Multilingual Radiology Report Classification

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Medical

This talk

Everyone else here today

Multimodal

Multilingual

How Do Multilingual Language Models Remember Facts?

Constanza Fierro[†] **Negar Foroutan**[‡] **Desmond Elliott**[†] **Anders Søgaard**[†]
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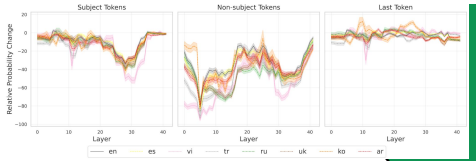

Multilingual Pretraining for Pixel Language Models

Ilker Kesen[†] **Jonas F. Lotz**[†,‡] **Ingo Ziegler**[†] **Phillip Rust**[†] **Desmond Elliott**[†]
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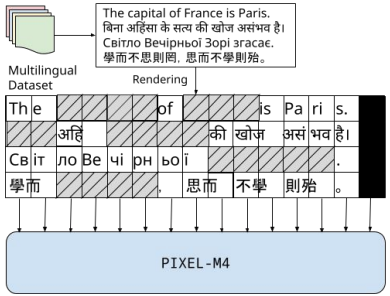
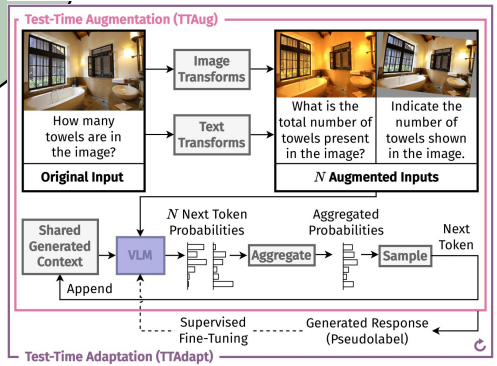


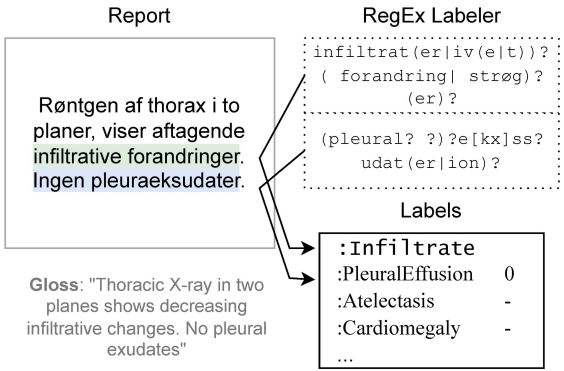
EFFICIENT TEST-TIME SCALING FOR SMALL VISION-LANGUAGE MODELS

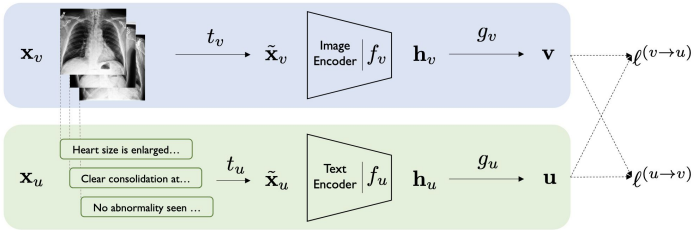
Mehmet Onurcan Kaya[1,2] **Desmond Elliott**[3,2] **Dim P. Papadopoulos**[1,2]
[1] Technical University of Denmark [2] Pioneer Center for AI [3] University of Copenhagen



Radiology Report Classification

- Backbone of training imaging classification systems
  - `regex` is everywhere
  - SSL emerging as an alternative
    - This is compute-intensive compared to LLM knowledge
- Not much publicly shared data
  - MIMIC-CXR, CheXpert, etc.
- Disjoint findings labels
  - MIMIC-CXR: 15 findings
  - PadChest: 49 findings





When are radiology reports useful for training medical image classifiers?

Herman Bergström*[1], Zhongqi Yue[1], and Fredrik D. Johansson[1]
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Chalmers University of Technology and University of Gothenburg

MR-CLIP: Efficient Metadata-Guided Learning of MRI Contrast Representations

Mehmet Yigit Avci[1], Pedro Borges[1], Paul Wright[1], Mehmet Yigitsoy[2], Sebastien Ourselin[1], and Jorge Cardoso[1]

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Are Large Vision Language Models Truly Grounded in Medical Images? Evidence from Italian Clinical Visual Question Answering

Federico Felizzi[1,*], Olivia Riccomi[1], Michele Ferramola[2], Francesco Andrea Causio[3,1],
Manuel Del Medico[3,1,*], Vittorio De Vita[3,1], Lorenzo De Mori[1,4], Alessandra Piscitelli[1,5],
Pietro Eric Risuleo[3,1], Bianca Destro Castaniti[1,5], Antonio Cristiano[3,1],
Alessia Longo[6], Luigi De Angelis[1,7], Mariapia Vassalli[1,5], Marcello Di Pumpo[3,1]

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How can we combine publicly available radiology report resources into a single classification model?

