European Centre for the Development of Vocational Training

50 YEARS
SHAPING LEARNING AND SKILLS FOR EUROPE

Using language models for extracting regions of employment from online job vacancies

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Web Intelligence Network Conference – From Web to Data

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Introduction

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  - Multiple languages
  - EU27+ coverage
  - 2018-24
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In this work:
- Greek language
- NUTS-2 region

Challenges

- **Plan A:** Using commercial LLMs

- Data sensitivity
- Cost

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  - (a) Manual annotation of two datasets (train/test)
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- Time consuming (a)
- Labour intensive (a)

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OJA-1: SSP ltd, a thriving force in online marketing, with offices in **Athens**, **Mykonos** and **Crete**, is looking for an enthusiastic mid-level Java developer for our new office in **Thessaloniki**. If interested, send your CV to yptoleme@myemail.gr.

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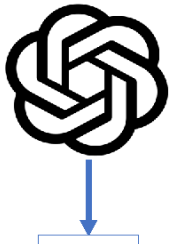

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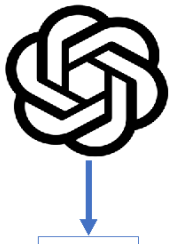

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Labels: EL30 EL42 EL43 EL52

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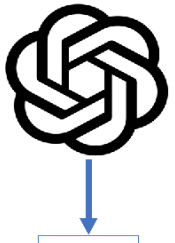

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  - Anchors contextual embeddings: extracted from OJAs (Greek language)
  - **Candidates**: highly similar embeddings to anchors

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Step 2: LLMs as ‘experts’

You are an NLP annotator. You are being provided with a phrase (unigram or bigram) in Greek, which is very likely to be the name of a location (not necessarily in Greece).

Your task is to find and output the NUTS-2 region of the phrase (or of part of the phrase) in the following format: <NUTS2_CODE><NUTS2_NAME> (e.g.: <EL30><Περιφέρεια Αττικής>)

If the phrase does not match any location, output: <NONE><NONE>

If the phrase is more generic (e.g., 'Greece'), output the respective NUTS-1 region, if available (or country code, otherwise): <NUTS1_CODE><NUTS1_NAME>

If you find multiple locations for the same phrase, list up to 3 locations:

<NUTS2_CODE1><NUTS2_NAME1>, …, <NUTS2_CODE3><NUTS2_NAME3>

Try to associate a phrase with a NUTS-2 code, even if you are not certain about it (avoid <NONE><NONE> as much as possible). Do not reason about your answers. The phrase is:

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LM fine-tuning

- **Step 3: Training dataset creation**
  - Map candidates/NUTS-2 labels from Step 2 back to their OJA descriptions
  - Keep OJAs with only one NUTS-2 region assigned
  - Result: **6,501** (OJA_text, NUTS2_region) tuples (from 10k OJAs)

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- **Test dataset creation**
  - Manual annotation: **528** (OJA_text, NUTS2_region) written in Greek

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- **Fine-tune BERT** (Koutsikakis et al., 2020) for classification task**:**
  - Train on the 6,501 OJA descriptions
  - Apply model on the 528 OJA descriptions
  - Measure accuracy on the 528 OJAs

Image source: github

Koutsikakis, John, et al. "Greek-bert: The greeks visiting sesame street." *11th Hellenic conference on artificial intelligence*. 2020.

Results

	Model Explanation
Majority	Predicts ‘EL30’ all the time
ChatGPT	Labels ‘candidate’ location terms extracted from each OJA in the test set. The output is the final prediction for each OJA.
Ours	A BERT-based model that is trained on 6,501 OJAs that were previously annotated by ChatGPT.

Results

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Majority	Predicts ‘EL30’ all the time	.254	.329
ChatGPT	Labels ‘candidate’ location terms extracted from each OJA in the test set. The output is the final prediction for each OJA.	**.813**	.828
Ours	A BERT-based model that is trained on 6,501 OJAs that were previously annotated by ChatGPT.	.767	**.933**

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Ours	A BERT-based model that is trained on 6,501 OJAs that were previously annotated by ChatGPT.	.767	.933	**$34 (for all OJAs in Greek)**

