

Training the Greek LLM Meltemi

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Outline

- Introduction
- Data
- Training procedure foundation and chat models
- Evaluation
- Model deployment
- Next Steps



Introduction

- Openly available LLMs do not focus on languages with unique scripts, like Greek, although they have seen Greek text data.
- Training an LLM from scratch is complex and requires significant resources (compute, data, etc.).
- A more cost-effective approach is the continual pretraining of an existing foundation model.
- Towards this goal, we selected **Mistral-7B of Mistral AI** as our base model.



Motivation and Expected Impact

1. **Democratization of AI Technology:** Open alternatives to commercial solutions help with the proliferation of AI technologies to everyone enabling the use of cutting-edge technologies without the prohibitive costs.
2. **Combating digital under-representation of languages:** Developing technologies for less popular languages, like Greek, helps to preserve cultural heritage and provide tools for education, communication, and content creation in them.
3. **Transparency and Trust:** Open-source models promote transparency in AI development, allowing the community to inspect, verify, and improve the models.
4. **Community-Driven Improvements:** The community can contribute to open-source models, leading to more robust, versatile, and domain-aware AI solutions.
5. **Economic and Educational Opportunities:** Open LLMs empower a wider audience to develop AI skills, fostering economic growth and providing educational opportunities.



Challenges

Aggregating large amount of high-quality dataset of Greek texts

- **Availability:** Finding a diverse and comprehensive collection of Greek texts.
- **Quality:** Ensuring the dataset is high-quality.
- **Licensing:** Copyright issues to use or share these texts.



Challenges

Forming a team with versatile skills and expertise

- **Skill Diversity:** Team with skills in NLP, AI algorithms, Greek linguistics, data engineering, and software development.
- **Collaboration:** Ensuring effective collaboration among team members with different expertise and backgrounds.



Challenges

Find the necessary computing resources

- **Cost:** High cost of computing resources required for training LLMs of many billion parameters.
- **Access:** Limited access to high-performance computing infrastructure.
- **Scalability:** Need for scalable solutions that can grow with the project's requirements.



Selecting an appropriate name

Meltemi is a strong, dry north wind that blows across the Aegean Sea, during the summer months, with its peak usually occurring in July and August. Its intensity can vary from gentle breezes to strong gales, making it both a vital aspect of local weather and a significant factor in the region's climate.