Alice

MOSAIC: A Multilingual, Taxonomy-Agnostic, and Computationally Efficient Approach for Radiological Report Classification

Alice Schiavone[1,2], Marco Fraccaro[3], Lea Marie Pehrson[1,4,5], Silvia Ingala[4,6], Rasmus Bonnevie[3]
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Desiderata

- **Fully open source:** keep your medical data on-site
- **Accessible:** run and train on inexpensive general-purpose GPUs
  - training and inference on an 24GB RTX 3090
- **Multilingual:** works for any EU26 major language
  - only evaluated in 4 languages due to data availability
- **Flexible:** adapts to different findings labels with minimal intervention
  - LLMs are reservoirs of written human knowledge

The LLM money pit

The rich man experience:

- LLM can solve 6 additional **high-school** competition math problems (AIME) for 4.2M USD
  - Reaching 65% on the test (below the acceptance cutoff) using only 16 tries…

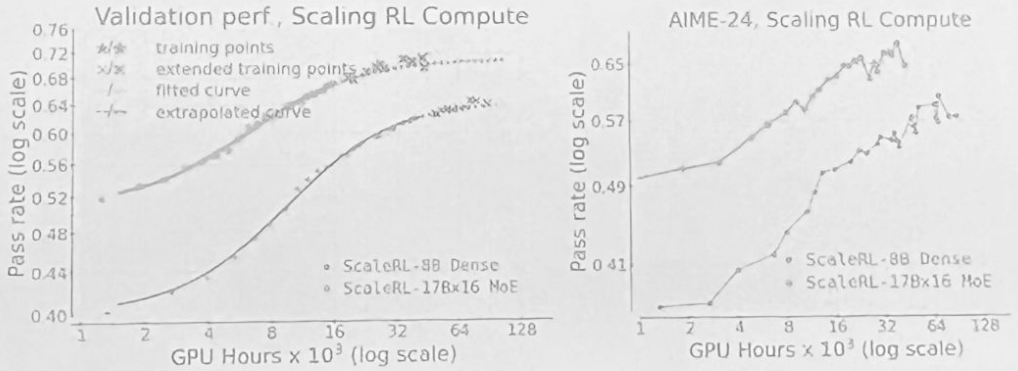
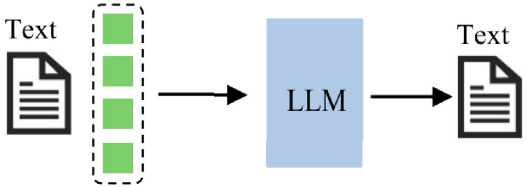


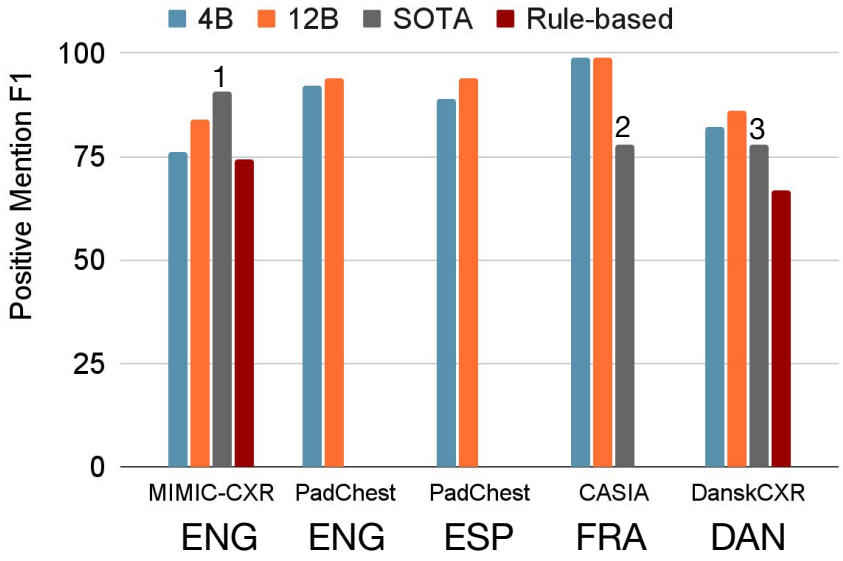
Figure 1 Predictably Scaling RL compute to 100,000 GPU Hours (a) We run ScaleRL for 100k GPU hours on an 8B dense