Correlation against official statistics & discussion

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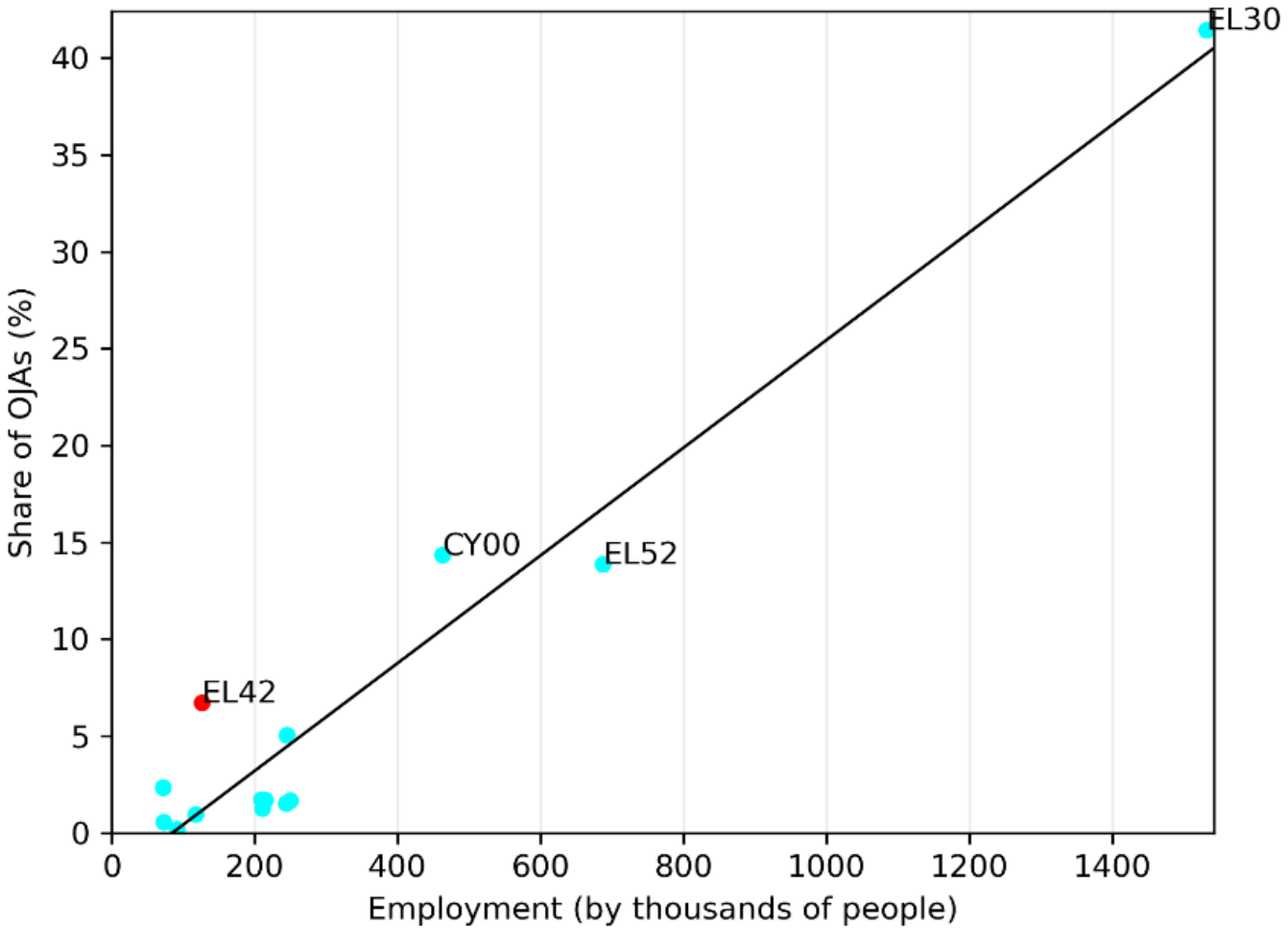