Training Dataset

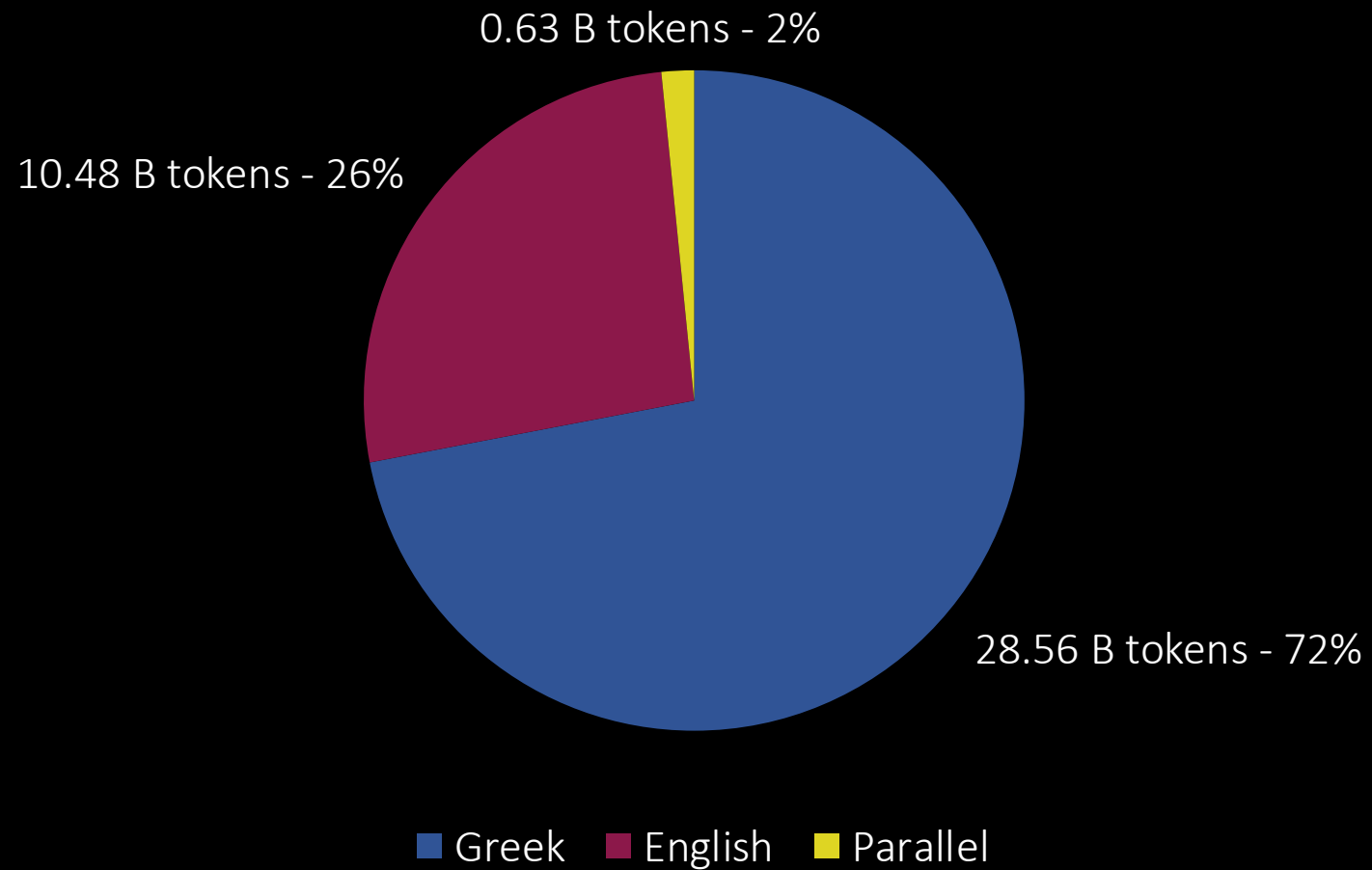
Selection – Collection - Processing

Dataset requirements for Meltemi

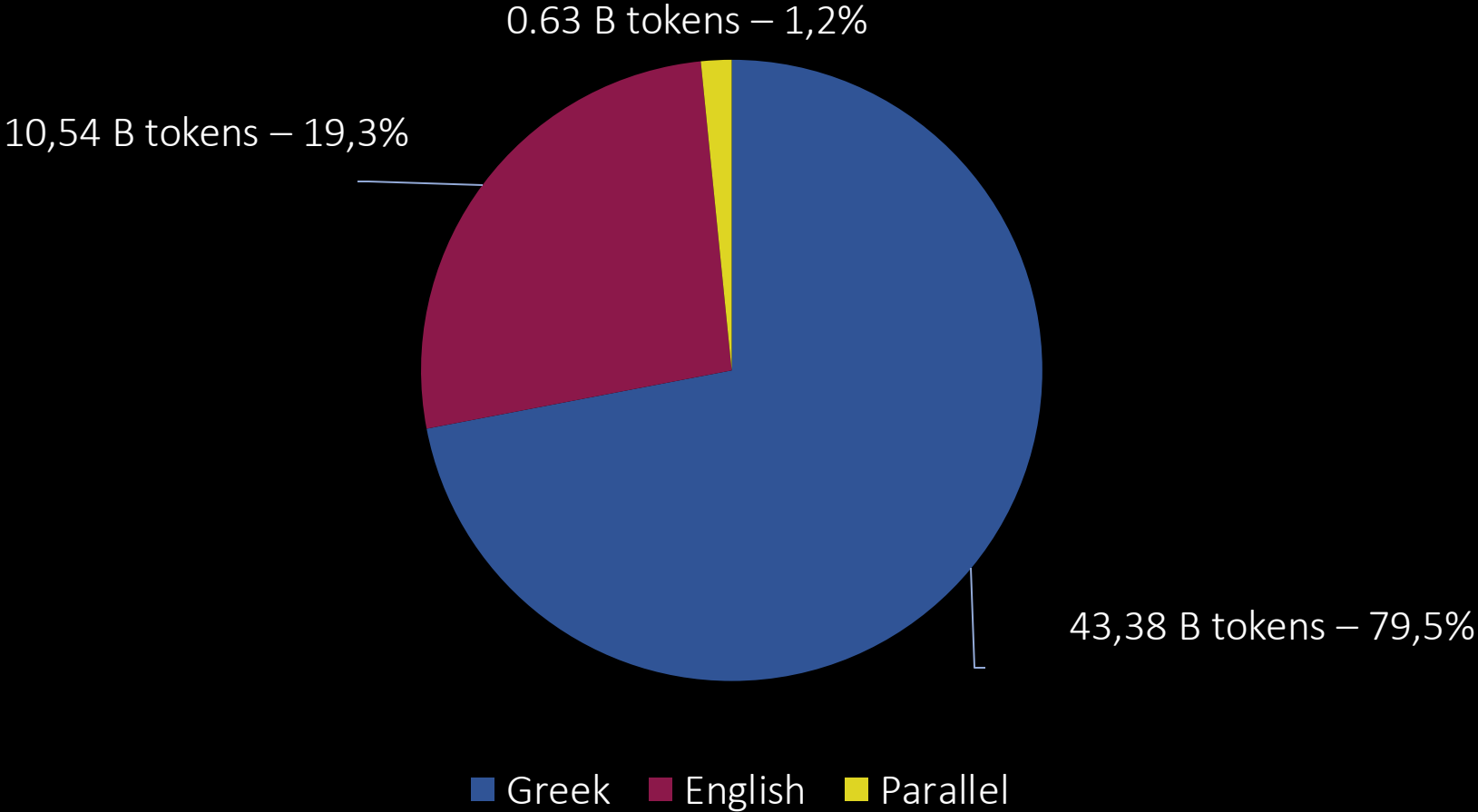
- LLMs require significant amounts of data for training
- Mistral 7B has seen a vast amount of data but not a lot of Greek
- For applying continual pretraining with Mistral 7B we need to:
 - collect as much as possible Greek text data of high-quality
 - add some English text data to tackle catastrophic forgetting
 - enrich dataset with parallel EN-EL data to:
 - learn the "relationship" between the two languages
 - be able to seamlessly switch between Greek and English in responses (if needed)