Alexia Jolicoeur-Martineau, Mila, October 2025

MOSAIC-4B and 12B

- Finetuned on 10K reports in English, Spanish, and French
  - QLoRA optimization on the Q,K,V, FF, and Output layers
  - Need maximum of 16.2G VRAM and 33 minutes for SFT
- Prompt-based inference that can predict up to 68 findings





1. CheX-GPT, 2. CASIA-CLS, 3. DanskBERT

Lucas Dixon, Google DeepMind

How I think about LLMs...

An interpreter (that can translate between languages, concepts, and styles)

An improv comedian

A fuzzy database of the web

Prompt-based Inference

Require JSON-structured responses

```
You are a helpful radiology assistant.
Given a radiology report, classify each
abnormality into a class. Output a valid
JSON with each abnormality as key, and the
class as value. The keys must be
{findings}. The values can be one of
{classes}. The values have the following
interpretation:
```

Define style of positive/uncertain findings

```
(1) the abnormality was mentioned, even
with uncertainty, in the report, e.g. 'A
large pleural effusion', 'The cardiac
contours are stable.', 'The cardiac size
cannot be evaluated.';
```

Negative mentions

```
(2) the abnormality was negatively
mentioned in the report; e.g. 'No
pneumothorax.'
```

Datasets

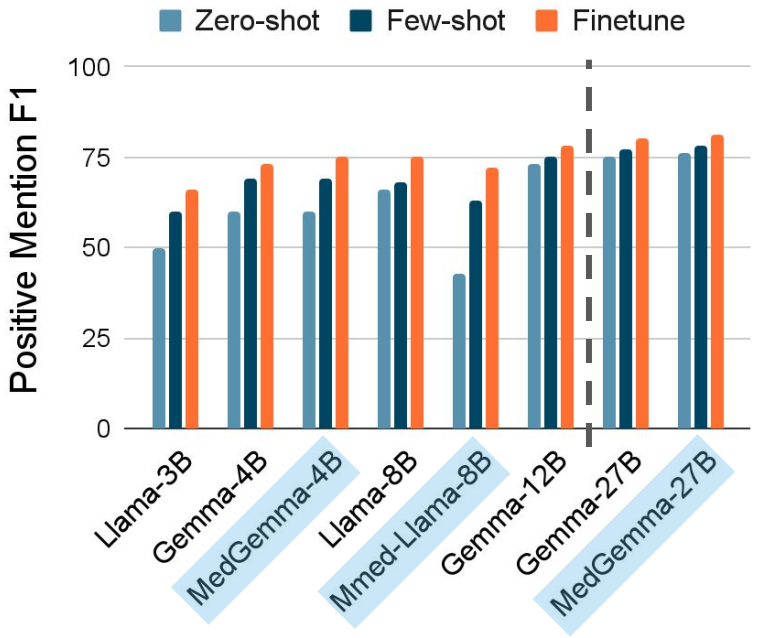
Dataset	Language	Modality	Number of Findings	Avg. Chars	Mention Classes	Train	Dev	Test
MIMIC-CXR	en	Chest X-Ray	14	760	$+, -, \sim$	535	50	100
PadChest-GR	es, en	Chest X-Ray	49	115	$+$	1951	100	879
CASIA-CXR	fr	Chest X-Ray	5	400	$+$	7677	100	3334
DanskCXR	da	Chest X-Ray	48	312	$+, -$	1600	125	750
DanskMRI	da	Brain MRI	3	1941	$+, -, \sim$	194	50	345

- Focus on publicly available datasets
  - 194-7600 training examples
  - 115–1941 characters
  - 3–49 findings across variable number of mention classes
- DanskMRI evaluates performance on different imaging modality

Which Backbone LLM?

