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ArBanking77: Intent Detection Neural Model and a New Dataset in Modern and Dialectical Arabic

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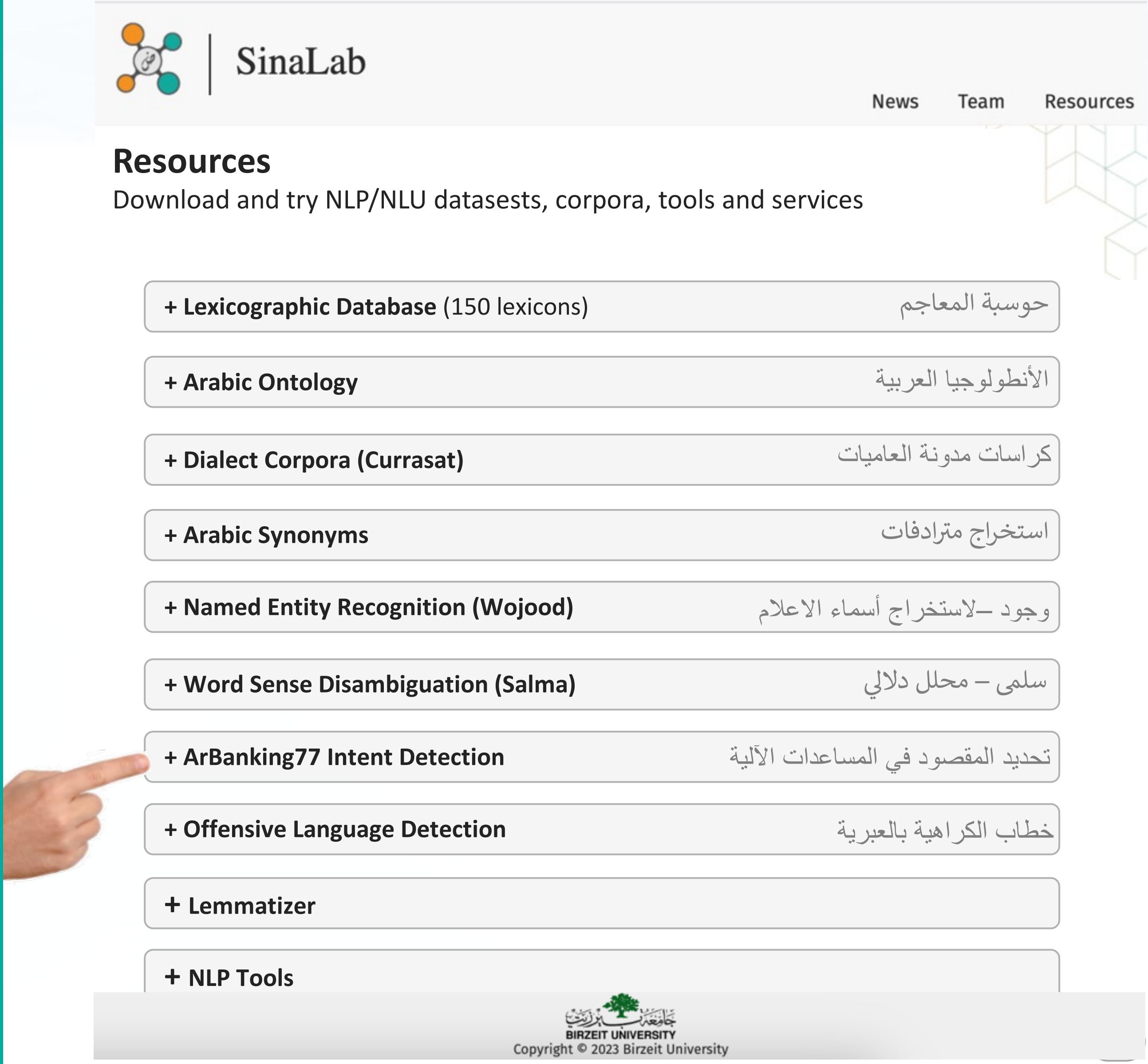