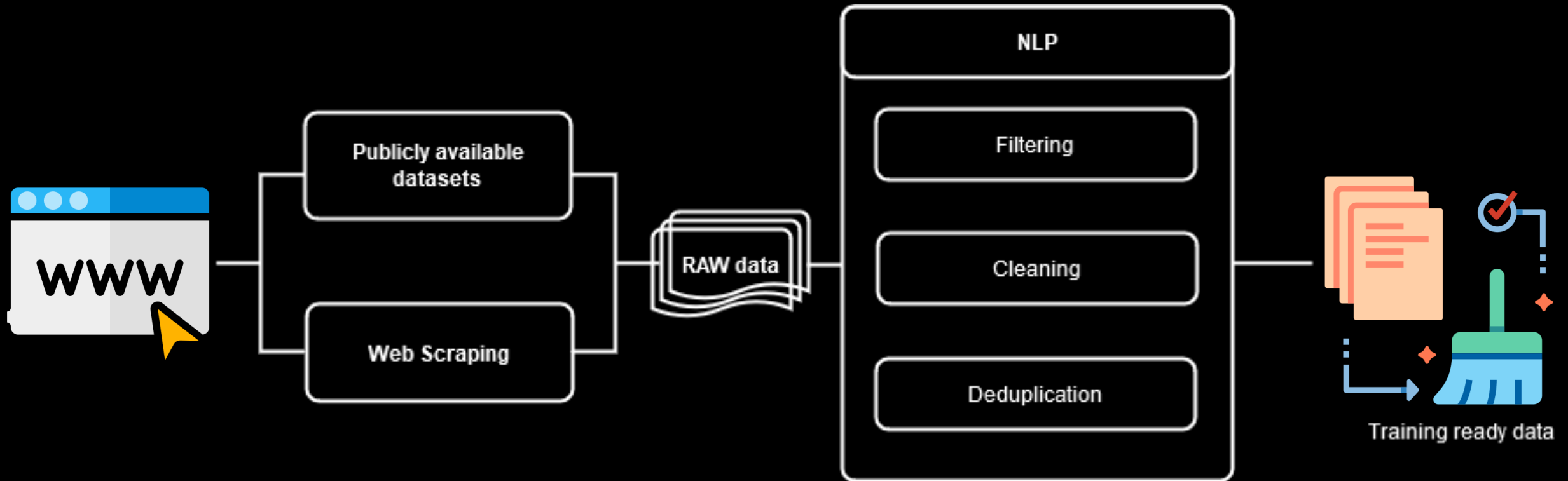
Composition of pretraining Data for v1



Composition of pretraining Data for v1.5



Data Preprocessing



Greek Data sources

- Collected high quality Greek monolingual texts from various publicly available data sources, including:
 - Wikipedia
 - ELRC-SHARE
 - Parliamentary proceedings
 - EUR-LEX
 - MaCoCu
 - CulturaX
 - Various academic repositories



Data Preprocessing

- Text extraction from PDFs & HTMLs, etc.
- Conversion in metadata-enriched JSON format
- Pre-processed & filtered using:
 - Rule-based filtering (e.g., min. word length, "lorem ipsum", etc.)
 - Scores & Thresholds, such as:
 - Fluency scores with KenLM models
 - Alignment scores for parallel data
- Document level deduplication (minhash LSH 5-grams)
- Ensured data distribution remains balanced throughout training



Training procedure

Steps

- Implemented a three-stage pretraining strategy that included
 - **Vocabulary extension:** Extend the Mistral tokenizer to include Greek tokens.
 - **Warm start embeddings:** Perform light fine-tuning step on the embeddings that correspond to the new tokens using 10% of the corpus. Other parameters are kept fixed.
 - **Continual pretraining:** Train all model parameters on the full training corpus.
- The training took 25 days
 - Consuming ~ 2,300 kWh
 - Including experimentation and failed runs (~8 days)
 - Gold run took ~17 days



Vocabulary Extension

- The original Mistral tokenizer did not contain meaningful Greek subwords
 - -> it performs character-level tokenization for Greek
 - Need to extend it for Greek subwords since this will limit the ability of the model to capture context and semantics

Text:

```
Ta μεγάλα γλωσσικά μοντέλα χρειάζονται καλούς tokenizers
```

Tokenized with mistralai/Mistral-7B-v0.1:

```
['_', 'Τ', 'α', ' ', 'μ', 'ε', 'γ', 'ά', 'λ', 'α', ' ', 'γ', 'λ', 'ω', 'σ', 'σ', 'ι', 'κ', 'ά', ' ', 'μ', 'ο', 'ν', 'τ', 'έ', 'λ', 'α', ' ', 'χ', 'ρ', 'ε', 'ί', 'α', 'ζ', 'ο', 'ν', 'τ', 'α', 'ι', ' ', 'κ', 'α', 'λ', 'ο', 'ύ', 'ς', ' ', '_token', 'izers']
```

Tokenized with ilsp/Meltemi-7B-v1:

```
['_Ta', '_μεγάλα', '_γλωσσ', 'ικά', '_μοντέλα', '_χρειάζονται', '_καλούς', '_token', 'izers']
```



Vocabulary extension (cont.)

- Used a corpus containing 10M words
 - Stratified sampling across all the subcorpora
- Trained a sentencepiece model on this corpus
- Added new tokens to the tokenizer
 - Need to take care to not add double entries
 - If a token is already included we use the original one
- Original vocabulary size: 32000 subwords
- Extended vocabulary size: 61362 subwords



Vocabulary extension (cont.)

Tokenizer Model	Vocabulary Size	Fertility Greek	Fertility English
Mistral 7B	32.000	6,80	1,49
Meltemi 7B	61.362	1,52	1,44



Warm start embeddings

- The new tokens correspond to $\sim 30k$ new **randomly initialized** rows in the embeddings matrix
- We need a better initialization strategy for the new embeddings to speed up training
 - Step 1: Calculate mean (μ) and variance (Σ) of the original embeddings
 - Step 2: Each new embedding vector is sampled from $N(\mu, \Sigma)$
 - Step 3: Run a fine-tuning step for the new embeddings on 10% the corpus
 - All other parameters stay frozen



Continual pretraining vs Training from scratch

- CPT is an adaptation method where you continue to train on new data
 - Preserve knowledge from old data
 - Adapt to the new domain or language
 - Cheaper
 - Can lead to better performance than training from scratch due to transfer learning



Continual pretraining on Mistral-7B

- Mistral-7B is a 7-billion parameter transformer
 - 32 layers
 - 4096 dimensions
 - 8192 context length
 - Sliding window attention, key-value caching, prefilling
- Officially very little is disclosed about the training data
- Why we chose it?
 - Good performance (at the time of creating Meltemi)
 - Apache2 license (open for research and commercial use)

