthrough model.

A widening gap.

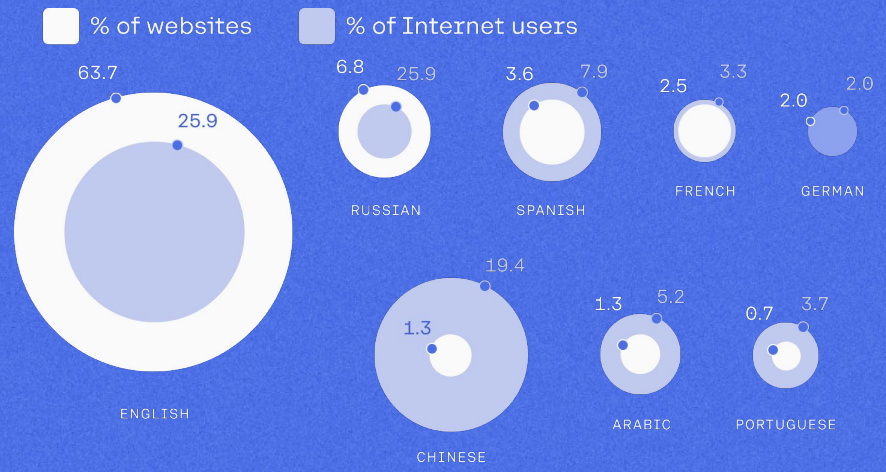
The impetus for this project stems from the stark reality that while natural language processing technologies have advanced exponentially, not all languages have been treated equally by developers and researchers. A significant drawback lies in the source of data used to train large language models, predominantly originating from the internet.

Language	# of papers per million speakers	# of speakers (in millions)
Irish	5235	0.2
Basque	2430	0.5
German	179	83
English	63	550
Chinese	11	1000
Hausa	1.5	70
Nigerian Pidgin	0.4	30

Van Esch, et al. 2022. Writing System and Speaker Metadata for 2,800+ Language Varieties. In Proceedings of the *Thirteenth Language Resources and Evaluation Conference*, pages 5035–5046, Marseille, France. European Language Resources Association.

English is the internet's dominant language

Share of websites using selected languages vs. estimated share of internet users speaking those languages*



*Websites as of February 2022, internet users as of 2021.
Sources: W3Techs, Internet World Stats

This mirrors the early adoption stage of this technology, where a mere 5% of the world's population speaks English at home, yet a surprising 63.7% of internet communication is in English. This trend inadvertently widens the gap in language access to new technologies, exacerbating disproportionate representation, and perpetuating this divide further.

Richter, F. (2022, February 21). English Is the Internet's Universal Language. *Statista.* https://www.statista.com/ chart/ 26884/languages-on-the-internet/

Endurance and resourcefulness

The name Aya originates from the Twi language, meaning "fern," symbolizing endurance and resourcefulness – a perfect testament to the movement's commitment to accelerating multilingual AI progress. What we didn't realize when we named the project was how much endurance and resourcefulness we would need to pull it off.

“If you want to go fast,
go alone.

If you want to go far,
go together.”

– African Proverb

Creating together

Aya has been the largest open-science project in the field of AI. Bringing together 3,000+ collaborators from 119 countries is no small feat. In addition to all the typical challenges of working in groups, we had to take into account time differences, language barriers, various culture understandings and resource inequity.

We hope our journey will help serve as a case study for future participatory research initiatives. We share both the challenges as well as the unique advantages of working together on this mega-scale scientific initiative.

One step down a long road

The Aya models and dataset are released openly, inviting researchers and developers to build upon this progress and conduct further research and build tools to increase access for people in their communities.

By leveraging the Aya resources, you can contribute to the larger challenge of shifting the focus of technological development to encompass all communities and their unique languages.

Visit the Aya website

Together, we can create the future of AI advancement that benefits all.

Let us unite, collaborate, and unleash the full potential of open science for the betterment of global communication.

02

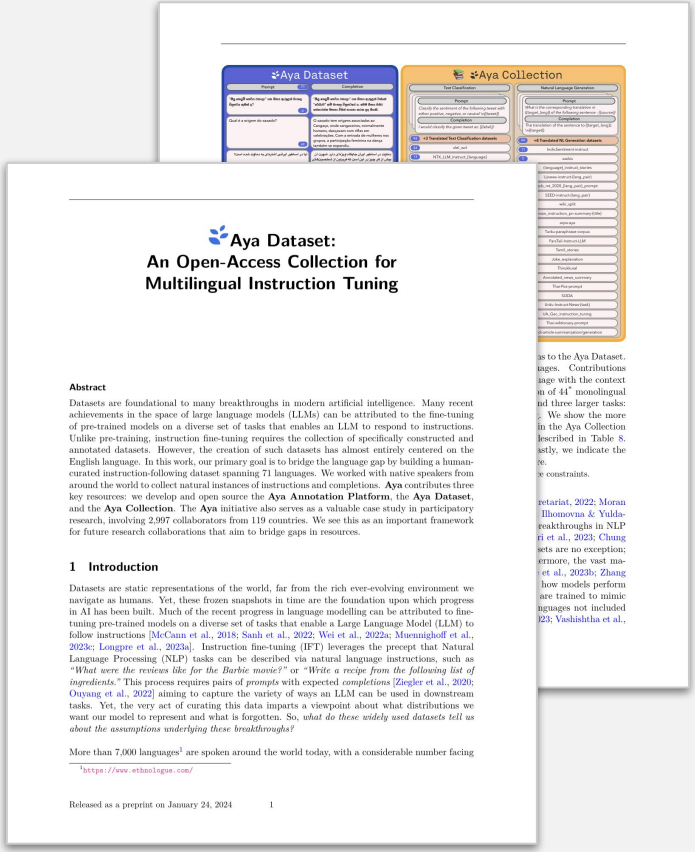
Aya Dataset & Collection

Aya Dataset

An Open-Access Collection for Multilingual Instruction Fine-Tuning

The Aya Dataset represents the most extensive compilation of multilingual instructional examples to date, and it is accessible for use under a fully permissive licensing framework.

For the full paper, read here.



Aya Dataset: An Open-Access Collection for Multilingual Instruction Tuning

Abstract

Datasets are foundational to many breakthroughs in modern artificial intelligence. Many recent achievements in the space of large language models (LLMs) can be attributed to the fine-tuning of pre-trained models on a diverse set of tasks that enables an LLM to respond to instructions. Unlike pre-training, instruction fine-tuning requires the collection of specifically constructed and annotated datasets. However, the creation of such datasets has almost entirely centered on the English language. In this work, our primary goal is to bridge the language gap by building a human-curated instruction-following dataset spanning 71 languages. We worked with native speakers from around the world to collect natural instances of instructions and completions. **Aya** contributes three key resources: we develop and open source the **Aya Annotation Platform**, the **Aya Dataset**, and the **Aya Collection**. The **Aya** initiative also serves as a valuable case study in participatory research, involving 2,997 collaborators from 119 countries. We see this as an important framework for future research collaborations that aim to bridge gaps in resources.

1 Introduction

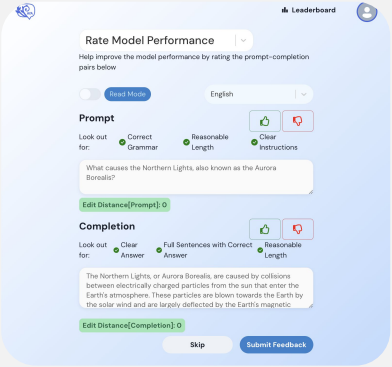
Datasets are static representations of the world, far from the rich ever-evolving environment we navigate as humans. Yet, these frozen snapshots in time are the foundation upon which progress in AI has been built. Much of the recent progress in language modelling can be attributed to fine-tuning pre-trained models on a diverse set of tasks that enable a Large Language Model (LLM) to follow instructions [McCann et al., 2018; Sanh et al., 2022; Wei et al., 2022a; Muennighoff et al., 2023c; Longpre et al., 2023a]. Instruction fine-tuning (IFT) leverages the precept that Natural Language Processing (NLP) tasks can be described via natural language instructions, such as *"What were the reviews like for the Barbie movie?"* or *"Write a recipe from the following list of ingredients."* This process requires pairs of *prompts* with expected *completions* [Ziegler et al., 2020; Ouyang et al., 2022] aiming to capture the variety of ways an LLM can be used in downstream tasks. Yet, the very act of curating this data imparts a viewpoint about what distributions we want our model to represent and what is forgotten. So, *what do these widely used datasets tell us about the assumptions underlying these breakthroughs?*

More than 7,000 languages[1] are spoken around the world today, with a considerable number facing

[1] https://www.ethnologue.com/

Released as a preprint on January 24, 2024 1

Aya contributes four key resources:

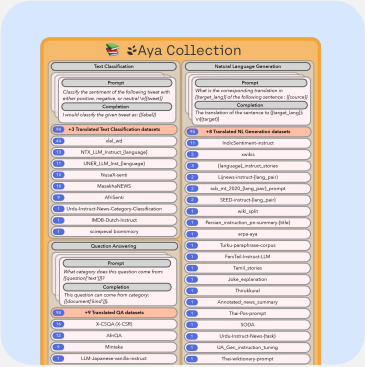


Aya Annotation Platform

A user interface for large-scale participatory research available for free. Used by **2,997 Aya contributors**

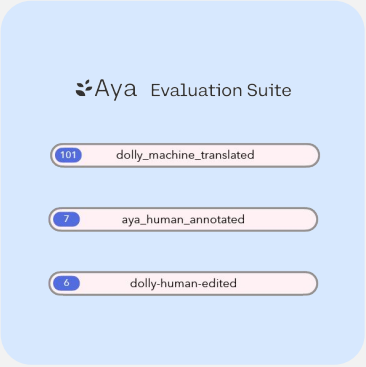
Aya Dataset

The largest human-annotated, multilingual dataset supporting **65 languages**



Aya Collection

A collection of **44 templated and 19 translated datasets, supporting 115 languages**, to train multilingual LLMs



Aya Evaluation Suite

A high quality dataset for evaluation of LLMs. Subsets include **human-written (7 languages), post-edited translations (6 languages)**, and translations of manually selected prompts **(101 languages)**

Aya Datasets at a glance

Dataset

Download

65 lanuages

Human-written instances from fluent native speakers

204K instances

Collection

Download

115 lanuages

Templating and Translating existing datasets

513M instances

Evaluation

Download

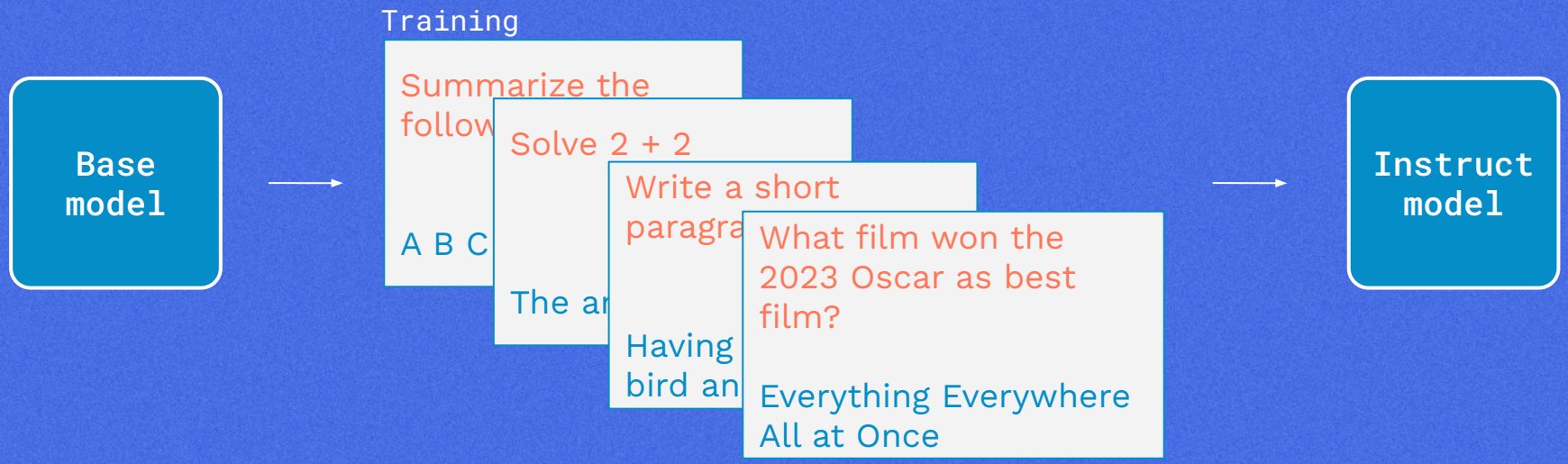
101 lanuages

Mixture of human-curated, postedits, and translations

23K instances

What Is Instruction Fine-Tuning?