- Setups:
  - Zero-shot prompting
  - Few-shot prompting
  - Dataset-specific fine-tuning

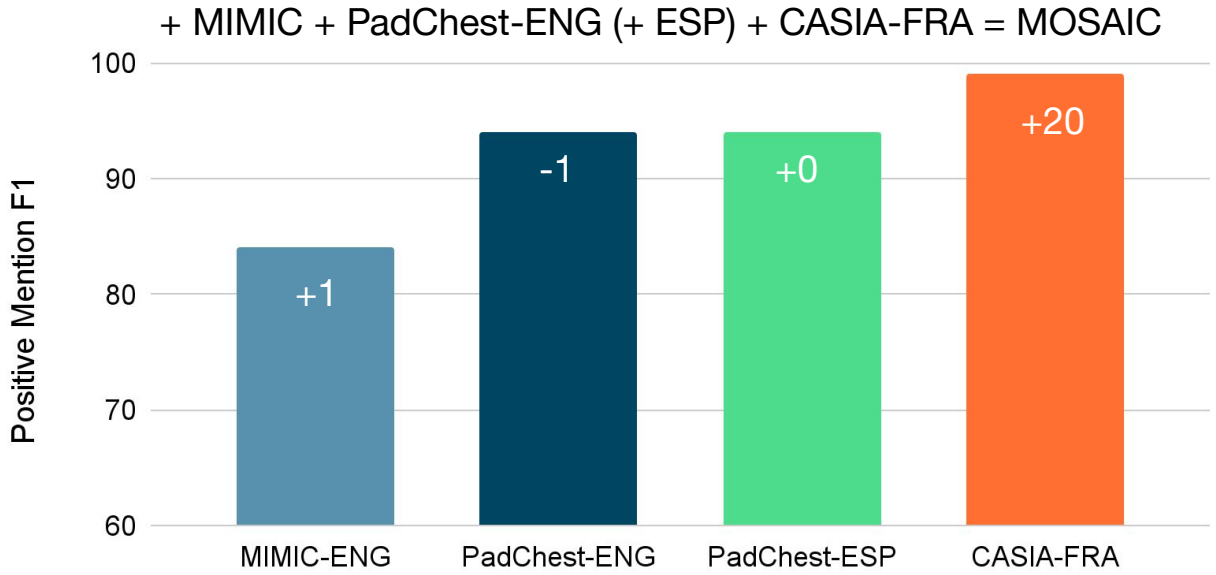
- Gemma and LLaMA LLMs
  - 3B–27B variants
  - General and medical domain



Finding 1: No substantial difference between general / medical domain models

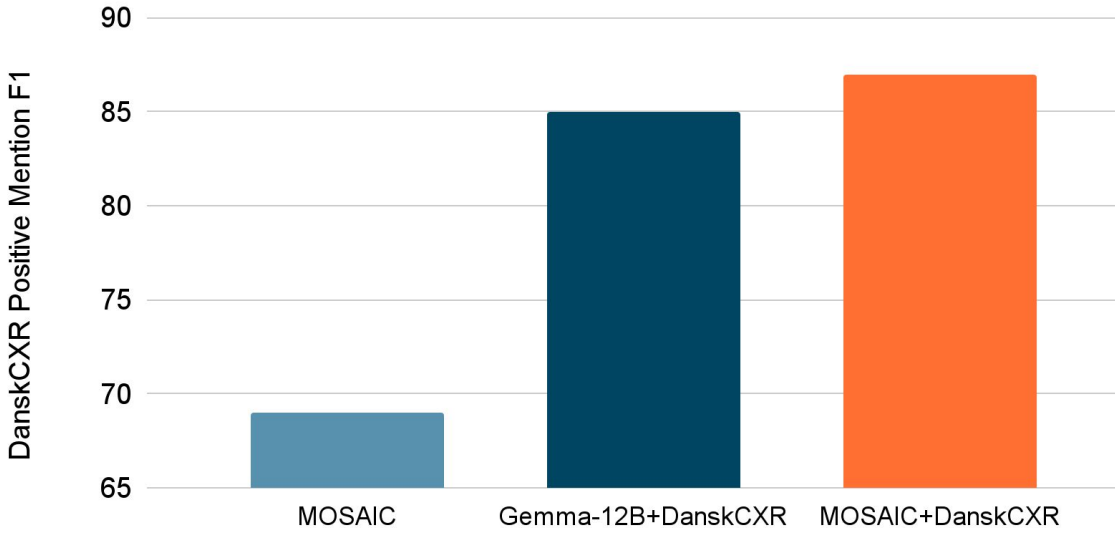
Finetuning on Public Datasets

- How does performance improve as we train on different label sets?