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Resources

Download and try NLP/NLU datasests, corpora, tools and services

+ **Lexicographic Database** (150 lexicons) حوسبة المعاجم

+ **Arabic Ontology** الأنطولوجيا العربية

+ **Dialect Corpora (Currasat)** كراسات مدونة العاميات

+ **Arabic Synonyms** استخراج مترادفات

+ **Named Entity Recognition (Wojood)** وجود –لاستخراج أسماء الاعلام

+ **Word Sense Disambiguation (Salma)** سلمى – محلل دلالي

+ **ArBanking77 Intent Detection** تحديد المقصود في المساعدات الآلية

+ **Offensive Language Detection** خطاب الكراهية بالعبرية

+ **Lemmatizer**

+ **NLP Tools**

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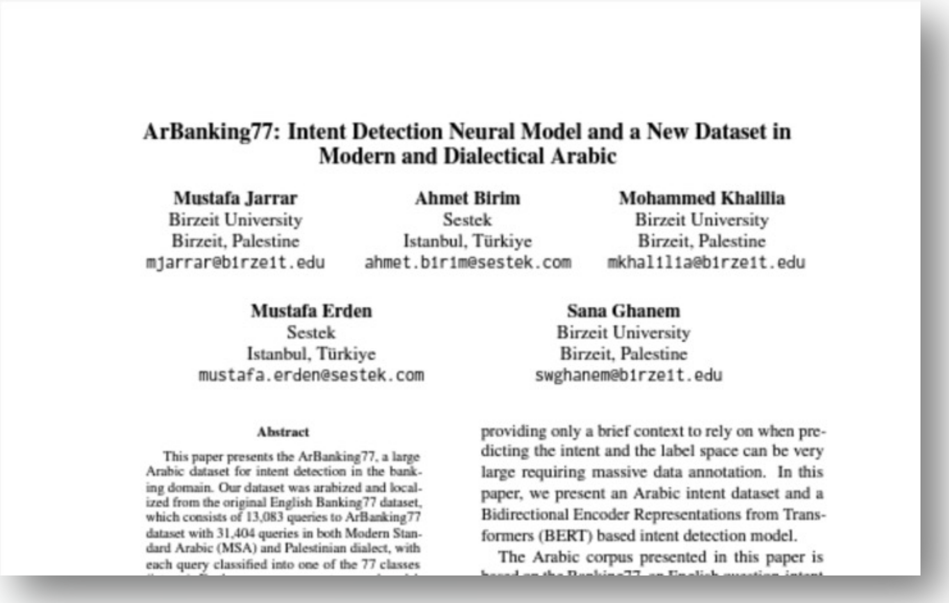