Instruction Fine-Tuning (IFT) is a form of model training that enables models to better understand and act upon instructions. It is based on the idea that we can use everyday language to ask a model to perform a task and in return the model generates an accurate response in natural language.



Challenges With Multilingual Data Quality and Coverage

To effectively train foundational models with multilingual instructions, we need access to large volumes of quality multilingual instructional data.

This has been plagued by three challenges:

Data scarcity

Low quality data

Lack of qualified contributors for low-resource languages

Without robust multilingual datasets to train models, we risk:

Introducing biases towards languages not included.

Marginalizing speakers of languages not included.

Creating a performance-divide for languages with limited datasets.

Introducing security flaws.

The Aya Dataset

The largest human-curated multilingual dataset for fine-tuning LLMs to follow instructions.

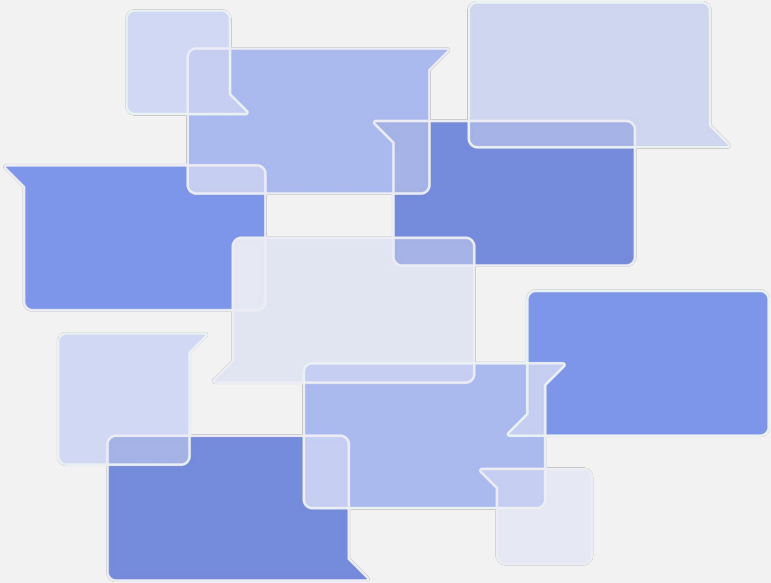
The Aya Collection

The Aya Evaluation Suite

The Largest Human-Curated Dataset from Native and Fluent Speakers

Human-curated data from native and fluent speakers can be hard to come by. It can be costly and difficult to orchestrate.

By leveraging best practices from open-source and crowdsourced science projects, we were able to create the Aya Dataset – the largest collection to date of human-curated and annotated multilingual instruction data.



Aiming for Worldwide Coverage of Languages

Behind each datapoint for each language is a person familiar with the nuances of the language. This level of expertise provides the subtle distinctions and variations in meaning that make each language unique in practice.

Criteria for Inclusion in Aya Dataset

The **Aya Dataset** includes all original annotations and a subset of all re-annotations that vary to a certain extent from the originals.

In order to ensure linguistic diversity and quality, we included languages that were varied, with at least 50 contributions, and with naturally long prompts and corresponding completions.

65 languages

33 high-resource

12 mid-resource

31 low-resource languages

The goal was to include as many languages as possible without lowering the overall quality of the dataset. The table below lists details of the **Aya** Dataset.

Aya Dataset Statistics (number of pairs of prompts and completions obtained through various annotation tasks)

		Count
Original Annotations		138,844
Re-Annotations	xP3 datasets	2,895
	Translated datasets	7,757
	Templated datasets	11,013
	Original Annotations	43,641
Aya Dataset Total		**204,114**

The Aya Dataset

The Aya Collection

The Aya Evaluation Suite

A combination of human-annotated, translated, and templated data.

An Overview of the Aya Collection

How do we make the world's largest multilingual instruction dataset?

Human Annotated

Human-annotated data is information that has been manually reviewed, labelled, and/or annotated by human annotators, leveraging their native knowledge of a language to provide context and enhance machine learning algorithms.

Translated

Translated multilingual data is when machine translation tools convert text from one language to another, making use of an existing dataset in one language to create the set in another.

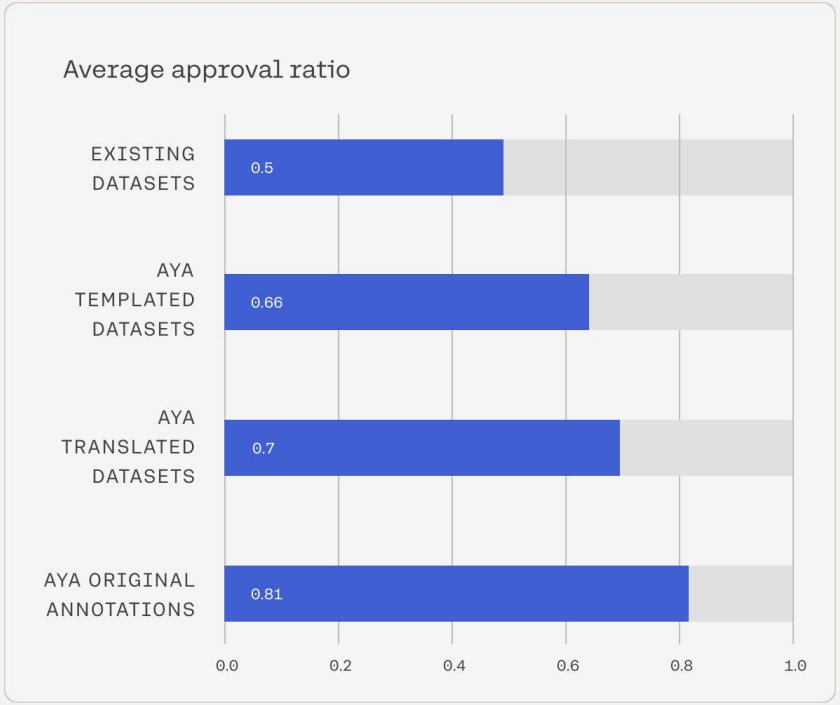
Templated

Templated is created by annotators writing templates and then applying them to datasets to reformat existing NLP datasets into instruction-style.

Aya Collection Surpasses Previous Multilingual Datasets in terms of quality

The quality of instruction data significantly influences the performance of the fine-tuned language model.

Through a global assessment, we enlisted annotators to assess the quality of various multilingual data collections. This process revealed that Aya's original annotations received the highest approval ratings from both native and fluent speakers.



Expanding Data Diversity and Task Coverage

Increasing diversity while maintaining high quality will result in more robust and powerful [1, 2]

We focused on existing datasets templated for instructions and finding tasks that require asking questions and answering based on small pieces of information.

The collection includes 3 main tasks,

1) Question Answering
2) Natural Language Generation
3) Text Classification

and 12 fine-grained task types.

Task Taxonomy of NLP tasks in the Aya Collection

Main Task Type	Fine-grained Task Type
Question Answering	—
Natural Language Generation	Summarization
	Translation
	Paraphrasing
	Dialogue
	Text SImplification
Text Classification	Sentiment ANalysis
	Information Extraction
	Named Entity Recognition
	Event Linking
	Natural Language Inference
	Document Representation

The Aya Dataset

The Aya Collection

The Aya Evaluation Suite

A diverse multilingual dataset to assess open-ended generation capabilities of LLMs.

Building an Evaluation Suite

We curate and release an evaluation suite tailored for multilingual models.

This set is a valuable contribution in tackling the scarcity of multilingual data, a challenge that becomes even more apparent when considering evaluation sets.

To strike a balance between language coverage and the quality that comes with human oversight, we create an evaluation suite that includes:

(1) **human-curated** examples in a limited set of languages,

(2) automatic **translations** of handpicked examples in an extensive number of languages, and

(3) **human-post-edited** translations in a few languages.

Human-curated examples

7 languages

1750 instances

Translations of hand-picked examples from Dolly-15k

101 languages

20K instances

Human-post-edited translations

6 languages

1200 instances

Limitations of the Aya Dataset

All research has limitations. Below we outline the top challenges faced by the Aya project and results.

- **Language and dialect coverage**: 115 languages (Aya Dataset and Aya Collection) is only a tiny fraction of the world's linguistic diversity.
- **Uneven distribution of contributions**: Relatively few contributors accounted for the most annotations.
- **Cultural or personal bias**: limited representation can lead to a narrow selection of cultural viewpoints.
- **Gendered pronouns**: featuring languages with gendered pronouns or lacking gender-neutral ones, requires careful response crafting to maintain gender neutrality.
- **Formality distinctions**: released dataset contains many languages that have varying levels of standardization and differing style guidelines for formal language like honorifics.
- **Toxic or offensive speech:** the annotation platform does not contain specific flags for toxic, harmful, or offensive speech, so it is possible that malicious users could submit unsafe data.
- **Accounting for mislabeled data**: the annotation platform does not contain any components that enable re-labeling the assigned language of annotations.
- **Coverage of tasks in Aya Collection:** the collection only includes 3 main tasks (Question Answering, Natural Language Generation, Text Classification) and 12 fine-grained task types.