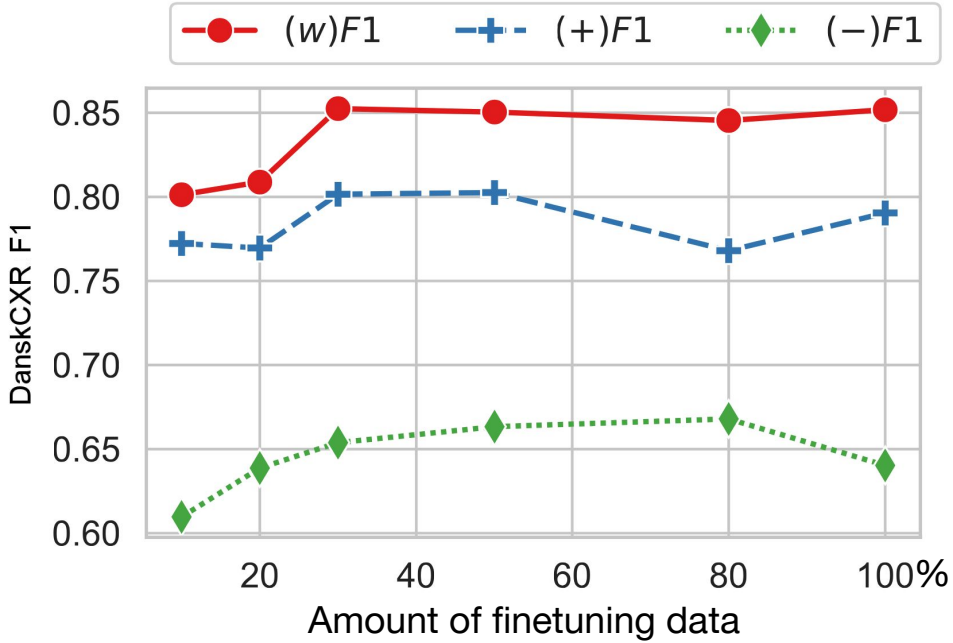
Finding 2: Improvements are additive and do not seem to interfere

New Dataset Adaptation



Finding 3: MOSAIC is a better starting point for new data

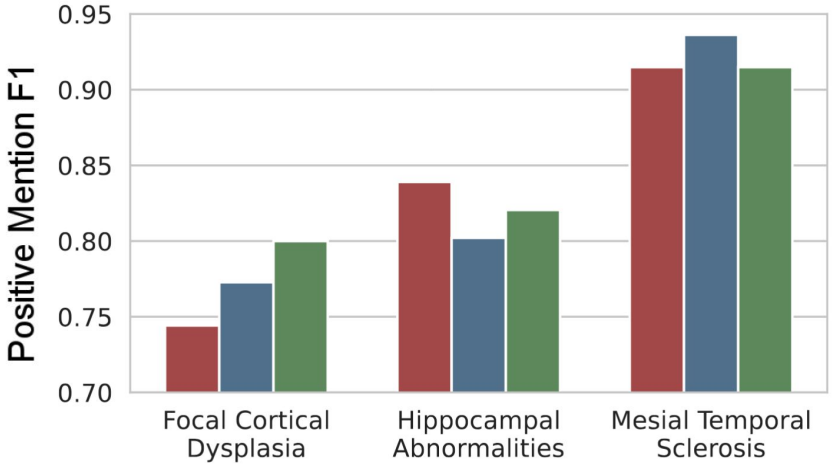
How Much Data Do You Need?



Finding 4: You don't need much data if you start from MOSAIC

Different Imaging Modality

- Adapt MOSAIC to predicting three findings in Epilepsy MRI reports
  - Gemma-12B SFT on 196 reports
  - MOSAIC-12B
    - + ENG translation of 196 reports



Finding 5: MOSAIC can be repurposed to a new modality

Open Directions

- **Multimodal inputs** could improve performance but how to handle reports from different imaging modalities
- **Simple text-only augmentation** could substantially improve performance [Aepli and Sennrich, 2022; Kaya et al. 2025]
- **Multi-agent LLMs** could better handle different mention classes
- **Broken tokenizers** could be fixed to further improve performance
  - See, e.g. TokenDist [Dobler et al. 2025]
- **Synthetic data generation** using self-consistency [Wang et al. 2023]

Conclusions

- Multilingual LLMs are radiology report classifiers
  - Handle different label sets
  - Handle reports from different imaging modalities
- Multilingual multi dataset SFT can reduce the total amount of data that needs expert annotation
  - Focus the time of our clinical colleagues on labelling lower-frequency findings or difficult examples
- MOSAIC is open source
  - Please tell us if it works for your data and language

References

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- Wang et al. ICLR 2023. Self-Consistency Improves Chain of Thought Reasoning in Language Models.