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Abstract

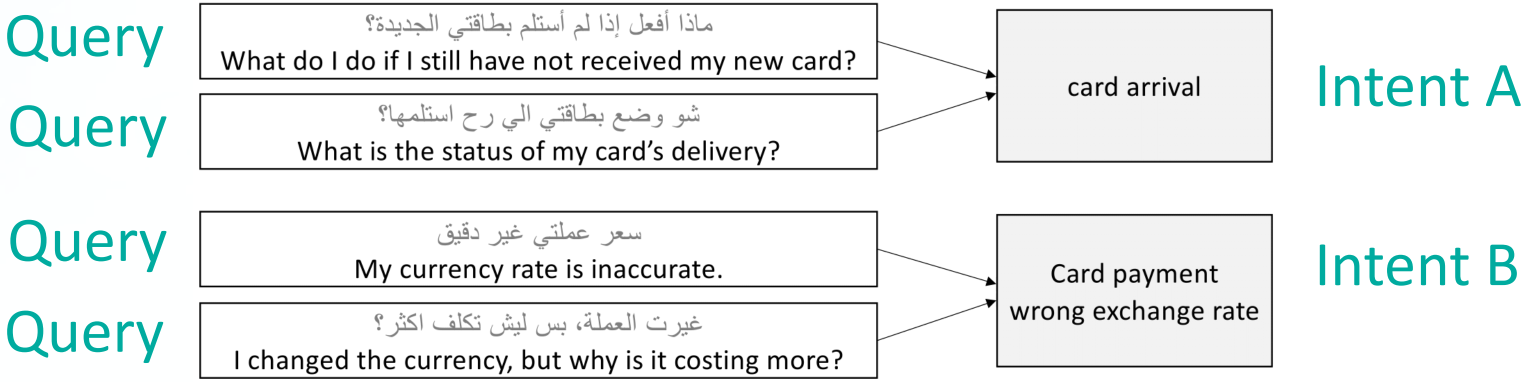
This paper presents the ArBanking77, a large Arabic dataset for intent detection in the banking domain. Our dataset was arabized and localized from the original English Banking77 dataset, which consists of 13,083 queries to ArBanking77 dataset with 31,404 queries in both Modern Standard Arabic (MSA) and Palestinian dialect, with each query classified into one of the 77 classes

providing only a brief context to rely on when predicting the intent and the label space can be very large requiring massive data annotation. In this paper, we present an Arabic intent dataset and a Bidirectional Encoder Representations from Transformers (BERT) based intent detection model.

The Arabic corpus presented in this paper is

Jarrar, M., Birim, A., Khalilia, M., Erden, M., Ghanem, S. (2023) ArBanking77: Intent Detection Neural Model and a New Dataset in Modern and Dialectical Arabic. In Proceedings of the Arabic Natural Language Processing Conference (ArabicNLP 2023), Singapore.

The problem



Query

ماذا أفعل إذا لم أستلم بطاقتي الجديدة؟

What do I do if I still have not received my new card?

Query

شو وضع بطاقتي الي رح استلمها؟

What is the status of my card’s delivery?

card arrival

Intent A

Query

سعر عملتي غير دقيق

My currency rate is inaccurate.

Query

غيرت العملة، بس ليش تكلف اكثر؟

I changed the currency, but why is it costing more?

Card payment wrong exchange rate

Intent B

Challenging to: build an Arabic intent dataset, and train BERT.

Our Contributions

❖ArBanking77 dataset

- ArBanking77 dataset consists of 31,404 queries.
- 2.4x larger than the Banking77 dataset.
- On average, there are 408 queries per intent
  - 202 MSA queries/intent
  - 206 Palestinian queries/intent.

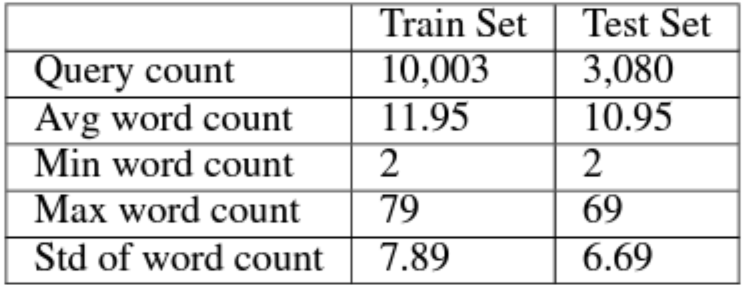
❖Intent detection model

- AraBERTv2
- F1-scores on MSA and PAL are 0.9209 and 0.8995, respectively

Corpus Collection

The ArBanking77 corpus:

- Derived from the Banking77 dataset
  - 13,083 queries
  - 77 classes (intents)
  - Single domain, banking
  - Open under the (CC-BY-4.0) license
  - The original Banking77 dataset is divided into train and test dataset.