03
Aya Models

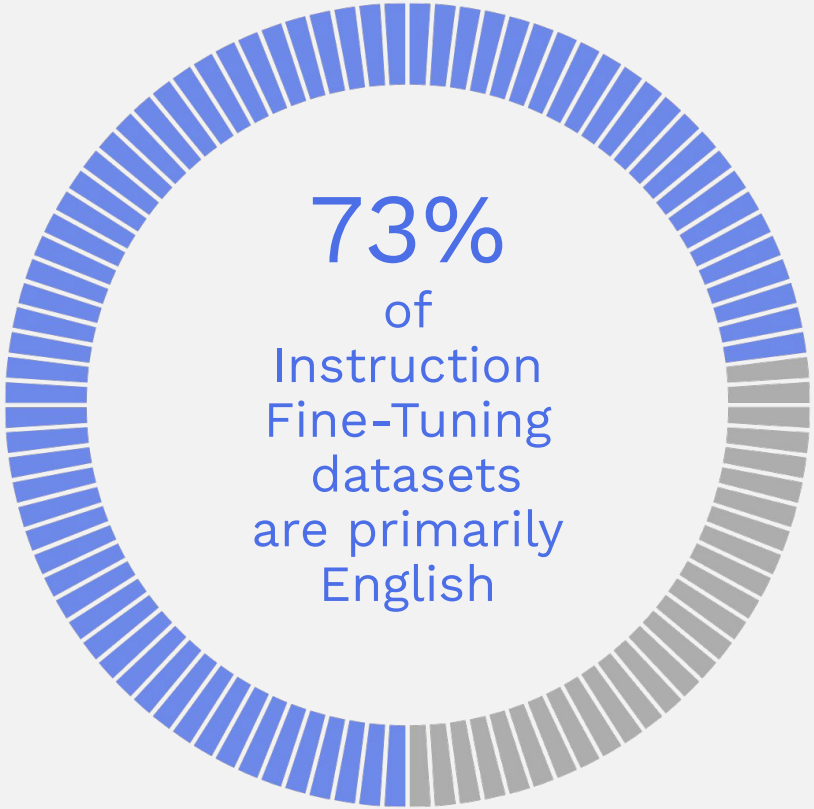
Introducing the Aya Models

The landscape of modern machine learning has been profoundly shaped by datasets. Yet, this progress has predominantly favored a few data-rich languages due to legacy use and lack of accessible resources. The global linguistic diversity is not represented.

This skew contrasts sharply with a core machine learning principle: **training data should mirror the real-world's vast linguistic diversity**.

We face a glaring inclusivity gap.

> “The limits of my **language** means the limits of my **world.**”
>
> – Ludwig Wittgenstein



The Aya Model aims to bridge this divide, pushing for multilingual IFT datasets that truly reflect our world's rich tapestry of languages, making machine learning not just smarter, but more equitable and representative.

Prompt:

What are some languages spoken in Mexico?

Output:

The three most spoken languages in Mexico are Spanish, Nahuatl, and Maya.

Instruction Fine-Tuning involves training a foundational model on a dataset of prompts or instructions followed by the desired outputs.

The Aya Models Explained

The Aya Models are designed to tackle linguistic inequality. They can execute tasks in response to prompts given in any supported language. This eliminates the need for multilingual speakers to default to English when writing prompts.

Our goal is to greatly expand the coverage of languages to 101, far beyond the current coverage of previous instruction fine-tuned multilingual models.

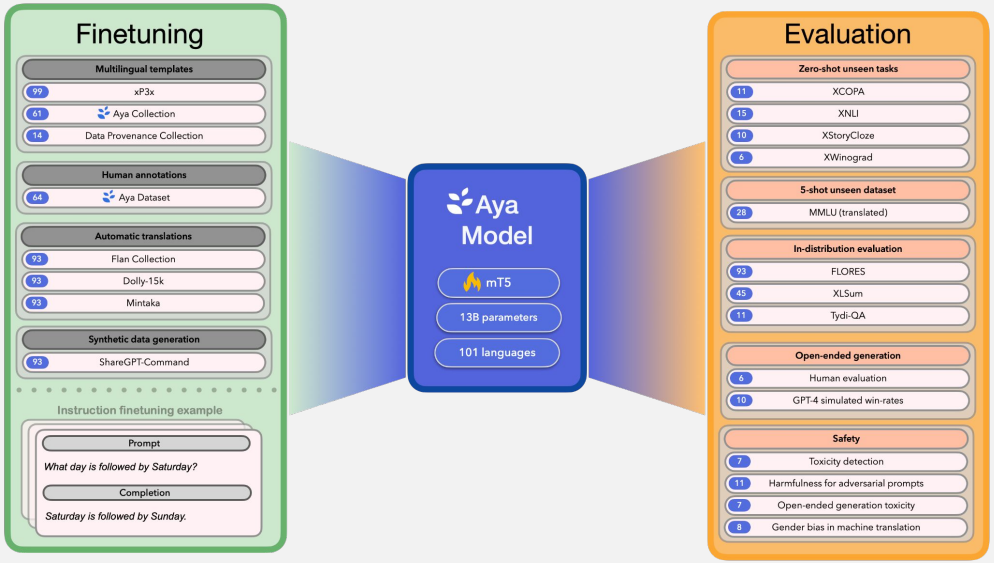


Figure 2: Aya 101 involved extensive contributions to both the breadth of IFT training dataset, optimization techniques including weighting of datasets and introducing more extensive evaluation of performance across varied tasks.

There are three models in the Aya family

Aya Expanse 8B

STATE OF THE ART, ACCESSIBLE RESEARCH LLM

Aya Expanse - 8B

Aya Expanse 32B

STATE OF THE ART RESEARCH LLM

Aya Expanse - 32B

Aya 101 13B

MASSIVELY MULTILINGUAL RESEARCH LLM

Aya 101

Our first Aya model was Aya 101

Aya 101
13B

Representing Linguistic Diversity through Aya 101

To create a model with diverse linguistic representation, we focused on four areas:

Expansion of Language Coverage

We more than doubled the number of languages with 2.5x the size of the starting dataset.

Broadening Multilingual Evaluation

We benchmark on 99 languages with 4 different evaluation categories using 10 datasets.

Leading Multilingual Performance

The Aya Model consistently outperforms various baselines across all multilingual benchmarks.

Safety

We evaluate our model for gender bias, social bias, harmfulness, and toxicity across languages.

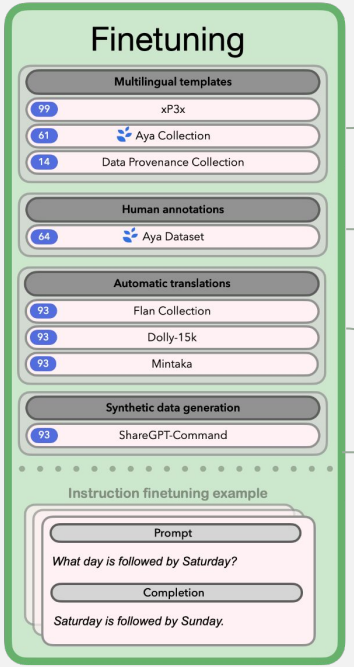
Recipe for building Aya 101

We fine-tuned pretrained multilingual T5 (mT5) language model using instructions in 101 languages

We carefully selected data sources and further prune them to have high quality and diverse set of instruction datasets

We balanced different data sources during fine-tuning, resulting in high performance across several category of tasks

Building a Massively Multilingual and Diverse Instruction Fine-tuning Mixture



Carefully selected and pruned **multilingual templates** from 3 sources:

1) **xP3x,** a multilingual collection of academic datasets
2) **Aya Template Collection,** templated data subset from AYA Collection
3) **Data Provenance Collection,** permissively licenced data collection

101 languages

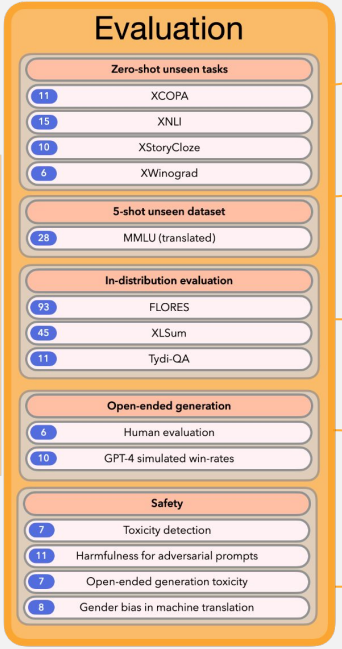
203 million examples

Aya Dataset, a fully human-curated dataset of instructions

Machine translated datasets into 93 languages

Synthetic instructions generated by Cohere Command and translated afterward into 93 languages

Creating a Massively Multilingual Evaluation Suite



Unseen tasks, or tasks the model has not been trained on:

1) **Discriminative,** to test how the model distinguishes between different types of inputs
2) **General purpose,** to test the models ability to handle diverse situations

In-distribution generative tasks, to test for generation of new outputs based on statistical distribution of original model

Human and simulated evaluation, to test quality and nuances of responses

Safety, toxicity, and bias measures, to test for harmful outputs.

Evaluation at a glance:

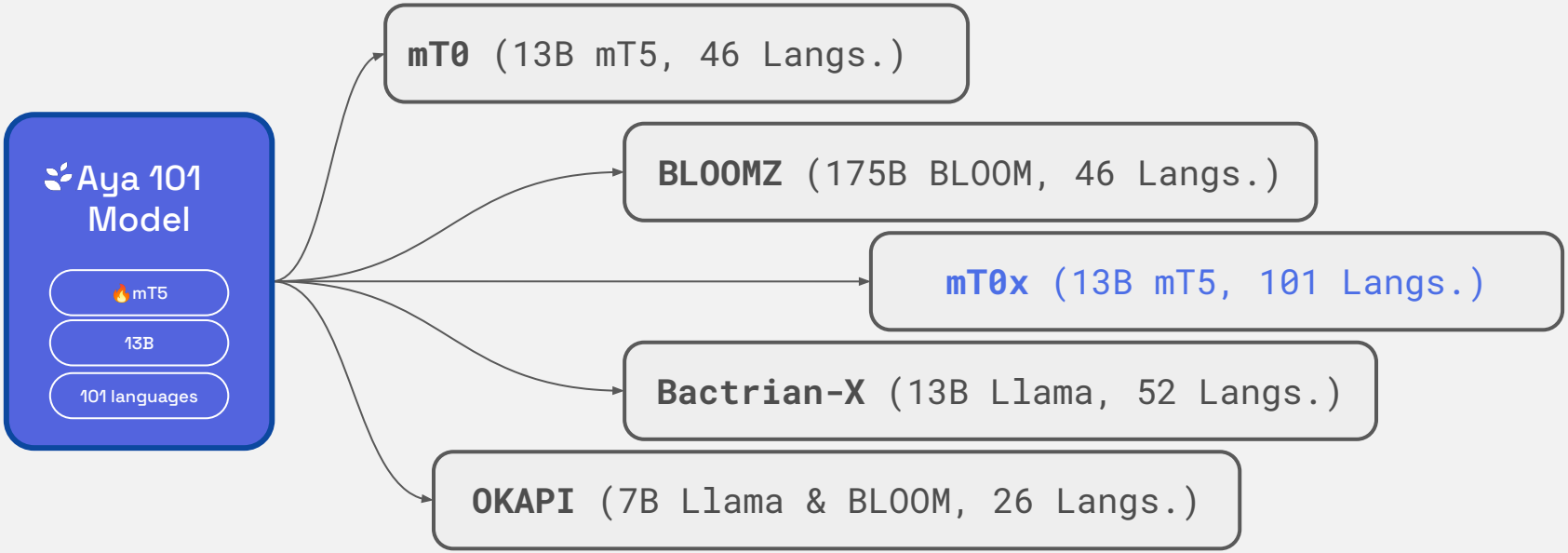
99 languages

13 datasets

6 distinct evaluation types:

- Unseen zero-shot tasks
- General purpose unseen dataset (5-shot)
- In-distribution generative tasks
- Human eval
- LLM simulated eval
- Safety eval

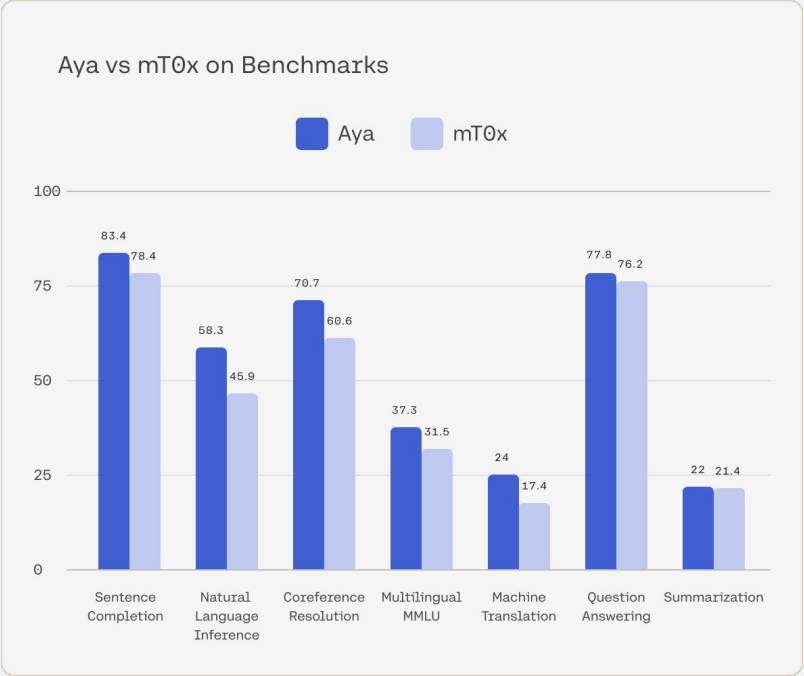
Aya 101 Compared With Multiple Baselines



Advancing Multilingual Performance

Aya 101 achieves superior performance compared to mT0x in the multilingual benchmarks.