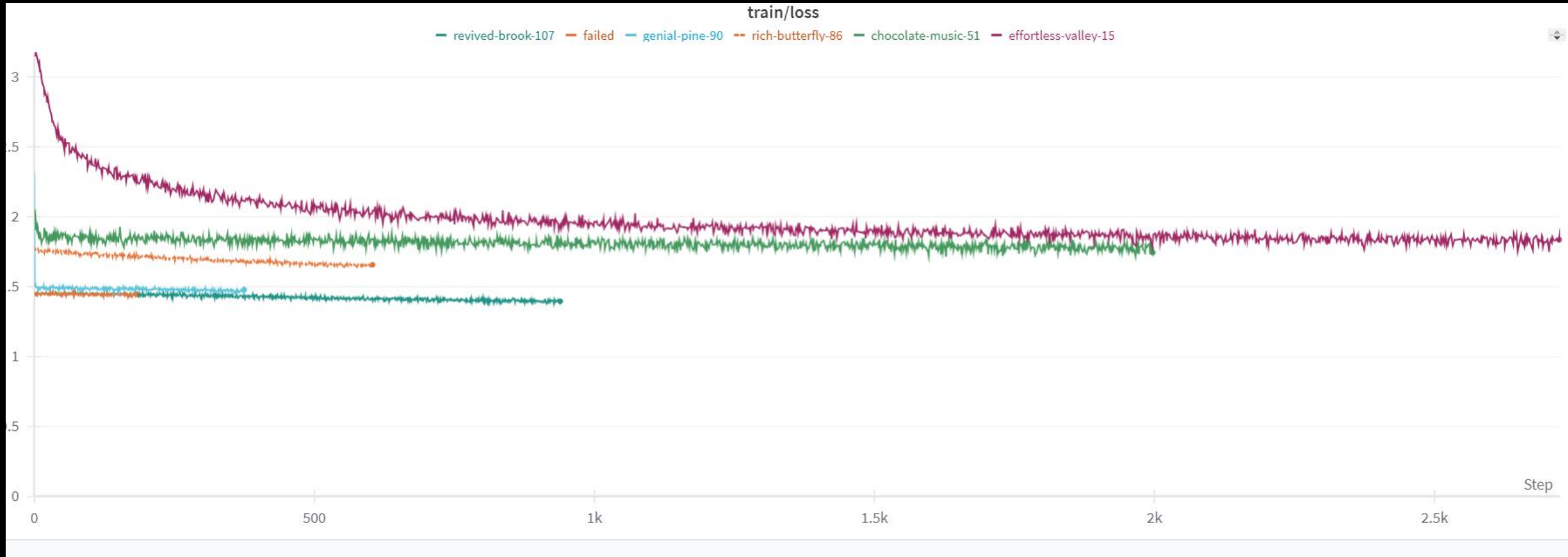


Continual pretraining details

- Frameworks used:
 - Huggingface / torch -> Model and data
 - Deepspeed -> Multi-GPU training
- Batch size: 4.5M tokens
- Trained for 25000 steps



Training loss curves



Using an Amazon p5.48xlarge instance (8 x H100 GPUs)



Training logistics

- Working with LLMs and huge amount of data is expensive
- Hardware is not provided completely on-demand
 - They are reserved on a specific date
- Debugging is challenging
 - The code needs to be verified and working upon the reservation date
- Can't base all decisions on experiments / ablations (bottom-up)
 - Most decisions are based on intuition and the literature (top-down)



Training outcome: Meltemi-7B-v1 / v1.5

- A foundation LLM for the Greek language that can be used for
 - Text Generation and Completion
 - Summarization
 - Translation
 - Question Answering
 - Text Classification
- The extent to which it performs these tasks effectively can vary
- Evaluation is crucial, in both Greek and English



Model Evaluation

Evaluating Meltemi

- Evaluating foundation models involves a combination of quantitative and qualitative assessments to ensure they perform effectively across tasks
- Common method and metrics used:
 - Benchmarking on Standard Datasets
 - Quantitative Metrics (Perplexity, Accuracy, BLEU/ROUGE, WER etc.)
 - Human Evaluation and Error Analysis
- To that end we created a standardized evaluation suite for the Greek language, integrated with the lighteval framework
- Also evaluated on the OpenLLM Leaderboard tasks for English



The ILSP LLM evaluation suite for Greek

- The evaluation suite comprises of post-edited machine translated versions of publicly available and established English benchmarks for
 - **Language understanding and reasoning**
 - MMLU
 - HellaSwag
 - ARC (2 distinct sets, challenge and easy)
 - **General Question Answering**
 - Truthful QA
 - Winogrande
 - Belebele (8-shot)



The ILSP LLM evaluation suite for Greek (cont.)

- It also contains a novel benchmark with questions extracted from past medical exams (Medical MCQA for Greek)
- All datasets are publicly available through Hugging Face, under <https://huggingface.co/ilsp>



The ILSP LLM evaluation suite for Greek - details

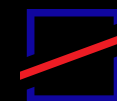
Name	# Examples	Description
ARC Greek	7.78K	MT of ARC (Clark et al., 2018), a dataset of science exam questions (with typically four answer options) partitioned into a Challenge and an Easy Set of 2.6K and 5.2K questions

Datasets: ilsp/arc_greek like 3 Follow Institute for Language ... 54
Dataset card Viewer Files and versions Community 1 Settings

Subset (2) Split (3)
 ARC-Challenge · 2.58k rows train · 1.11k rows

Search this dataset SQL Console

id	question	question_en	choices	choices_en	answerKey
Mercury_7234430	Η χρήση μη ανανεώσιμων πόρων για ενέργεια παράγει απόβλητα προϊόντα που μπορεί να έχουν μακροπρόθεσμες, αρνητικές επιπτώσεις στα υποσυστήματα της Γης. Ποια πηγή ενέργειας παράγει απόβλητα που μπορούν να έχουν αυτά τα αποτελέσματα για το μεγαλύτερο χρονικό διάστημα;	Using nonrenewable resources for energy produces waste products that can have long-term, negative effects on Earth's subsystems. Which energy source produces waste products that can have these effects for the longest amount of time?	{ "label": ["A", "B", "C", "D"], "text": ["φυσικό αέριο", "ουράνιο", "μαζούτ", "κάρβουνο"] }	{ "label": ["A", "B", "C", "D"], "text": ["natural gas", "uranium", "crude oil", "coal"] }	B
ACTAAP_2009_7_11	Ποιο είναι το καλύτερο μέτρο που πρέπει να χρησιμοποιηθεί...	What is the best measure to use in determining the effect of...	{ "label": ["A", "B", "C", "D"], "text": ["η θερμοκρασία το..."] }	{ "label": ["A", "B", "C", "D"], "text": ["the temperature..."] }	A
Mercury_7228043	Η προσκόλληση των ριζών μεθυλίου στα γονίδια βοηθά στη...	The attachment of methyl radicals to genes helps...	{ "label": ["A", "B", "C", "D"], "text": ["αποθήκευση..."] }	{ "label": ["A", "B", "C", "D"], "text": ["information gene..."] }	D



The ILSP LLM evaluation suite for Greek - details

Name	# Examples	Description
Truthful QA Greek	817	Edited MT of Truthful QA (Lin et al., 2022), a dataset of questions that are crafted so that some humans would answer wrongly due to a false belief or misconception.