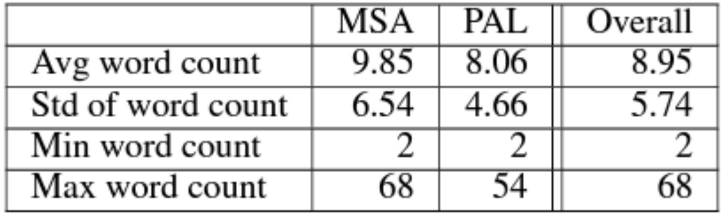
	Train Set	Test Set
Query count	10,003	3,080
Avg word count	11.95	10.95
Min word count	2	2
Max word count	79	69
Std of word count	7.89	6.69

Corpus Collection

The ArBanking77 corpus:

Each query in the original Banking77 has at least two corresponding queries in the ArBanking77

- At least one query written in MSA.
- At least one query written in Palestinian dialect.



	MSA	PAL	Overall
Avg word count	9.85	8.06	8.95
Std of word count	6.54	4.66	5.74
Min word count	2	2	2
Max word count	68	54	68

Annotation Process

- 26 annotators (Well trained)
- Done using Google Sheets
- Over several months

- Phases:

  Phase I: Arabization and Localization

  Phase II: Review

Annotation Process

Phase I: Arabization and Localization

1. The translation of the Banking77 from English into MSA.
   - Done using Google Translate API.

2. The manual annotation .

Annotation Process

Phase I: Arabization and Localization

The annotators performed four steps for each original English query:

(i) MSA_1 should be revised in case of incorrect translation.
(ii) MSA_2 is optionally written by the annotator.
(iii) PAL_1 is the formulation of the query in the Palestinian dialect.
(iv) PAL_2 is optionally written by the annotator.

Each intent was divided among 2-5 annotators.

Annotation Process

Phase II: Review

Step1: Each annotator reviewed three related intents, to ensure that:

(i) The MSA and Palestinian queries should be acceptable, semantically correct and well-formulated.

(ii) All queries in one intent belong to that intent, and not to other intents (labeling consistency).

(iii) Spelling mistakes are ignored in order to simulate common errors and noise in real NLP systems, especially in live chat queries.

Step2: We revised duplicate queries by introducing additional variations to make them unique.

Final Dataset

Lexical Relation between MSA and PAL

- Measured using the Jaccard Index for each parallel pair (MSA and PAL)

  Results of Jaccard index:

  - The mean is 0.16,
  - The median 0.13
  - The standard deviation 0.13.

- Thus, for diaglossic languages such as Arabic, training on one variation is not necessarily extensible.

Intent Detection Model

Transformer-based Intent Classifier

- BERT encoder is fine-tuned on Arabic intent detection task using the ArBanking77 dataset.
- A single linear layer was added on top of BERT transformer layers to perform the intent classification task.

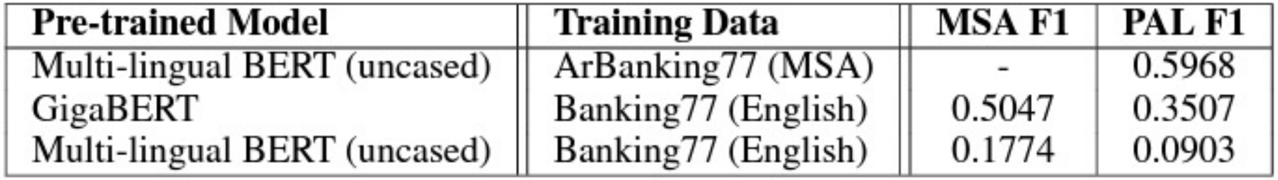
Model Training

- Training (21,559 queries), validation (2,464 queries) and test (7,381 queries).
- Learning rate, $\eta = 4e^{-5}$
- Batch size of 64, maximum of 20 epochs

Experiments and Results

Zero-Shot Cross-Lingual Transfer Learning

- Used multi-lingual BERT (mBERT) (Devlinetal.,2018) and GigaBERT (Lanetal., 2020).