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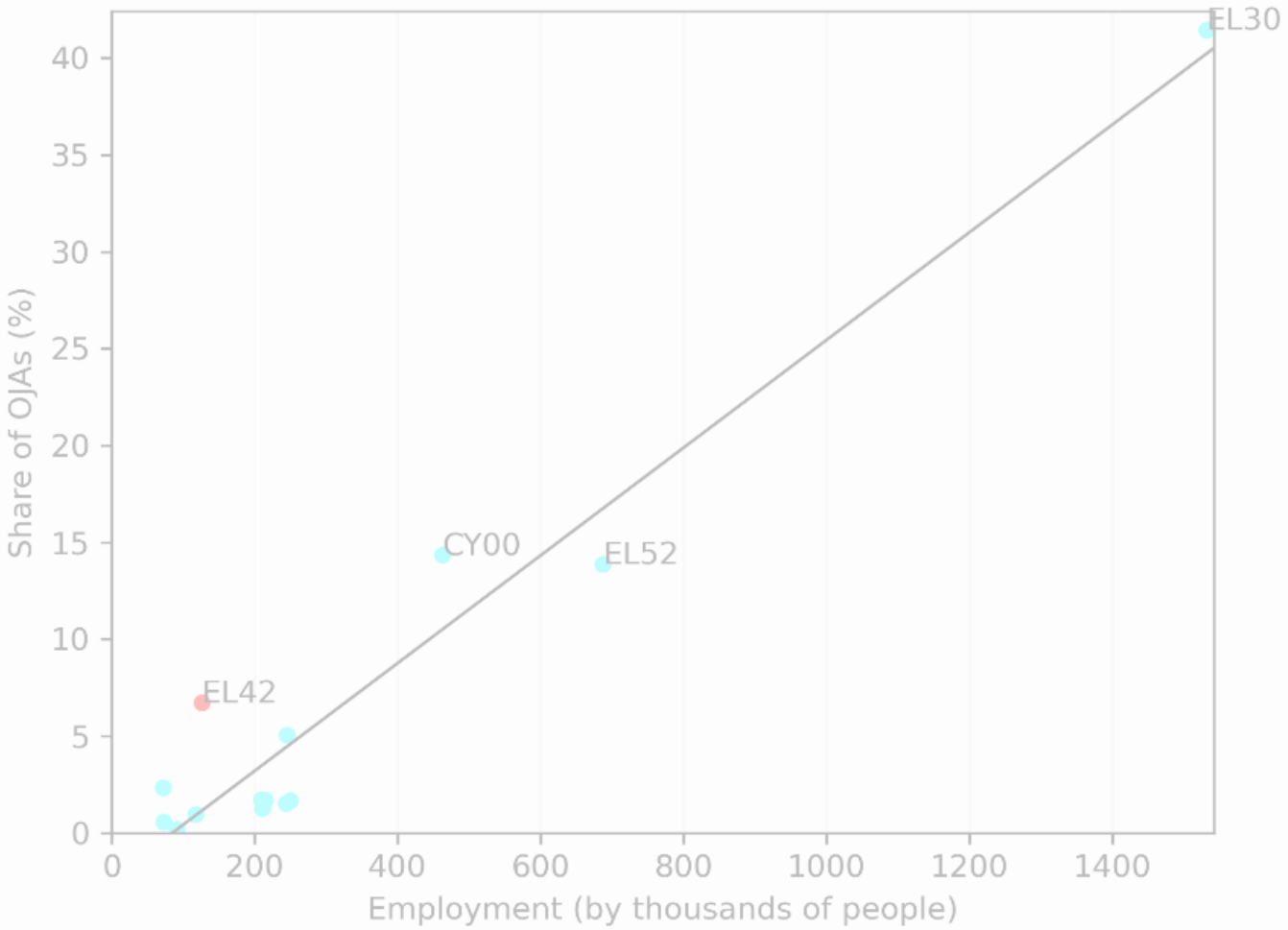