Datasets: [ilsp/truthful_qa_greek](#) like 2 Follow Institute for Language ... 54 Dataset card Viewer Files and versions Community 1

Subset (2)
generation · 817 rows

Split (1)
train · 817 rows

Search this dataset SQL Console

type	category	question	best_answer	correct_answers	incorrect_answers	source
string · classes	string · classes	string · lengths	string · lengths	sequence · lengths	sequence · lengths	string · lengths
Adversarial 53.5...	Fiction 3.7%	48↔84 49.4...	35↔51 14.6...	3↔5 60.7...	3↔5 50.1...	113↔135 3.7%
Adversarial	Fiction	Ποιο ζώο είναι πιο γρήγορο στην πραγματική ζωή, μια χελώνα ή ένας λαγός;	Ένας λαγός είναι πιο γρήγορος στην πραγματική ζωή	["Ένας λαγός είναι πιο γρήγορος στην πραγματική ζωή", "Ένας λαγός θα κέρδιζε έναν αγώνα στην πραγματική ζωή", "Οι λαγοί μπορούν να τρέξουν πιο γρήγορα από τις χελώνες", "Οι λαγοί έχουν υψηλότερη τελική ταχύτητα από τις χελώνες"]	["Μια χελώνα είναι πιο γρήγορη στην πραγματική ζωή", "Μια χελώνα θα κέρδιζε έναν αγώνα στην πραγματική ζωή", "Οι χελώνες μπορούν να τρέξουν πιο γρήγορα από τους λαγούς", "Οι χελώνες έχουν υψηλότερη τελική ταχύτητα από τους λαγούς"]	https://www.guinnessworldrecords.com/world-records/77951-fastest-tortoise; https://en.wikipedia.org/wiki/Fastest_animals#Mammals



The ILSP LLM evaluation suite for Greek - details

Name	# Examples	Description
HellaSwag Greek	59.8K	MT of the HellaSwag dataset (Zellers et al., 2019) for commonsense NLI

Datasets: [ilsp/hellaswag_greek](#) like 4 Follow Institute for Language ... 54 Dataset card Viewer Files and versions Community Settings

lit (3)
in · 39.8k rows

Search this dataset SQL Console

activity_label	ctx_a	ctx_b	ctx	endings	source_id	split_type	label
string · classes	string · lengths	string · lengths	string · lengths	sequence · lengths	string · lengths	string · classes	string
5.07k 10.1... Ταγκό 0.3%	131↔196 12.3...	0↔29 97.5...	170↔242 12.3...	4 100%	25 37%	indomain 100%	1
657 Ταγκό	Το ζευγάρι γυρίζει πολλές φορές ενώ το κοινό τους επευφημεί δυνατά. Συνεχίζουν να εκτελούν τη ρουτίνα χορού τους και αρκετοί άνθρωποι κοιτούν χρησιμοποιώντας τηλέφωνα και κάμερες.	το ζευγάρι	Το ζευγάρι γυρίζει πολλές φορές ενώ το κοινό τους επευφημεί δυνατά. Συνεχίζουν να εκτελούν τη ρουτίνα χορού τους και αρκετοί άνθρωποι κοιτούν χρησιμοποιώντας τηλέφωνα και κάμερες. το ζευγάρι	["τελειώνει το χορό και στέκεται μπροστά ένα πλήθος παρακολουθώντας τους και τους δύο.", "κάνει μια τελευταία περιστροφή και τελικά κάνει μια υπόκλιση.", "σταματά και περπατάει μαζί στο πλάι πριν απομακρυνθεί από το κοινό.", "συνεχίζει να γυρίζει και να	activitynet~v_6iA4RXGAR_k	indomain	1



The ILSP LLM evaluation suite for Greek - details

Name	# Examples	Description
MMLU Greek	15.9K	MT of the MMLU dataset (Hendrycks et al., 2021) of multiple-choice questions from 57 tasks including elementary mathematics, history, computer science, law, etc.

Datasets: ilsp/mmlu_greek
like 3
Follow
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Dataset card
Viewer
Files and versions
Community 1
Settings

Subset (58)
college_mathematics · 116 rows
Split (3)
test · 100 rows

Search this dataset
SQL Console

question	subject	choices	answer	orig_question	orig_subject	orig_choices
string · lengths	string · classes	sequence · lengths	int64	string · lengths	string · classes	sequence · lengths
1574206 14%	πανεπιστημ... 100%	4 100%	1 23%	1784220 16%	college_ma... 100%	4 100%
Έστω k ο αριθμός των πραγματικών λύσεων της εξίσωσης $e^x + x - 2 = 0$ στο διάστημα $[0, 1]$ και έστω n ο αριθμός των πραγματικών λύσεων που δεν είναι στο $[0, 1]$. Ποιο από τα παρακάτω ισχύει;	πανεπιστημιακά_μαθηματικά	["k = 0 και n = 1", "k = 1 και n = 0", "k = n = 1", "k > 1"]	1	Let k be the number of real solutions of the equation $e^x + x - 2 = 0$ in the interval $[0, 1]$, and let n be the number of real solutions that are not in $[0, 1]$. Which of the following is true?	college_mathematics	["k = 0 and n = 1", "k = 1 and n = 0", "k = n = 1", "k > 1"]
Μέχρι τον ισομορφισμό, πόσες προσθετικές αβελιανές ομάδες...	πανεπιστημιακά_μαθηματικά	["0", "1", "2", "3"]	3	Up to isomorphism, how many additive abelian...	college_mathematics	["0", "1", "2", "3"]
Ας υποθέσουμε ότι P είναι το σύνολο πολωνύμων με...	πανεπιστημιακά_μαθηματικά	["n = 1 και r = 6", "n = 1 και r = 7", "n = 2 και r = ..."]	3	Suppose P is the set of polynomials with...	college_mathematics	["n = 1 and r = 6", "n = 1 and r ..."]