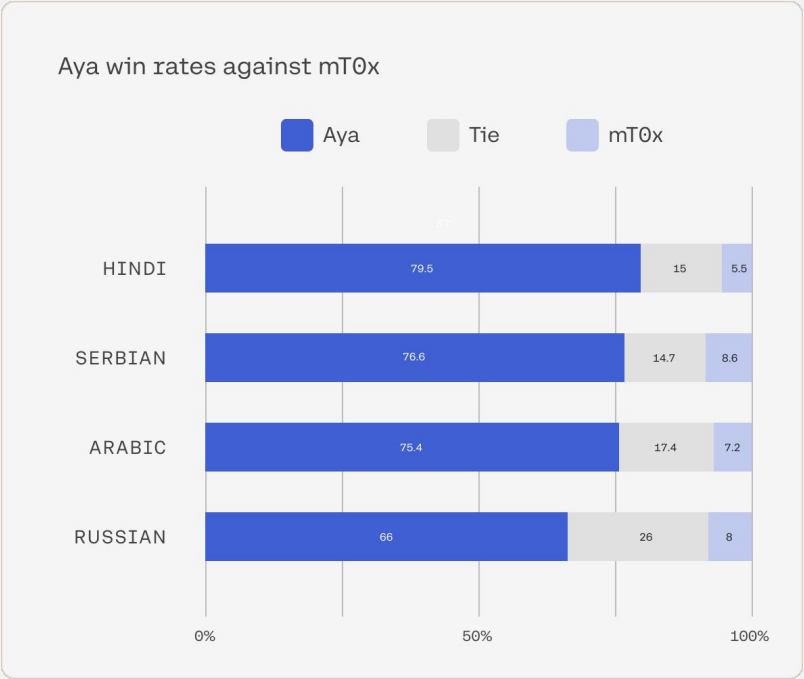
These benchmarks include a collection of unseen tasks and in-distribution generative tasks in total covering 100 languages. The Aya model outperforms mT0x in all tasks showing its multilingual capabilities in different task types.



Aya 101 Win Rates

Aya 101 follows instructions and generates responses of significantly higher quality than mT0x.

According to the human evaluation where the professional annotators compared models' responses for given instructions in multiple languages, **the Aya Model is preferred by an average of 77% times.**



Advancing the state of art with Aya Expanse

Aya Expanse

8B and 32B

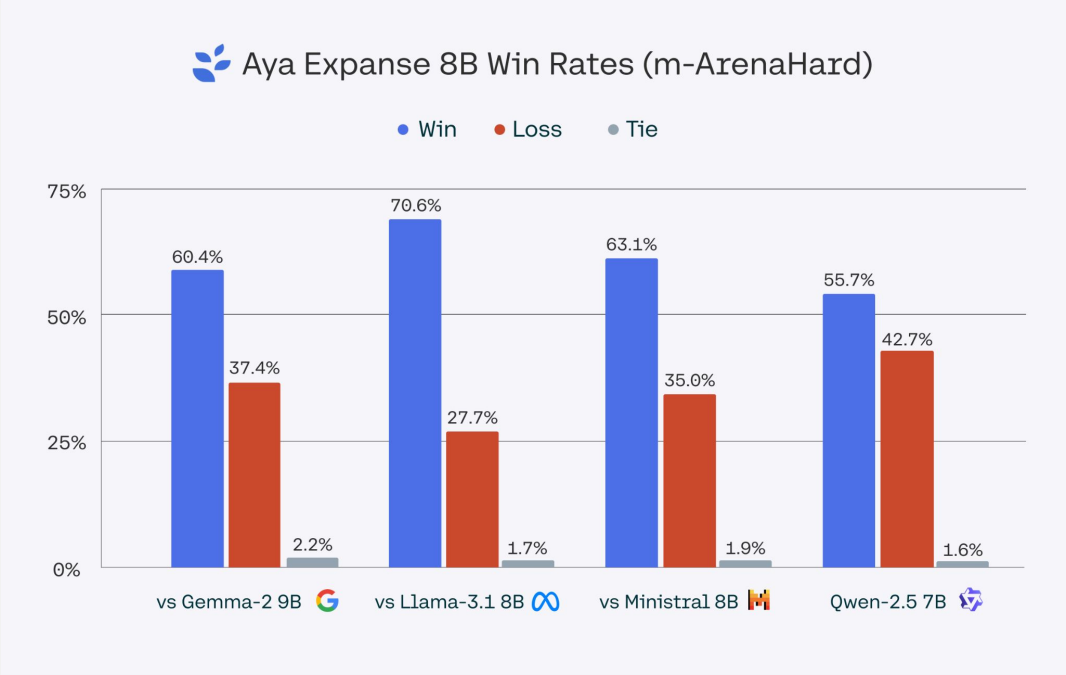
Introducing Aya Expanse

The Aya Expanse models advance the **state of the art in modeling 23 languages which cover half of the world's population**:

Arabic, Chinese, Czech, Dutch, English, French, German, Greek, Hebrew, Hebrew, Hindi, Indonesian, Italian, Japanese, Korean, Persian, Polish, Portuguese, Romanian, Russian, Spanish, Turkish, Ukrainian, and Vietnamese

Leading Multilingual Performance

Aya Expanse achieves **superior performance across 23 languages on difficult, diverse instruction following tasks** when compared to other open weights models including Gemma, Llama, Mistral, and Qwen.



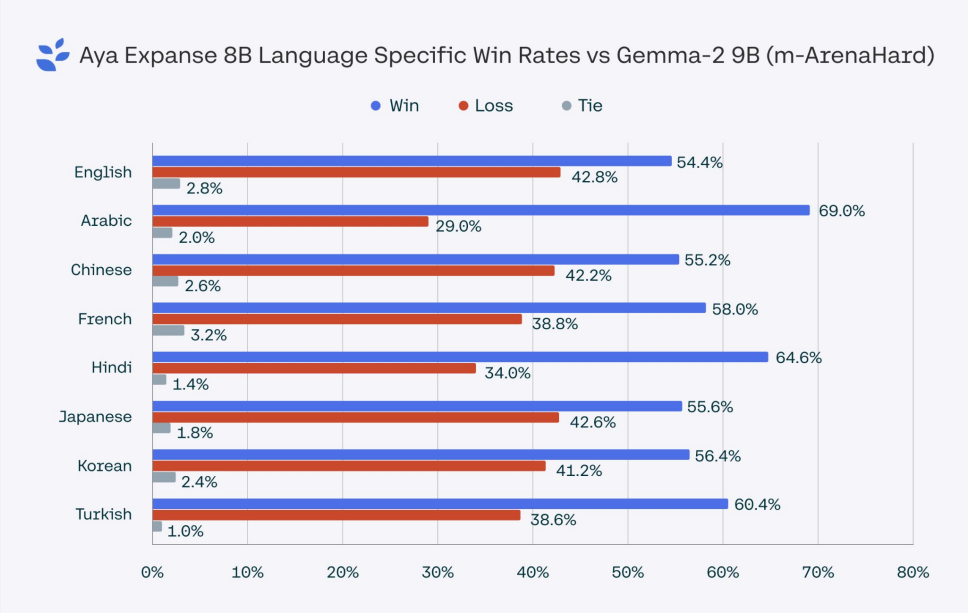
Builds on Several Years of dedicated Multilingual Research

Achieving Aya Expanse's leading multilingual performance **required combining years of multiple, dedicated multilingual research efforts**

Leading Multilingual Performance

Aya Expanse 8B **outperforms Gemma-2 9B across all 23 languages including English!**

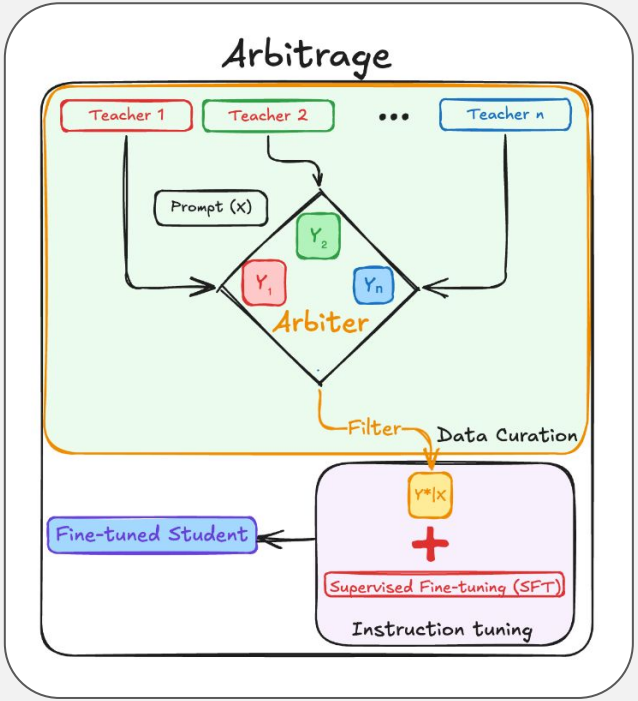
This shows that is possible to advance multilingual performance more equitably for lower resource languages without cannibalizing performance in higher resource languages like English



Training Aya Expanse: Arbitrage

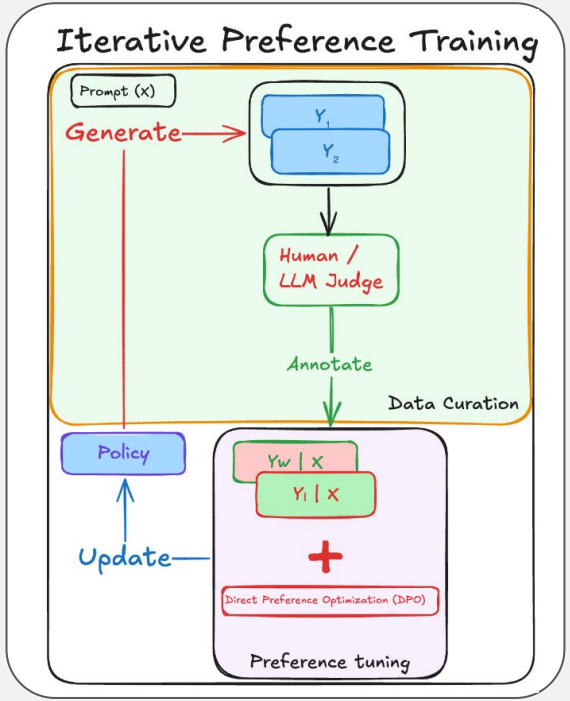
Multilingual Arbitrage: fine-tuning an LLM on the best completion (as determined by an arbiter) from a pool of teacher models