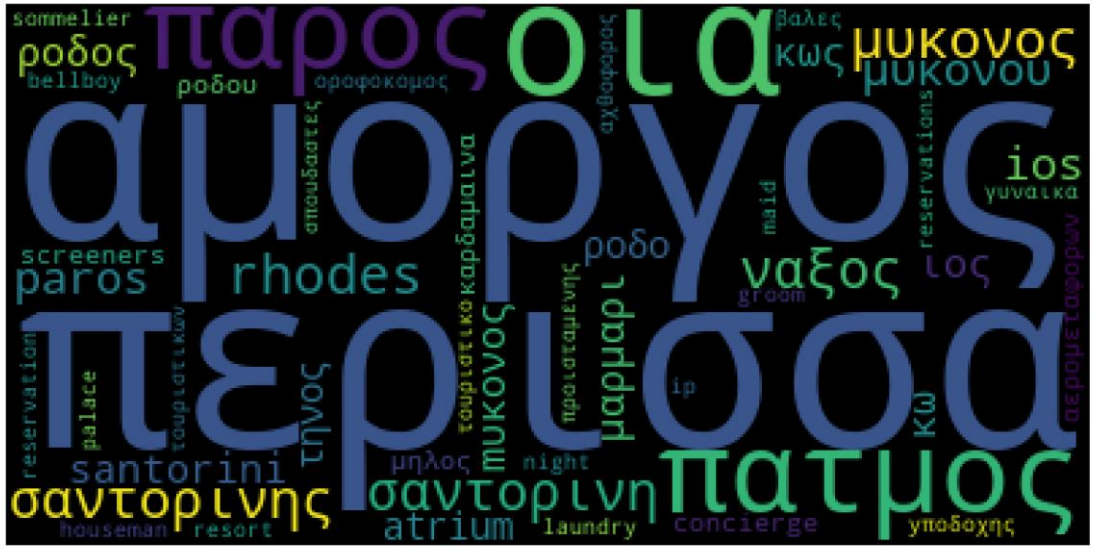

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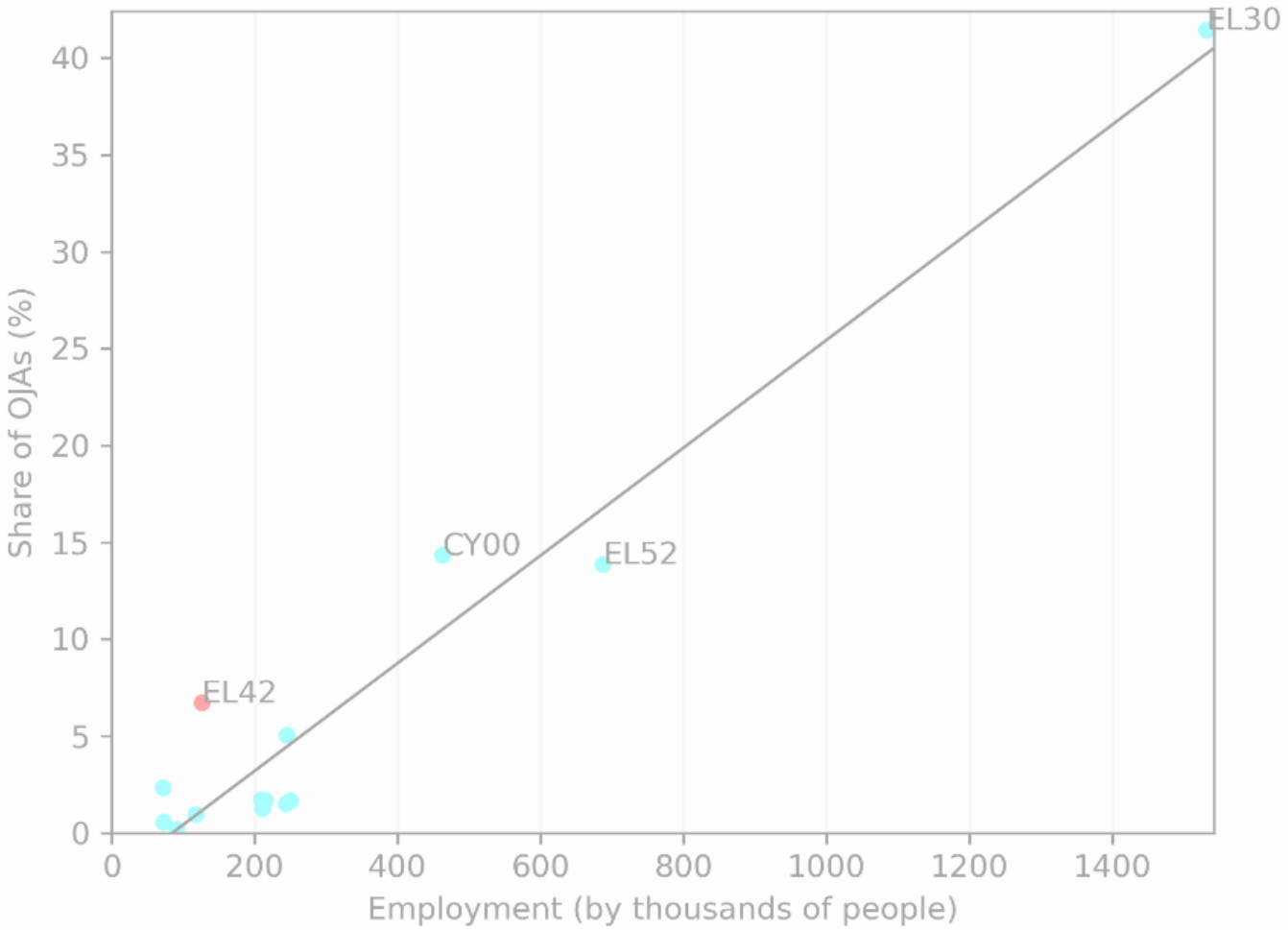

Most characteristic keywords:

palace, groom, laundry, reservations, porter, valet, touristic, sommelier, supervisor, reservation, houseman, students, resort, ip, bellboy, woman, night, reception, maid, airlines, screeners, concierge, atrium

Conclusion

- Task: extract NUTS-2 regions of employment from OJAs in Greek
  - LLMs as ‘annotators’
  - Extremely limited manual effort
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- Future work
  - Expand the approach across languages
  - Robust validation

Thank you

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