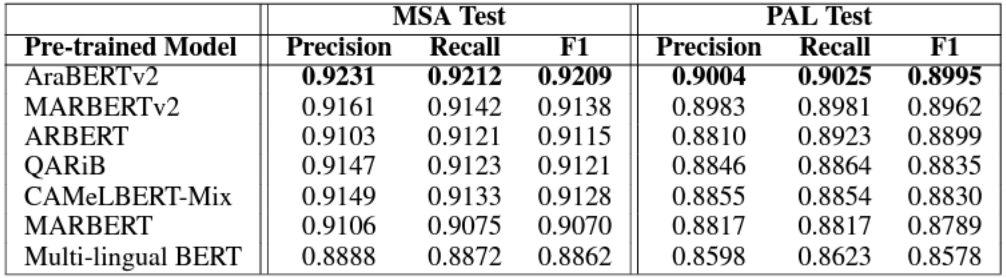
Pre-trained Model	Training Data	MSA F1	PAL F1
Multi-lingual BERT (uncased)	ArBanking77 (MSA)	-	0.5968
GigaBERT	Banking77 (English)	0.5047	0.3507
Multi-lingual BERT (uncased)	Banking77 (English)	0.1774	0.0903

- Multilingual pre-trained transformers did not perform well on MSA and PAL.

Experiments and Results

Pre-Trained Transformers Benchmark

- ❑ Evaluate various Arabic pre-trained transformer models, we benchmark against these models:



	MSA Test			PAL Test		
Pre-trained Model	**Precision**	**Recall**	**F1**	**Precision**	**Recall**	**F1**
AraBERTv2	**0.9231**	**0.9212**	**0.9209**	**0.9004**	**0.9025**	**0.8995**
MARBERTv2	0.9161	0.9142	0.9138	0.8983	0.8981	0.8962
ARBERT	0.9103	0.9121	0.9115	0.8810	0.8923	0.8899
QARiB	0.9147	0.9123	0.9121	0.8846	0.8864	0.8835
CAMeLBERT-Mix	0.9149	0.9133	0.9128	0.8855	0.8854	0.8830
MARBERT	0.9106	0.9075	0.9070	0.8817	0.8817	0.8789
Multi-lingual BERT	0.8888	0.8872	0.8862	0.8598	0.8623	0.8578