Multilingual Arbitrage enables strategic distillation from a pool of models where any individual teacher model may only be strong in small set of languages or domains



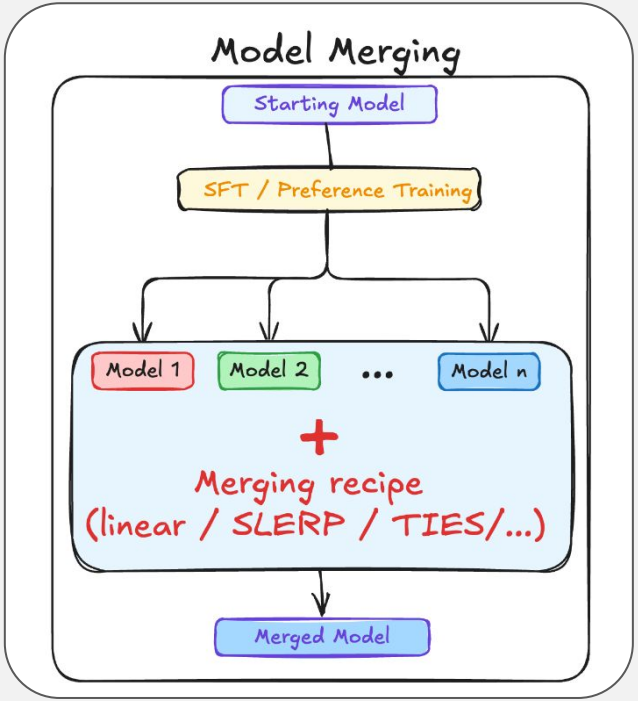
Training Aya Expanse: Preference Training

Aya Expanse is preference-trained by contrasting the best and worst completions from the arbitrage stage, **steering completions away from features of low-quality multilingual completions**



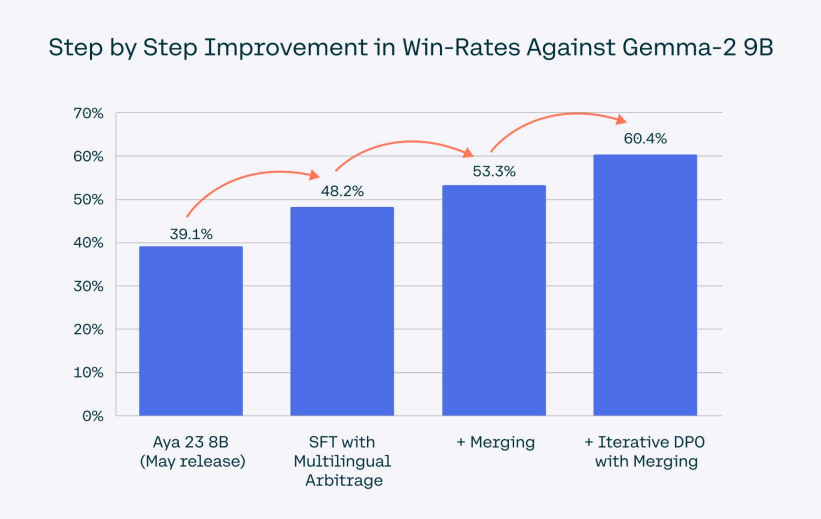
Training Aya Expanse: Model Merging

During SFT and RLHF stages of training Aya Expanse, **multiple models trained on different language subsets of the training data are merged** together to produce a single, more performant model across all languages



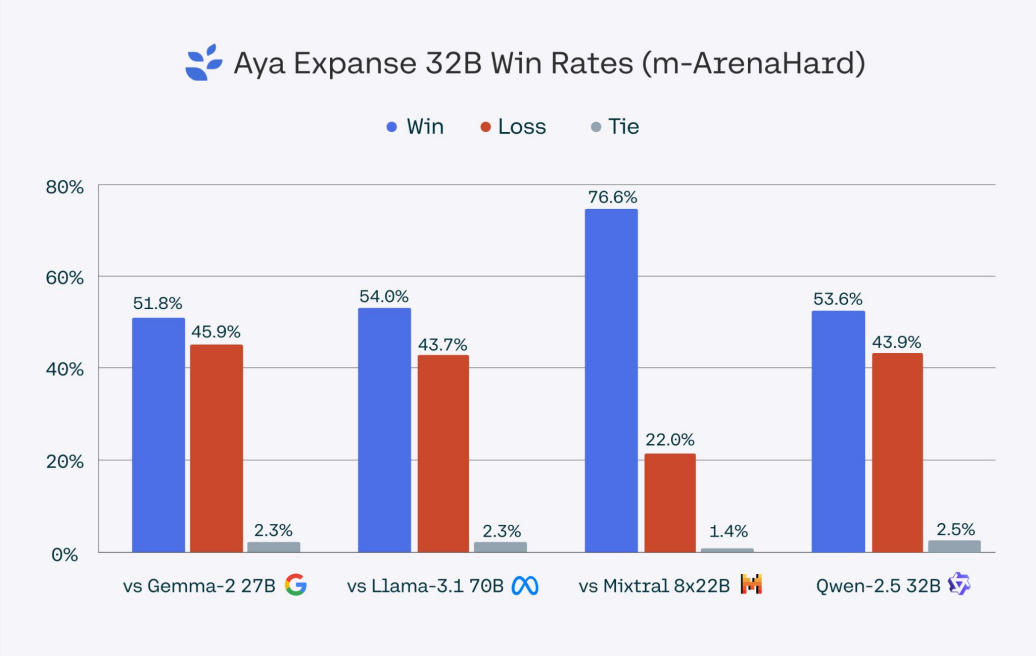
Training Aya Expanse: Summary

Multilingual arbitrage, multilingual preference training, and model merging were **all critical steps in achieving Aya Expanse's remarkable performance**



Scaling Aya Expanse

The same training recipe scales to 32B parameter scale, **outperforming competitor open weights models including LLMs with many more parameters!**



Aya Expanse Team

Core Aya Exanse Team

Madeline Smith, Marzieh Fadaee, Ahmet Üstün, Beyza Ermis, Sara Hooker, John Dang, Shivalika Singh, Arash Ahmadian, Daniel D'souza, Alejandro Salamanca, Aidan Peppin, Arielle Bailey, Meor Amer, Sungjin Hong, Manoj Govindassamy, Sandra Kublik

Wider Cohere For AI and Cohere Contributors

Acyr Locatelli, Adrien Morisot, Jon Ander Campos, Sara Elsharkawy, Eddie Kim, Julia Kreutzer, Nick Frosst, Aidan Gomez, Ivan Zhang

Aya Expanse Language Ambassadors

We create breakthroughs together. Ambassadors represent 45 countries and 23 languages. Before the launch of Aya Expanse, we invited 110 ambassadors to join us to shape how Aya worked for communities all over the world.

Mehmet Emre Akbulut
Samer Attrah
MUHDIN AWOL
Kenza Benkirane
Mann Bhanushali
Isabella Bicalho Frazeto
Danylo Boiko
Sabrina Boumaiza
Samuel Cahyawijaya
Samuel Cahyawijaya
Emirhan Çelik
Ryan Chan
Aurélien-Morgan CLAUDON
Urszula Czerwinska
Joana da Matta
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Burin Intachuen
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Juan Junqueras
Karthik Reddy Kanjula
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Morteza Kashani
Ahmed Khaled
Niharika Khanna
Dipika Khullar
Christopher Klamm
Nazar Kohut
Alkis Koudounas
Diana Kozachek
Katrina Lawrence
James León
Jiazheng Li
Nicolò Loddo
Dante, Fu On Lok
Iro Malta
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Bhavnick Minhas
Shachar Mirkin
Roa'a Mohammad
Yiyang Nan
Sree Harsha Nelaturu
Jekaterina Novikova
Roni Obaid
Olympiah Otieno
Enes Özgözler
Yavuz Alp Sencer Ozturk
Carlos Patiño
Jebish Purbey
Maria Quijano Jesurum
Swati Rajwal
Didi Ramsaran Chin
Divyaraj Rana
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Esra'a Saleh
Roshan Santhosh
Drishti Sharma
Kinza Sheikh
Aditya Shrivastava
Vivek Silimkhan
Marjana Skenduli
Soham Sonar
Gürkan Soykan
David Styveen
Anthony Susevski
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Ameed Taylor
Yiorgos Tsalikidis
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Hieu Vu
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Warren Williams
Joseph Wilson
Gusti Winata
Ege Yakut
Eray Yapağcı
Taha Yassine
Serhan YILMAZ
Hanna Yukhymenko
Mike Zhang

04 The People of Aya

The Frontiers of Participatory Research

Language is a deeply social phenomenon for its everyday users. It thrives on a network of social relations. However, there is no template or rulebook for working with 3000+ researchers and enthusiasts around the world. Instead, we kept in mind some guiding principles:

Whenever we engage with data, we are also engaging with the connections that data has to the people who produce it, prepare it, and distribute it.

Fluid Ownership and Growth

A decentralized model supports fluid leadership and flexible role adoption. It empowers members to take initiative independent of hierarchical position or level of involvement.

Organizational Structure

Asynchronous communication channels facilitate rich and timely collaborations.

Inclusion and Access

Bypass academic norms that often marginalize non-English speakers and people without formal academic credentials.

Participating motivators

Not based on financial remuneration but on ideals of community, identity, and social justice.

Cohere For AI

The Journey of Aya

Watch *The Journey of Aya*, a short documentary in which out collaborators tell the story of how Aya came to be.

Aya 101 Core team 1/2

Listed in alphabetical order.

The Core Team has been responsible for various technical elements of making our Aya 101 models and dataset a reality. Their contributions varied across building an accessible user interface, establishing strong baselines, exploring data augmentation strategies, ensure responsible deployment, and coordinating regional contributions.

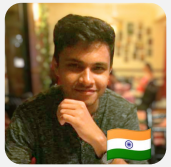
Aisha Alaagib
Cohere For AI Community

Emad A. Alghamdi
King Abdulaziz U ASAS.AI

Zaid Alyafeai
King Fahd University of Petroleum and Minerals or KFUPM

Viraat Aryabumi
Cohere For AI

Max Bartolo
Cohere



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Vu Minh Chien
Cohere For AI Community

Daniel D'souza
Cohere For AI

Irem Ergun
Cohere

Ellie Evans
Cohere For AI Community

Marzieh Fadaee
Cohere For AI

Hakimeh (Shafagh) Fadaei
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MIT

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Sarah Jafari
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Amr Kayid
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Farhan Khot

Wei-Yin Ko
Cohere

Julia Kreutzer
Cohere For AI

Aya 101 Core team 2/2

Listed in alphabetical order.

The Core Team has been responsible for various technical elements of making our Aya 101 models and dataset a reality. Their contributions varied across building an accessible user interface, establishing strong baselines, exploring data augmentation strategies, ensure responsible deployment, and coordinating regional contributions.