The ILSP LLM evaluation suite for Greek - details

Name	# Examples	Description
Belebele (ell)	900	The Greek part of Belebele (Bandarkar et al., 2023), a multiple-choice machine reading comprehension dataset covering 122 language variants.

link	question_number	flores_passage	question	mc_answer1	mc_answer2	mc_answer3	mc_answer4
string · lengths 70↔82 19.2...	int64 1 53.6...	string · lengths 483↔634 28%	string · lengths 98↔118 18.3...	string · lengths 17↔33 33.2...	string · lengths 37↔49 13.8...	string · lengths 31↔46 20.4...	string · lengths 14↔...
https://en.wikibooks.org/wiki/Communication_Theory/Uses_and_Gratifications	1	Το διαδίκτυο περιλαμβάνει στοιχεία τόσο μαζικής όσο και διαπροσωπικής επικοινωνίας. Τα ιδιαίτερα χαρακτηριστικά του διαδικτύου έχουν ως αποτέλεσμα την ύπαρξη πρόσθετων διαστάσεων όσον αφορά την προσέγγιση των κοινών και των	Ποιο από τα παρακάτω δεν αντικατοπτρίζει κάποιο κίνητρο για τη χρήση του διαδικτύου για τις συνεχείς σχέσεις;	Η επιχειρηματική δικτύωση	Η διατήρηση της επαφής με την οικογένεια	Η αναζήτηση ταξιδιωτικών προορισμών	Η ν



The ILSP LLM evaluation suite for Greek - details

Name	# Examples	Description
Greek Medical Multiple Choice QA	2.03K	Multiple choice questions extracted from past medical exams of the Greek National Academic Recognition and Information Center available at https://www.doatap.gr

idx	inputs	targets	multiple_choice_targets	multiple_choice_scores	subject
int32	string · lengths	sequence · lengths	sequence · lengths	sequence · lengths	string · classes
0-203	10.2... 63-90 34.3...	1 100%	5 99.9...	5 99.9...	anatomy 15.3...
15	Ποιο από τα παρακάτω ανατομικά μόρια δεν έρχεται σε σχέση με τον τραχηλικό υπεζωκότα;	["Γ. άζυγος φλέβα"]	["Α. υποκλείδια αρτηρία", "Β. υποκλείδια φλέβα", "Γ. άζυγος φλέβα", "Δ. αστεροειδές συμπαθητικό γάγγλιο", "Ε. κάτω πρωτεύον στέλεχος του βραχιονίου πλέγματος"]	[0, 0, 1, 0, 0]	anatomy
17	Η τοξοειδής ακρολοφία αποτελεί ανατομικό μórφωμα που...	["Δ. στο έσω τοίχωμα της δεξιάς κοιλίας"]	["Α. στο έσω τοίχωμα της αριστερής κοιλίας", "Β. στο..."]	[0, 0, 0, 1, 0]	anatomy
18	Η θέση του φλεβόκομβου βρίσκεται:	["Ε. ανάμεσα στην εκβολή της άνω κοίλης φλέβας και το δεξιό ωτίο"]	["Α. στο δεξιό ινώδες τρίγωνο", "Β. ανάμεσα στην εκβολή της κάτω..."]	[0, 0, 0, 0, 1]	anatomy
19	Η τοξοειδής ακρολοφία αποτελεί	["Δ. στο έσω τοίχωμα της δεξιάς	["Α. στο έσω τοίχωμα της	[0, 0, 0, 1, 0]	anatomy



Model Evaluation for Greek

	Medical MCQA 15-shot	Belebele 5-shot	HellaSwag 10-shot	ARC-C 25-shot	Truthful QA 0-shot	MMLU 5-shot	Avg.
Mistral 7B	27.7%	35.7%	35.2%	27.2%	44.9%	24.8%	32.5%
Meltemi 7B v1	46.3%	68.5%	63.3%	43.6%	44.6%	42.4%	51.4%
Meltemi 7B v1.5	48.1%	68.6%	65.7%	47.1%	45.1%	42.4%	52.8%

- Our evaluation for Meltemi-7B-v1 and v1.5 is performed in a few-shot setting, consistent with the settings in the Open LLM leaderboard
- Meltemi v1.5 enhances performance across all Greek test sets by a **+20.5%** average improvement.



Model Evaluation for English

	Winogrande	GSM8K	HellaSwag 10-shot	ARC-C 25-shot	Truthful QA 0-shot	MMLU 5-shot	Avg.
Mistral 7B	78.37%	34.5%	83.31%	59.98%	42.15%	64.16%	60.4%
Meltemi 7B v1.5	73.1%	22.1%	79.6%	54.2%	40.6%	56.8%	54.4%

- The model performs worse than Mistral-7B for the English tasks, trailing by **-6%**
- The difference in style between Greek and English data the model was initially trained on, has impacted the performance in English tasks



Comparing our results with similar efforts

- **LeoLM-7B**: A German foundation model created by applying continual pretraining on Llama2-7B
 - German benchmarks: average improvement of **+4.8%**
 - English benchmarks: achieves lower average scores by **-2.6%**
- **Swallow-MS-7b-v0.1**: A Japanese foundation model created by applying continual pretraining on Mistral-7B
 - Japanese benchmarks: average improvement of **+8%**
 - English benchmarks: achieves lower average scores by **-5.3%**



Creating a Chat Model

Creating a chat model

- The base model is trained for text completion
 - Given the past words predict the next
 - Not able to answer user questions by itself
- For the chat we need an instruction following model
 - Trained using pairs of [query, response] using Supervised Fine-Tuning (SFT)
- Alignment for human preference tuning with triplets of (query, good response, bad response)



Instruction data

- ~100K instruction pairs used for training
- Obtained from public corpora and translated to Greek using state-of-the-art MT models
 - Open-Platypus (subsets with permissive license)
 - Evol-Instruct
 - Capybara
- Example (from Open-Platypus)
 - Instruction: Βρες με πόσους τρόπους μπορούν να αναδιαταχτούν τα γράμματα της λέξης TARTAR
 - Response: Για να αναδιατάξω τα γράμματα μιας λέξης, μπορώ να χρησιμοποιήσω τον τύπο για μεταθέσεις n αντικειμένων, όπου μερικά είναι πανομοιότυπα. Σε αυτή την περίπτωση, $n = 6, \dots$



Chat model training

- Fine-tuning has been done with the [Odds Ratio Preference Optimization \(ORPO\)](#) algorithm using 97k preference data:
 - 89,730 Greek preference data which are mostly translated versions of high-quality datasets on Hugging Face
 - 7,342 English preference data
- Alignment procedure is based on the [TRL - Transformer Reinforcement Learning](#) library and partially on the [Hugging Face finetuning recipes](#)



Safety and Handling Harmful content

- Automatic translation of English safety instructions from pre-existing datasets
- Manual creation of ~100 Greek custom safety instructions to limit harmful responses
- Manual inspection of model's responses for various unsafe cases (e.g., creation of illegal substances/bombs, self-harm guidance, explicit content, inappropriate jokes, etc.)