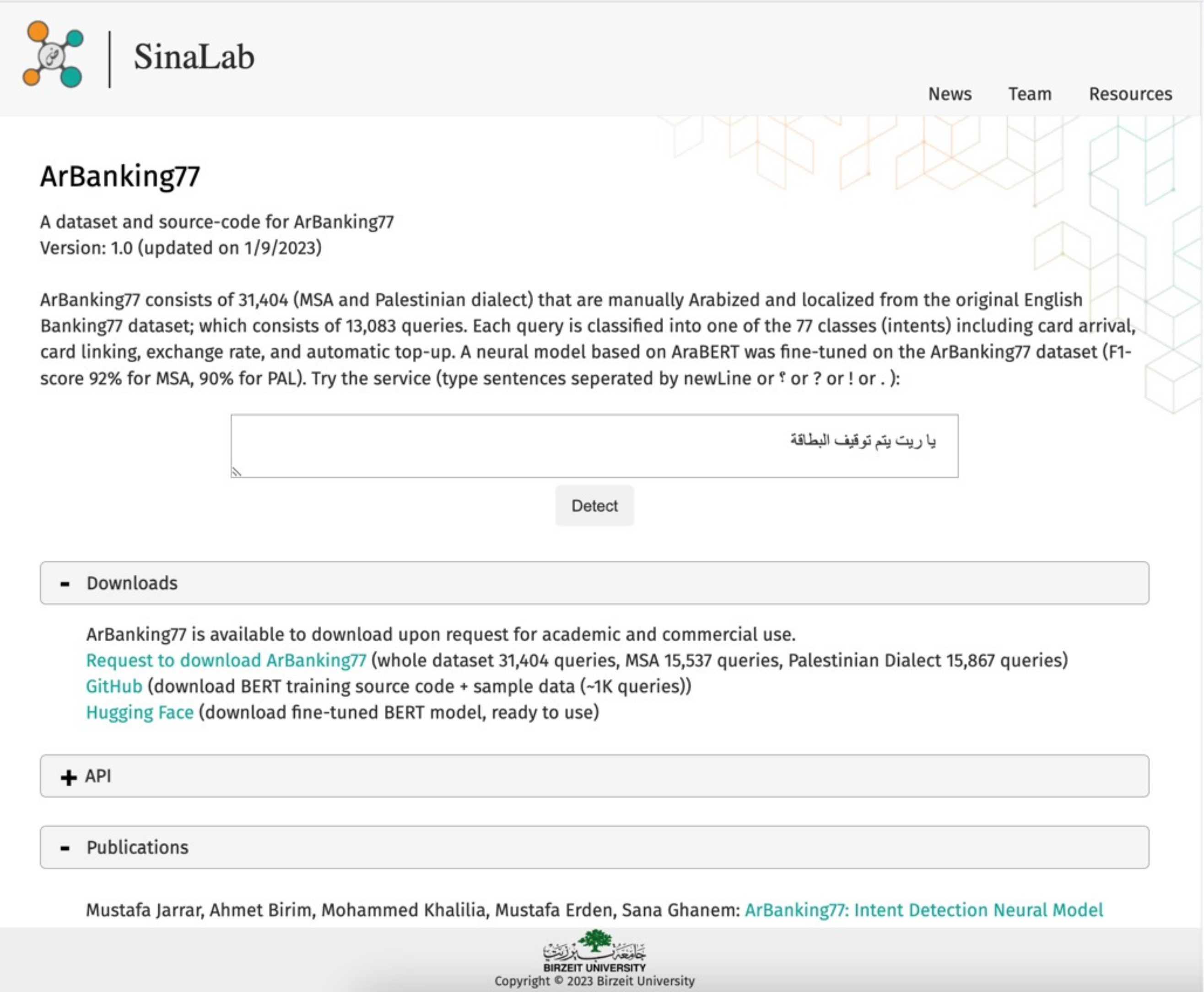
Results:

AraBERTv2 gives the best F1-score.

Summary

- ArBanking77 is the first Arabic intent detection dataset in the banking domain.
- Benchmarked different models for intent detection.
- AraBERTv2 is the best model for Arabic dialectical dataset.

Download



ArBanking77

A dataset and source-code for ArBanking77
Version: 1.0 (updated on 1/9/2023)

ArBanking77 consists of 31,404 (MSA and Palestinian dialect) that are manually Arabized and localized from the original English Banking77 dataset; which consists of 13,083 queries. Each query is classified into one of the 77 classes (intents) including card arrival, card linking, exchange rate, and automatic top-up. A neural model based on AraBERT was fine-tuned on the ArBanking77 dataset (F1-score 92% for MSA, 90% for PAL). Try the service (type sentences seperated by newLine or ؟ or ? or ! or .):

يا ريت يتم توقيف البطاقة

- Downloads

ArBanking77 is available to download upon request for academic and commercial use.
Request to download ArBanking77 (whole dataset 31,404 queries, MSA 15,537 queries, Palestinian Dialect 15,867 queries)
GitHub (download BERT training source code + sample data (~1K queries))
Hugging Face (download fine-tuned BERT model, ready to use)

+ API

- Publications

Mustafa Jarrar, Ahmet Birim, Mohammed Khalilia, Mustafa Erden, Sana Ghanem: ArBanking77: Intent Detection Neural Model

https://sina.birzeit.edu/arbanking77/

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