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Cohere For AI Community

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MIT

Marina Machado
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Abinaya Mahendiran
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Deividas Mataciunas
Cohere For AI Community

Oshan Mudannayake
Cohere For AI Community

Niklas Muennighoff
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Cohere For AI Community

Gbemileke Onilude
Carnegie Mellon University

Hui-lee Ooi
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Binghamton University, NY, USA

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Shivalika Singh
Cohere For AI Community

Madeline Smith
Cohere For AI

Luísa Souza Moura
Cohere

Ahmet Üstün
Cohere For AI

Freddie Vargus
Cohere For AI Community

Joseph Wilson
University of Toronto

Mike Zhang
IT University of Copenhagen

Yong Zheng Xin
Brown University
Cohere For AI Community

Aya 101 Language Ambassadors 1/3

Listed in alphabetical order.

Language Ambassadors spread the word about Aya to speakers of their language, recruit new contributors, support those contributors to understand the goals of Aya data collection efforts, and celebrate progress.

Diana Abagyan
Russian

Muhammad Abdullahi
Somali

Elyanah Aco
Filipino

Henok Ademtew
Amharic

Adil
Kazakh

Emad A. Alghamdi
Arabic

Zaid Alyafeai
Arabic

Ahmad Anis
Urdu

Daniel Avila
Spanish

Michael Bayron
Cebuano

Nathanael Carraz Rakotonirina
Malagasy

Alberto Mario Ceballos Arroyo
Spanish

Yi Yi Chan Myae Win Shein
Burmese

Vu Minh Chien
Vietnamese

Caroline Shamiso Chitongo
Zulu

Ionescu Cristian
Romanian

Ripal Darji
Gujarati

Suchandra Datta
Bengali

Rokhaya Diagne
Wolof

Irem Ergun
Turkish

Hakimeh (Shafagh) Fadaei
Persian

Aya 101 Language Ambassadors 2/3

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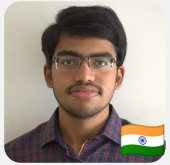
Language Ambassadors spread the word about Aya to speakers of their language, recruit new contributors, support those contributors to understand the goals of Aya data collection efforts, and celebrate progress.



Surya Krishna Guthikonda
Telugu

Aleksandra Hadžić
Serbian

Shamsuddeen Hassan Muhammad
Hausa

Ramith Hettiarachchi
Sinhala

Mochamad Wahyu Hidayat
Sundanese

Rin Intachuen
Thai

Eldho Ittan George
Malayalam

Ganesh Jagadeesan
Hindi

Murat Jumashev
Kyrgyz

Börje Karlsson
Portuguese and Swedish

Abhinav Kashyap
Kannada

JiWoo Kim
Korean

Alkis Koudounas
Italian

Kevin Kudakwashe Murera
Shona

Falalu Ibrahim Lawan
Hausa

Wen-Ding Li
Traditional Chinese

Abinaya Mahendiran
Tamil

Mouhamadane Mboup
Wolof

Oleksander Medyuk
Ukrainian

Pratik Mehta
Hindi

Iftitahu Nimah
Javanese

Aya 101 Language Ambassadors 3/3

Listed in alphabetical order.

Language Ambassadors spread the word about Aya to speakers of their language, recruit new contributors, support those contributors to understand the goals of Aya data collection efforts, and celebrate progress.

Solam Nyangiwe
Xhosa

Laura O'Mahony
Irish

Ifeoma Okoh
Igbo

Hui-Lee Ooi
Malay

Iñigo Parra
Basque

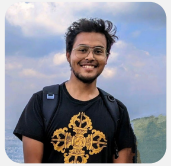
Jay Patel
Gujarati

Hanif Rahman
Pashto

Olanrewaju Samuel
Yorùbá

Suman Sapkota
Nepali

Giacomo Sarchioni
Italian



Rashik Shrestha
Nepali

Bhavdeep Singh Sachdeva
Punjabi

Sean Andrew Thawe
Chichewa

Alperen Ünlü
Turkish

Joseph Wilson
French

Emilia Wiśnios
Polish

Yang Xu
Simplified Chinese

Zheng-Xin Yong (Yong)
Malay

Mike Zhang
Dutch

Top 50 Quality Champions 1/2

Collaborators listed in ascending order based on Aya Quality Score.

These collaborators lead the way in ensuring the textual data contributed to Aya 101 was of high quality including being free of grammatical errors, safe and factually correct, and robust completions to support model training.

- Vu Minh Chien
- Hui-Lee Ooi
- Gamage Omega Ishendra
- Surya Krishna Guthikonda
- Hoang Anh Quynh Nhu
- Moses Oyeleye
- Amarjit Singh Sachdeva
- Mike Zhang
- Almazbekov Bekmyrza Ruslanovich
- Ramla Abdullahi Mohamed
- Börje F. Karlsson
- Regina Sahani Lourdes De Silva Goonetilleke
- Zaid Alyafeai
- Yong Zheng Xin
- Yavuz Alp Sencer Öztürk
- Mohammed Hamdy
- Anitha Ranganathan
- Ramith Hettiarachchi
- Ooi Hui Yin
- Caroline Shamiso Chitongo
- Bhavdeep Singh Sachdeva
- Valentyn Bezshapkin

Top 50 Quality Champions 2/2

Collaborators listed in ascending order based on Aya Quality Score.

These collaborators lead the way in ensuring the textual data contributed to Aya 101 was of high quality including being free of grammatical errors, safe and factually correct, and robust completions to support model training.

- Yang Xu
- Dominik Krzeminski
- Iftitahu Nimah
- Muna Mohamed Abdinur
- Nurbaeva Zhiidegul Talaibekovna
- Younes Bensassi Nour
- Eldho Ittan George
- Caio Dallaqua
- Hakimeh (Shafagh) Fadaei
- Henok Ademtew
- Vijayalakshmi Varadharajan
- Yogesh Haribhau Kulkarni
- Laura O'Mahony
- Jay Patel
- Luísa Souza Moura
- Rama Hasiba
- Geoh Zie Ee
- Gabriela Vilela Heimer
- Pratham Prafulbhai Savaliya
- Deividas Mataciunas
- Ifeoma Okoh
- Alberto Mario Ceballos Arroyo
- Basiiru Silla
- Yiorgos Tsalikidis

Dataset Champions

Collaborators listed in alphabetical order.

Aya 101 Dataset Champions sourced, formatted and submitted open-source datasets in their languages to be included in the Aya collection.

- Diana Abagyan
- Henok Ademtew
- Ahmad Anis
- Hakimeh (Shafagh) Fadaei
- Hamidreza Ghader
- Md. Tahmid Hossain
- Eldho Ittan George
- Ganesh Jagadeesan
- Börje F. Karlsson
- Surya Krishna Guthikonda
- Abinaya Mahendiran
- Desik Mandava
- Iftitahu Nimah
- Wannaphong Phatthiyaphaibun
- Mike Zhang

5000 Contribution Points

Collaborators listed in descending order of most points earned.

These contributors achieved at least 5000 Contributions Points via the Aya data collection user interface.

- Moses Oyeleye
- Vu Minh Chien
- Ramla Abdullahi Mohamed
- Gamage Omega Ishendra
- Nitta Sitakrishna
- Surya Krishna Guthikonda
- Hui-Lee Ooi
- Hoang Anh Quynh Nhu
- Nurbaeva Zhiidegul Talaibekovna
- Muna Mohamed Abdinur
- Amarjit Singh Sachdeva
- Yang Xu
- Almazbekov Bekmyrza Ruslanovich
- Ahmed Mohamed Hussein Malin
- Bhavdeep Singh Sachdeva
- Yong Zheng Xin
- Yavuz Alp Sencer Öztürk
- Regina Sahani Lourdes De Silva Goonetilleke
- Yogesh Haribhau Kulkarni
- Zaid Alyafeai
- L N Deepak
- Caroline Shamiso Chitongo
- Börje F. Karlsson
- Younès Bensassi Nour

1000 Contribution Points 1/3

These contributors achieved at least 1000 Contributions Points via the Aya data collection user interface.

Contributors listed in descending order from most points.

- Sudharshini AJ
- Maryam Sabo Abubakar
- Mr. A. Karthik
- Mike Zhang
- Caio Dallaqua
- Rokhaya Diagne
- Anitha Ranganathan
- Eldho Ittan George
- Dominik Krzeminski
- Rama Hasiba
- Dev Haral
- Gabriela Vilela Heimer
- Júlia Souza Moura
- Suchandra Datta
- Laura O'Mahony
- Valentyn Bezshapkin
- Makomborero Magaya
- Taqi Haider
- R. A. Nirmal Sankalana
- Basiiru Silla
- Ramith Hettiarachchi
- Yat Kan Eden Cheung
- Sefika Efeoglu
- Abdishakuur Mohamed Hussein
- Hakimeh (Shafagh) Fadaei
- Luísa Souza Moura
- Iñigo Parra
- Razafindrakotonjatovo Zo Anjatiana Henitsoa Kokoly
- Aidaiym Omurbekovna
- Ripal Darji
- Mr. MARAPPAN .A
- NDIMBIARISOA Valdo Tsiaro Hasina
- Rafael Panisset Motta
- Jay Patel
- Zalkarbek Tilenbaev
- Meghana Denduluri
- Abdou Sall
- Nathanaël Carraz Rakotonirina
- Dr. Maharasan.K.S
- Khaleel Jageer
- Falalu Ibrahim Lawan
- Iftitahu Nimah
- Armeen Kaur Luthra

1000 Contribution Points 2/3

These contributors achieved at least 1000 Contributions Points via the Aya data collection user interface.

Contributors listed in descending order from most points.

- Elyanah Marie Aco
- Adeer Khan
- Ooi Hui Mei
- Deividas Mataciunas
- Betel Addisu
- Randriamanantena Manitra Luc
- K.Chinnaraju
- Mouhamadane Mboup
- Filamatra Manampy Fanantenana Rasolofoniaina
- Amandeep Singh
- Alberto Mario Ceballos Arroyo
- Geoh Zie Ee
- Andriatsalama Fiononantsoa Jaofera
- Tsaramanga Jeanny Fidelica
- Sean Andrew Thawe
- Ratsimba Ranto Sarobidy
- Srinadh Vura
- Benmeridja Ahmed Younes
- Elshaday Desalegn Asfaw
- Md. Tahmid Hossain
- Henok Ademtew
- Mohammed Nasiru
- Harena Finaritra Ranaivoarison
- Mansi Kamlesh Patel
- Marina Fontes Alcântara Machado
- Tahina Mahatoky
- Ramarozatovomampionona Todisoa Nirina Mickael
- Ana Carolina Correia Pierote
- Ainura Nurueva
- Hollie O'Shea
- Wannaphong Phatthiyaphaibun
- Abubakr Labaran Salisu
- Ooi Hui Yin
- RAKOTONIRINA Tokinantenaina Mathieu Razokiny
- Robinson Rodrigo Silva Oliveira
- Hanif Rahman
- Maminirina Rahenintsoa

1000 Contribution Points 3/3

These contributors achieved at least 1000 Contributions Points via the Aya data collection user interface.

Contributors listed in descending order from most points.

- Krishna Chhatbar
- J.Nirmala
- Tharin Edirisinghe
- Randrianarison Diarintsoa Fandresena No HerijaonaHerijaona
- Andrianarivony Harijaona Fanirintsoa
- Rakotondrainibe Nirisoa Tendry
- Bekbolot Abdirasulov
- Joseph Marvin Imperial
- Ifeoma Okoh
- Sumi Shakya
- Alkis Koudounas
- Mohamad Aboufoul
- Emad A. Alghamdi
- Jothika. S
- Razakahasina Fanomezana Sarobidy
- Valério Viégas Wittler
- Anish Gasi Shrestha
- Joseph Wilson
- Ijeoma Irene Okoh
- Ajayi Akinloluwa Irawomitan
- Zarlykov Kelsinbek
- Micol Altomare
- Yadnyesh Chakane
- Rafidy Julie Tassia
- Rabin Adhikari
- Chinwendu Peace Anyanwu
- Dr. S.P. Balamurugan
- G. A. Jalina Hirushan Gunathunga
- Ogba Stephen Kesandu
- Tiana Kaleba Andriamanaja
- Andriamiadanjato Mioraniaina

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These contributors achieved at least 500 Contributions Points via the Aya data collection user interface.