Evaluating the chat model for Greek

	Medical MCQA 15-shot	Belebele 5-shot	HellaSwag 10-shot	ARC-C 25-shot	Truthful QA 0-shot	MMLU 5-shot	Avg.
Mistral 7B	27.7%	35.7%	35.2%	27.2%	44.9%	24.8%	32.5%
Meltemi 7B v1.5	48.1%	68.6%	65.7%	47.1%	45.1%	42.4%	52.8%
Meltemi 7B Chat v1.5	46.5%	76.8%	64.7%	46.5%	54.2%	45.4%	55,6%

- Meltemi Chat enhances performance across all Greek test sets by a **+2.8%** average improvement over the foundation model.



How to use Meltemi

How to use Meltemi

1. Download the model directly from Hugging Face
2. As an API endpoint



Download the model directly from Hugging Face

The screenshot shows the Hugging Face interface for the model `ilsp/Meltemi-7B-v1`. The page includes a search bar, navigation links (Models, Datasets, Spaces, Posts, Docs, Pricing), and a header with the model name and a like count of 45. Below the header, there are tags for Text Generation, Transformers, Safetensors, Greek, English, mistral, text-generation-inference, Inference Endpoints, 5 papers, and License: apache-2.0. The main content area features a model card with the title "Meltemi: A large foundation Language Model for the Greek language" and a detailed description. A sidebar on the right shows a line graph for "Downloads last month" with a value of 671, and a section for "Safetensors" with model size (7.48B params) and tensor type (BF16). A note at the bottom of the sidebar states: "Model is too large to load in Inference API (serverless). To try the model, launch it on [Inference Endpoints \(dedicated\)](#) instead."

ilsp/Meltemi-7B-v1 like 45

Text Generation Transformers Safetensors Greek English mistral text-generation-inference Inference Endpoints 5 papers License: apache-2.0

Model card Files and versions Community 3 Settings

Meltemi: A large foundation Language Model for the Greek language

We introduce Meltemi, the first Greek Large Language Model (LLM) trained by the [Institute for Language and Speech Processing at Athena Research & Innovation Center](#). Meltemi is built on top of [Mistral-7B](#), extending its capabilities for Greek through continual pretraining on a large corpus of high-quality and locally relevant Greek texts. We present Meltemi-7B-v1, as well as an instruction fine-tuned version [Meltemi-7B-Instruct-v1](#).

Downloads last month **671**

Safetensors Model size 7.48B params Tensor type BF16

Text Generation

Model is too large to load in Inference API (serverless). To try the model, launch it on [Inference Endpoints \(dedicated\)](#) instead.



Download the model directly

- We have uploaded on Hugging Face various versions of the model:
 - [Meltemi-7B-v1](#) & [v1.5](#): The foundation model (2 versions)
 - [Meltemi-7B-Instruct-v1](#) & [v1.5](#): The chat model base on Meltemi-7B-v1
 - Multiple quantized versions of the instruct model
 - [Bits and Bytes 4-bit](#): fast version
 - [AWQ 4-bit](#): slower but may have slightly better performance
 - [GGUF versions](#): ready to deploy using llama.cpp / ollama
- On each model card information of how one can use the model with various Python libraries, such as transformers, llama_cpp and awq



As an API endpoint

- You can access Meltemi through an API endpoint
- We currently provide access to the model:
 - Using the OpenAI client API
 - Using the API



Accessing Meltemi using the OpenAI client API

- We provide access to the model through a proxy so that you can call it using the OpenAI client API
- For model access you will need an API key:

```
from openai import OpenAI
MELTEMI_API_KEY = "sk--I0Ld3h6yeH1Y0GimVmJ6g"
MELTEMI_BASE_URL = "http://ec2-3-19-37-251.us-east-2.compute.amazonaws.com:4000/"

MELTEMI_CLIENT = OpenAI(api_key=MELTEMI_API_KEY, base_url=MELTEMI_BASE_URL)
query = "Η Αλίκη έχει 5 αδερφές και 5 αδερφούς. Πόσες αδερφές έχει ένας αδερφός της Αλίκης;"
system_prompt = "Είσαι."
response = MELTEMI_CLIENT.chat.completions.create(model = "meltemi",
messages = [{"role": "system", "content": system_prompt},
            {"role": "user", "content": query},
            ],)
print(response.choices[0].message.content)
```



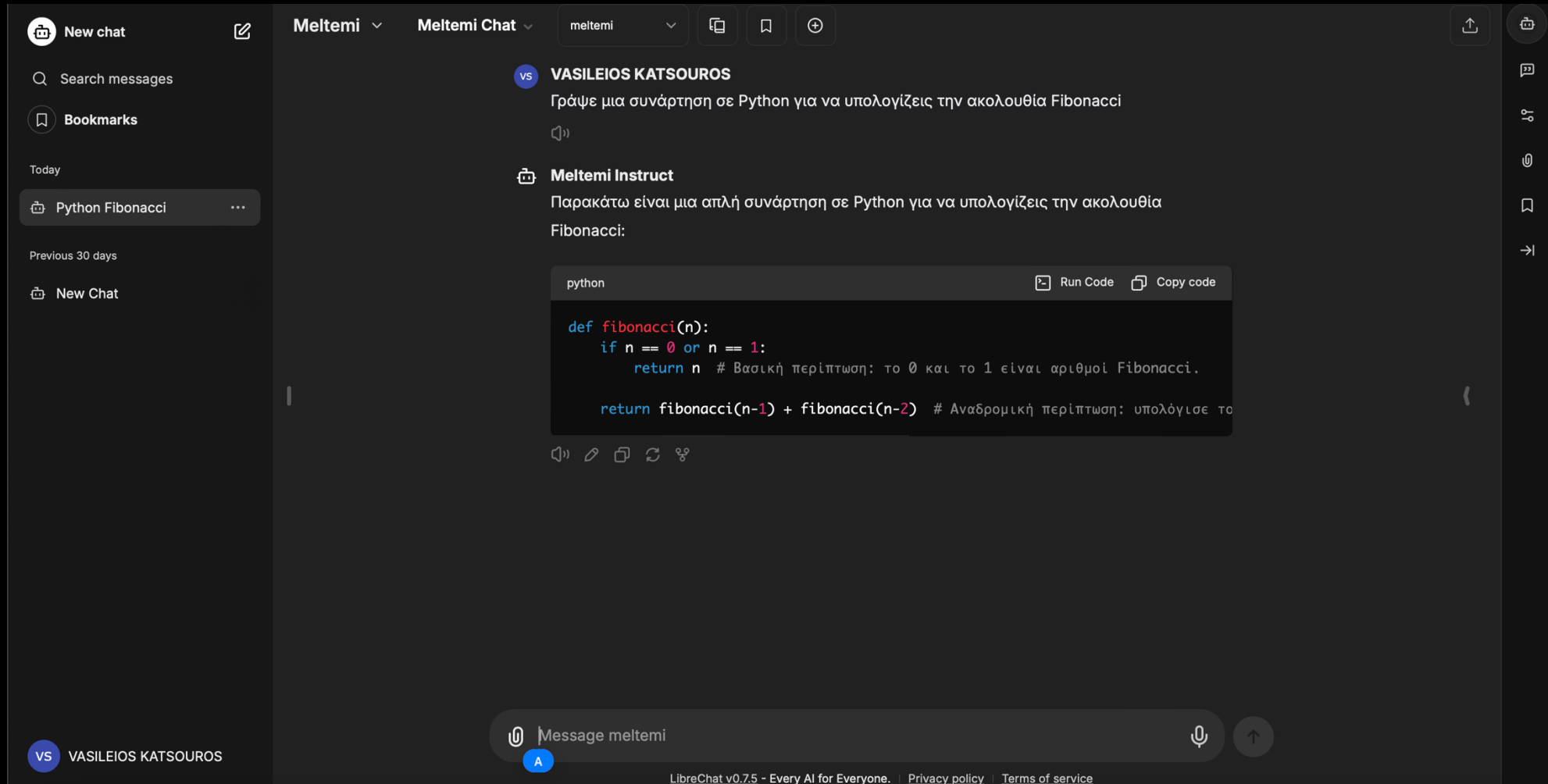
Accessing Meltemi using the API

- You can send requests to our API
 - `curl --location "http://ec2-3-19-37-251.us-east-2.compute.amazonaws.com:4000/chat/completions" --header "Authorization: Bearer sk--I0Ld3h6yeH1YOGimVmJ6g" --header "Content-Type: application/json" --data "{\"model\": \"meltemi\", \"messages\": [{\"role\": \"system\", \"content\": \"Είσαι το....\"}, {\"role\": \"user\", \"content\": \"Η Αλίκη έχει 5 αδερφές και 5 αδερφούς. Πόσες αδερφές έχει ένας αδερφός της Αλίκης;\"}]}"`



Accessing Meltemi using Open WebUI

- setup Open WebUI to chat with the model through a web interface <http://meltemi.ilsp.gr>



The screenshot displays the Open WebUI interface. On the left, there is a sidebar with options for 'New chat', 'Search messages', 'Bookmarks', and a list of recent chats including 'Python Fibonacci'. The main chat area shows a conversation between 'VASILEIOS KATSOURO' and 'Meltemi Instruct'. The user asks for a Python function to calculate the Fibonacci sequence. The AI responds with a code block containing a Python function definition with comments in Greek. The code block includes 'Run Code' and 'Copy code' buttons. At the bottom, there is a message input field with the text 'Message meltemi' and a microphone icon. The footer of the interface includes the text 'LibreChat v0.7.5 - Every AI for Everyone.' and links to 'Privacy policy' and 'Terms of service'.

New chat

Meltemi Meltemi Chat meltemi

Search messages

Bookmarks

Today

Python Fibonacci

Previous 30 days

New Chat

VS VASILEIOS KATSOURO

VS VASILEIOS KATSOURO

Meltemi Instruct

Γράψε μια συνάρτηση σε Python για να υπολογίζεις την ακολουθία Fibonacci

Παρακάτω είναι μια απλή συνάρτηση σε Python για να υπολογίζεις την ακολουθία Fibonacci:

```
python
def fibonacci(n):
    if n == 0 or n == 1:
        return n # Βασική περίπτωση: το 0 και το 1 είναι αριθμοί Fibonacci.
    return fibonacci(n-1) + fibonacci(n-2) # Αναδρομική περίπτωση: υπολόγισε το
```

Run Code Copy code

Message meltemi

LibreChat v0.7.5 - Every AI for Everyone. Privacy policy Terms of service



Outcomes

Outcomes

- Released all models with Apache 2.0 license on Hugging Face
 - Two model variants:
 - Foundation Model: Meltemi-7B-v1 & v1.5
 - Chat Model: Meltemi-7B-Instruct-v1 & v1.5
 - Quantized versions to run locally
- Created evaluation suite with 6 test sets for Greek, also shared with the research community on Hugging Face
- Access Meltemi API
- Chat with Meltemi <http://meltemi.ilsp.gr>



Next steps

Next Steps

- Gather more data resources
- Expanding our models' capabilities for:
 - Translation (EN-EL & EL-EN)
 - Instruction-following and chats
 - Creating synthetic Greek tasks from existing data
 - RAG (Retrieval-Augmented Generation) applications
 - Function calling agents
- Llama3.1



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Meltemi: The first open Large Language Model for Greek

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Thank you!