Contributors listed in descending order from most points.

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- Sabita Rajbanshi
- Silambarasan U.
- Dr.A.Prasanth
- Sara Salvador
- Dr A.Jeba Christy
- Mr.V.Balakrishnan
- Abinaya Mahendiran
- Solam
- Rashik Shrestha
- Easwaran K
- Ahmad Mustafa Anis
- Dr.G.Thilagar
- Gan Chin Chin
- Bhanu Prakash Doppalapudi
- Abdullahi Adan Hassan
- Sara Hooker
- Amjad Abdulkhaliq Alkhatabi
- Muhamad Audi Bin Pasha
- Santiago Pedroza Díaz
- Siyu Wang
- Randinu Jayaratne
- Rithara Kithmanthie
- Bhanu Prakash Doppalapudi
- TSuman Sapkota
- Charindu Abeysekara
- Afifah binti Mohd Shamsuddin
- Verassree Rajaratnam
- Ruqayya Nasir Iro
- Geetharamani R.
- Sandesh Pokhrel
- Orozbai Topchubek uulu
- Prajapati Maitri R.
- Francisco Valente
- Gaurav Jyakhwa
- Mrs. G. Sangeetha
- Ahmet Güneyli

Public Release and Engineering Team 1/2

Collaborators listed in alphabetical order.

The public release team is responsible for bringing Aya to the world. From building and deployment of the model, planning the launch event, creating *The Journey of Aya* documentary, hosting the model and coordinating outreach efforts.

- 🇮🇳 Viraat Aryabumi
- 🇺🇸 Saurabh Baji
- 🇬🇧 Max Bartolo
- 🇨🇦 Claude Beaupré
- 🇬🇧 Phil Blunsom
- 🇪🇸 Tomeu Cabot
- 🇨🇦 Isabelle Camp
- 🇺🇸 Jon Ander Campos
- 🇨🇦 Claire Cheng
- 🇨🇦 Linus Chui
- 🇺🇸 Jenna Cook
- 🇨🇦 Natasha Deichmann
- 🇺🇸 Roy Eldar
- 🇺🇸 Irem Ergun
- 🇩🇪 Beyza Ermis
- 🇳🇱 Marzieh Fadaee
- 🇨🇦 Ramy Farid
- 🇨🇦 Nick Frosst
- 🇺🇸 Josh Gartner
- 🇨🇦 Aidan Gomez
- 🇺🇸 Manoj Govindassamy
- 🇨🇦 Rod Hajjar
- 🇺🇸 Sara Hooker
- 🇨🇦 Monica Iyer
- 🇨🇦 Sarah Jafari
- 🇨🇦 Amr Kayid
- 🇨🇦 Julia Kedrzycki
- 🇺🇸 Wei-Yin Ko

Public Release and Engineering Team 1/2

Collaborators listed in alphabetical order.

The public release team is responsible for bringing Aya to the world. From building and deployment of the model, planning the launch event, creating *The Journey of Aya* documentary, hosting the model and coordinating outreach efforts.

- 🇨🇦 Martin Kon
- 🇺🇸 Dave Kong
- 🇨🇦 Julia Kreutzer
- 🇺🇸 Kyle Lastovica
- 🇺🇸 Tali Livni
- 🇧🇷 Marina Machado
- 🇨🇦 Abigail Mackenzie-Armes
- 🇨🇦 Kim Moir
- 🇬🇧 Luísa Moura
- 🇨🇦 Alyssa Pothier
- 🇺🇸 Brittawnya Prince
- 🇨🇦 Daniel Quainoo
- 🇺🇸 Jess Rosenthal
- 🇺🇸 Sudip Roy
- 🇩🇪 Sebastian Ruder
- 🇬🇧 Astrid Sandoval
- 🇨🇦 Shubham Shukla
- 🇨🇦 Madeline Smith
- 🇨🇦 Trish Starostina
- 🇺🇸 Kate Svetlakova
- 🇨🇦 Chris Taeyoung Kim
- 🇸🇬 Yi Chern Tan
- 🇳🇱 Ahmet Üstün
- 🇨🇦 Jaron Waldman
- 🇨🇦 Donglu Wang
- 🇨🇦 Lauren Waters
- 🇨🇦 Ivan Zhang

Safety Evaluation

Our multilingual human evaluation annotators help us understand model quality across languages. They support our evaluations of where models differ and uncover safety and quality issues.

Faraaz Ahmed

April Alcantara

Kirill Borisov

Owen Chung

Laura De Vuono

Sama Elhansi

Sonja Gavric

Marwan Genena

Robin Gershman

Stuti Govil

Bruno Guratti

Maryam Helmy

Ricardo Joaquin Hornedo Aldeco

Nishi Jain

Milica Jez

Dina Kliuchareva

Finlay Korol-O'Dwyer

Rachel Lo

Juan Lozano

Arishi Maisara

Brenda Malacara

Annika Maldonado

Simar Malhan

Jullia Naag

Sasha O'Marra

Uros Popic

Naeesha Puri

Elina Qureshi

Alizé Qureshi

Manuela Ramirez Naranjo

Boris Sehovac

Ankit Sharma

Hana Sherafati Zanganeh

Ambuj Upadhyay

Susheela Willis

Linda Yanes

Joanna Yulo

Partner Organizations

These organizations supported Aya by hosting events, providing resources, and/or spreading awareness of the project, thereby facilitating contributions and boosting language inclusion efforts.

Universiti Malaysia Sarawak
Faculty of Computer Science and Information Technology

GalsenAI

SIMAD iLab

Google Developer Student Clubs
Thapar Institute of Engineering and Technology, Patiala, under the leadership of Siya Sindhani

Google Developer Student Club
P P Savani University, Surat, Gujarat

KG College of Arts and Science
Coimbatore

Linguistics Circle
Nigeria

Rotaract Club
University of Moratuwa, Sri Lanka, led by Nawoda Thathsarani, Jalina Hirushan and Chamod Perera

Tensorflow
User Group Surat, Gujarat

Aya Expanse

Language Ambassadors 1/2

For Aya Expanse, an additional set of Language Ambassadors supported in testing the model across their languages and raising awareness of the model across their communities.

- Mehmet Emre Akbulut
- Samer Attrah
- MUHDIN AWOL
- Kenza Benkirane
- Mann Bhanushali
- Isabella Bicalho Frazeto
- Danylo Boiko
- Sabrina Boumaiza
- Samuel Cahyawijaya
- Emirhan Çelik
- Ryan Chan
- Aurélien-Morgan CLAUDON
- Urszula Czerwinska
- Joana da Matta
- Nguyễn Đạt
- Manasvi Dawane
- Akanksha Devkar
- Sharad Duwal
- Abdeljalil EL MAJJODI
- Shafagh Fadaei
- Neil Fernandes
- Silvia Fernandez
- Hamidreza Ghader
- Manuel Goulão
- Bassam Gouti
- María Grandury
- Miguel Guerrero
- Siddhesh Gunjal
- Mohammed Hamdy
- Hafedh Hichri
- Nhu Hoang Anh Quynh
- Kyle Howard
- Jiwung Hyun
- Joseph Marvin Imperial
- Burin Intachuen
- Ryan Junejo
- Juan Junqueras
- Karthik Reddy Kanjula
- Albert Kao
- Morteza Kashani
- Ahmed Khaled
- Niharika Khanna
- Dipika Khullar
- Christopher Klamm
- Nazar Kohut
- Alkis Koudounas
- Diana Kozachek
- Katrina Lawrence
- James León
- Jiazheng Li
- Nicolò Loddo
- Dante, Fu On Lok
- Iro Malta
- Harras Mansoor
- Bhavnick Minhas

Aya Expanse

Language Ambassadors 2/2

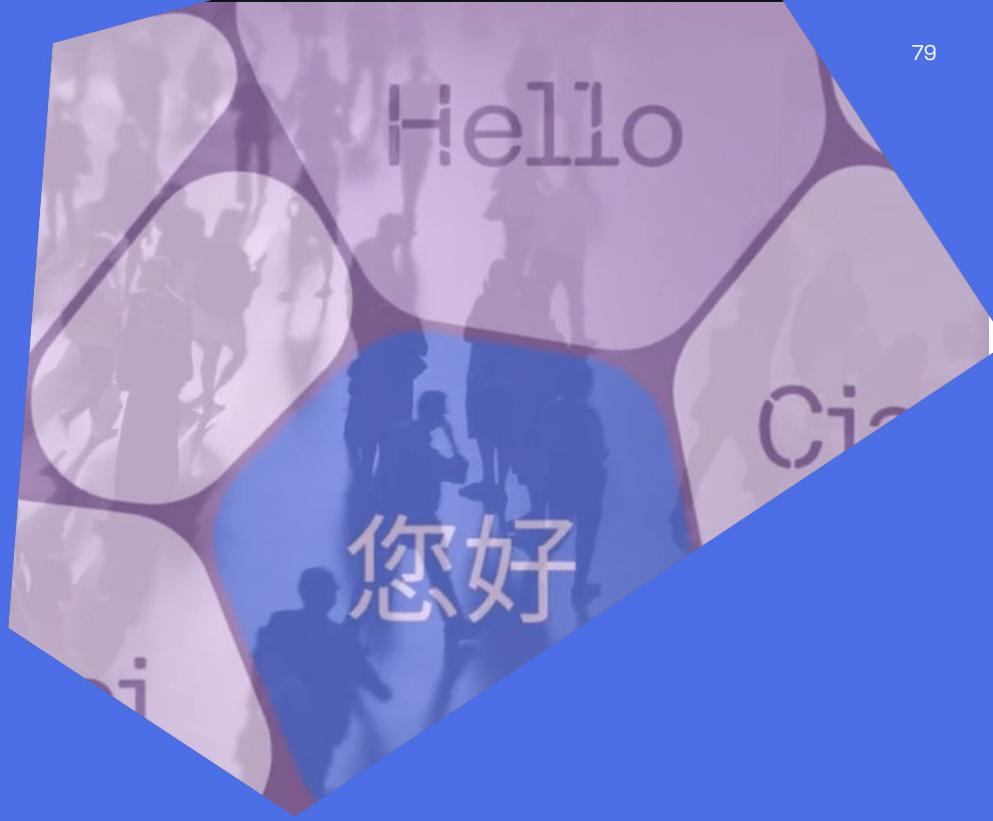
For Aya Expanse, an additional set of Language Ambassadors supported in testing the model across their languages and raising awareness of the model across their communities.

Shachar Mirkin
Roa'a Mohammad
Yiyang Nan
Sree Harsha Nelaturu
Jekaterina Novikova
Roni Obaid
Olympiah Otieno
Enes Özgözler
Yavuz Alp Sencer Ozturk
Carlos Patiño
Jebish Purbey
Maria Quijano Jesurum
Swati Rajwal
Didi Ramsaran Chin

Divyaraj Rana
Aditya Retnanto
Rodrigo Ribeiro Gomes
Esra'a Saleh
Roshan Santhosh
Drishti Sharma
Kinza Sheikh
Aditya Shrivastava
Vivek Silimkhan
Marjana Skenduli
Soham Sonar
Gürkan Soykan
David Styveen
Anthony Susevski

Adrian Szymczak
Joanne Tan
Quentin Tardif
Ameed Taylor
Yiorgos Tsalikidis
Roman Tymtsiv
Muhammad Saad Uddin
Louis Ulmer
Sundar Sripada V. S.
Freddie Vargus
Vlad Vasilescu
Karan Verma
Henry Vo

Minh Chien Vu
Hieu Vu
Azmine Toushik Wasi
Warren Williams
Joseph Wilson
Gusti Winata
Ege Yakut
Eray Yapağcı
Taha Yassine
Serhan YILMAZ
Hanna Yukhymenko
Mike Zhang



05 Responsibility

Safety for All Languages

The model may produce undesirable responses, such as toxic, biased, or harmful responses - but we want to ensure a safe and responsible use - across all languages.

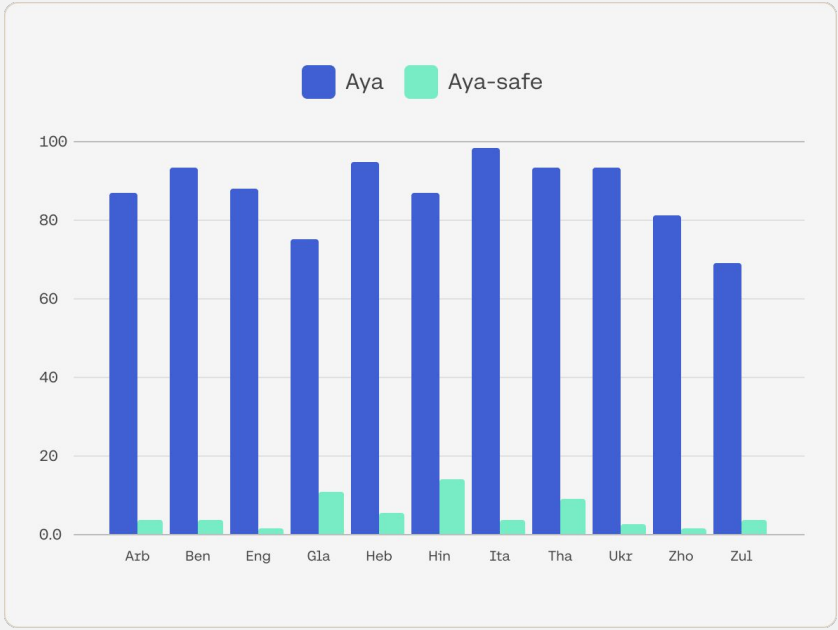
Previous safety mitigations have predominantly focused on English, which can lead to safety oversights in other languages. This means models might produce safe outputs in English but unsafe ones when prompted in different languages.

With Aya, we focus on a wide, multilingual evaluation of biases, toxicity, and harmfulness, and we implement a multilingual safety measure to prevent misuse for potentially harmful user intentions.

Multilingual Safety Context Distillation

First we define a set of unsafe contexts, where a user queries the model with an adversarial prompt and a harmful intention. We can then train the Aya Model to generate refusal messages for such use cases across all of its languages.

The refusal messages are obtained by querying a teacher model with a safety preamble that explicitly discourages harmful responses. By training on these responses, we distill concepts of safety into the Aya Model, achieving *more harmless responses*, and *maintaining open-ended generation quality*.



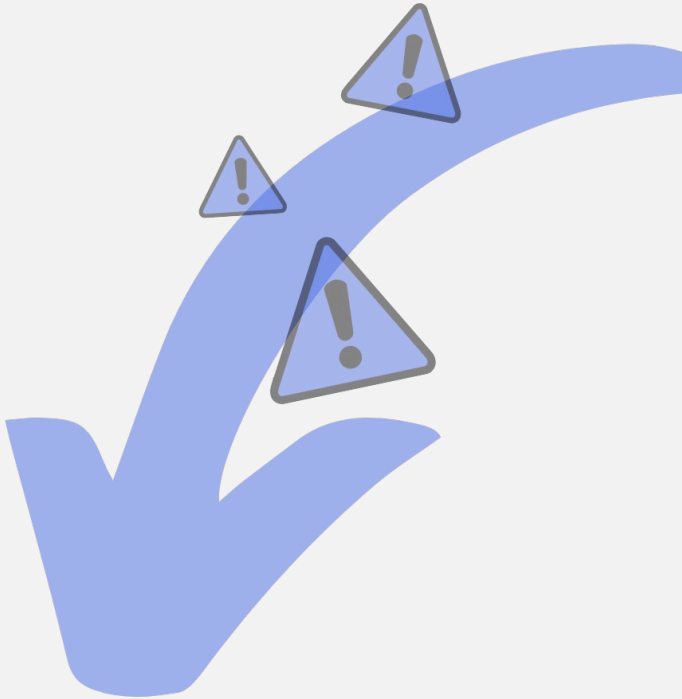
NOTE: The release of the Aya model will make community-based red-teaming efforts possible by exposing an open-source multilingual model for community research.

Measuring Toxicity and Bias

Benchmarking toxicity and bias in models helps us understand how often and how seriously the model might give responses that could be toxic or biased across languages.

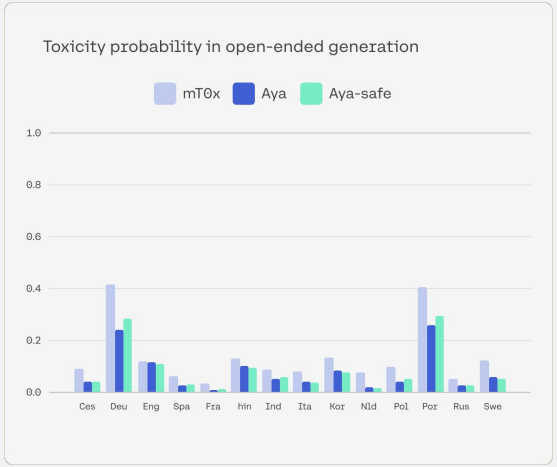
The Aya Model is tested on two evaluation scenarios:

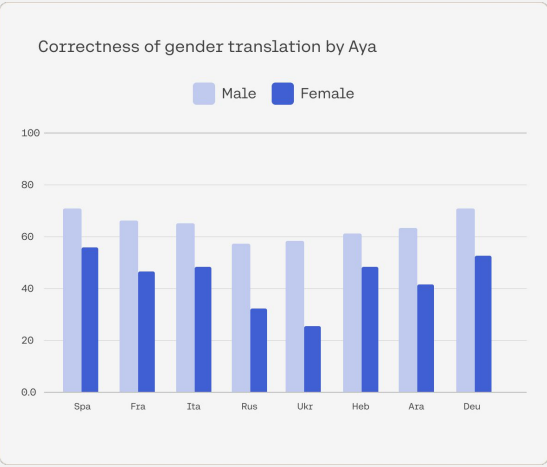
1) Toxicity and bias in open-ended generation, across 14 languages.
2) Gender bias in machine translation, across 8 languages.



Results From Benchmarking Toxicity and Bias

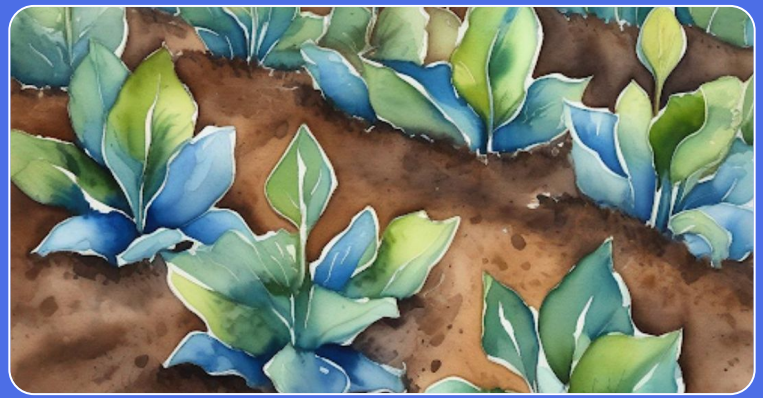
1. Our findings show that instruction fine-tuning and safety mitigation reduce toxicity and bias.
2. Absolute tendencies towards toxic and bias outputs vary across languages.
3. The problem is not solved: especially racial and gender biases are still present.





06
The Aya Movement

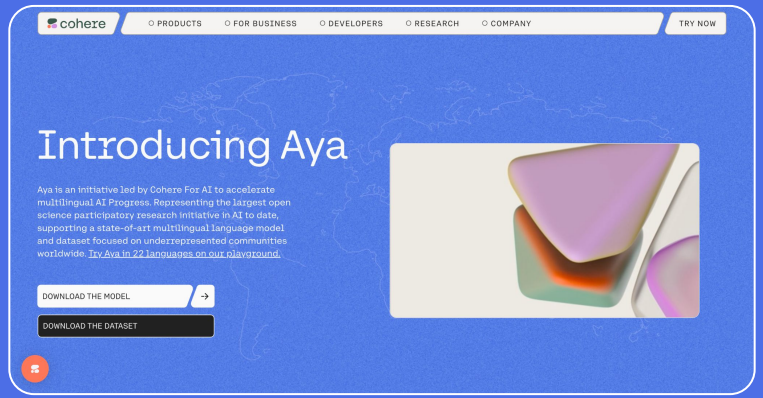
Read the Research



Read our research, Aya Dataset: An Open-Access Collection for Multilingual Instruction Tuning.

Read our research, Aya Model: An Instruction Finetuned Open-Access Multilingual Language Model.

Learn more



Visit the Aya webpage to download the model and dataset, see the latest Aya press coverage, and get to know some of our collaborators.

Read our blog post on Aya 101's release and on Aya Expanse.

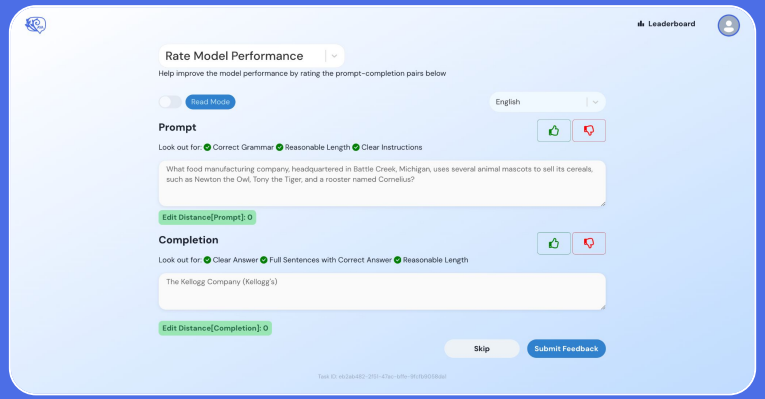
Dive Deeper

Watch *The Journey of Aya*, a 20-minute documentary featuring many of our collaborators that highlights the importance of progress in multilingual ML, and showcases how this major research effort came together over the past year.

Use your own prompts to Try Aya on the Cohere Playground in 22 sample languages, or try Aya Expanse on Hugging Face Spaces.

Join us

This is only the beginning. Aya will be a foundation for additional open science projects and we expect to continue to improve Aya capabilities.



Contribute to Aya. Share expertise in your language to be include. We will continue to release data every year or each time an additional 20,000 annotations are contributed (whichever comes first).

Join Aya Community - a space for ML researchers worldwide to connect, learn from one another, and work collaboratively to advance the field of ML research. We will continue to host open science initiatives.

Aya

cohere.com/research/aya

@CohereForAI

/showcase/cohere-for-ai