KONVOO PROJECT

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The Whys of Konvoo

- The ETP (Patient Therapeutic Education) aims to help patients acquire or maintain the skills they need to best manage their lives with a chronic disease.

- It takes the form of a personalized appointment between a pharmacist and its patient in the pharmacy.

- The pharmacist has an important role to play in this area, as he is the easiest health professional accessible for any patient.

The Whys of Konvoo

- The ETP is for anyone with a chronic disease, regardless of age, type, stage and progression of the disease.

- However, only a small part of pharmacists actually do ETP appointments.

- A survey has been shared in a group of pharmacists, here are the results :

The Whys of Konvoo

- 79% do NOT do any ETP, but 95% want to make more.
- The main reasons for not making more ETP is :
  - The lack of time required to know if a patient needs an ETP
  - The lack of knowledge about which patient need it
  - The lack of time to make the ETP itself.
- **90% of the pharmacists would use a solution that would help them to know if a patient needs an ETP !**

The Whys of Konvoo

- 53% would like a daily/weekly report on the patients detected as needing an ETP
- 47% would like to be notified instantly each time a patient is detected as described above.
- The main ways chosen for receiving the notifications/reports are :
  - Through the pharmacy software used by the pharmacists at the counter
  - By mail in the mail address of the pharmacy
  - Through a smartphone app.

The Whys of Konvoo

- Finally, 84% of the pharmacists would like to receive suggestions of questions, targeting the pathology and treatments of each patient.

- This survey was done on a small set of pharmacists (n = 19), thus it does not represent the majority of pharmacists.

- The goal of Konvoo is then to create a solution to detect if a patient needs an ETP, and to plan an appointment with a pharmacist in that case.

Is this solution sustainable ?

- A huge part of patients have a chronic disease :
  - Diabetes : 46M+ patients
  - Asthma/BPCO : 4M+ patients
  - Smoking : 16M+ patients
- It helps the pharmacists :
  - Automated Solution (time saved)
  - Customized solution (understanding of the patient)
  - Improves patients health (empowered patients)
  - Brings an extension of pharmacist role (increased responsibility)

CONCEPT of Konvoo

- Patient books video call with pharmacist via the KONVOO app
- Info provided at time of booking undergoes sentiment/emotion analysis – details stored for pharmacist use.
- During video call, pharmacist is provided with real-time feedback on client sentiment/emotion.
- Unbiased detection of patient emotion/sentiment provides additional info to pharmacist, enabling improved patient experience and outcomes.

PROJECT STAGES

1. Data collection – web scraping and data processing
2. Model development – natural language processing (in French)
3. Develop proof of concept app - make bookings, implement video call capability, integrate sentiment/emotion analysis with information provided at booking.

STAGE 1 - DATA SOURCE

REQUIREMENTS

- Large body of French language text
- Natural / informal language
- Of a medical / health nature

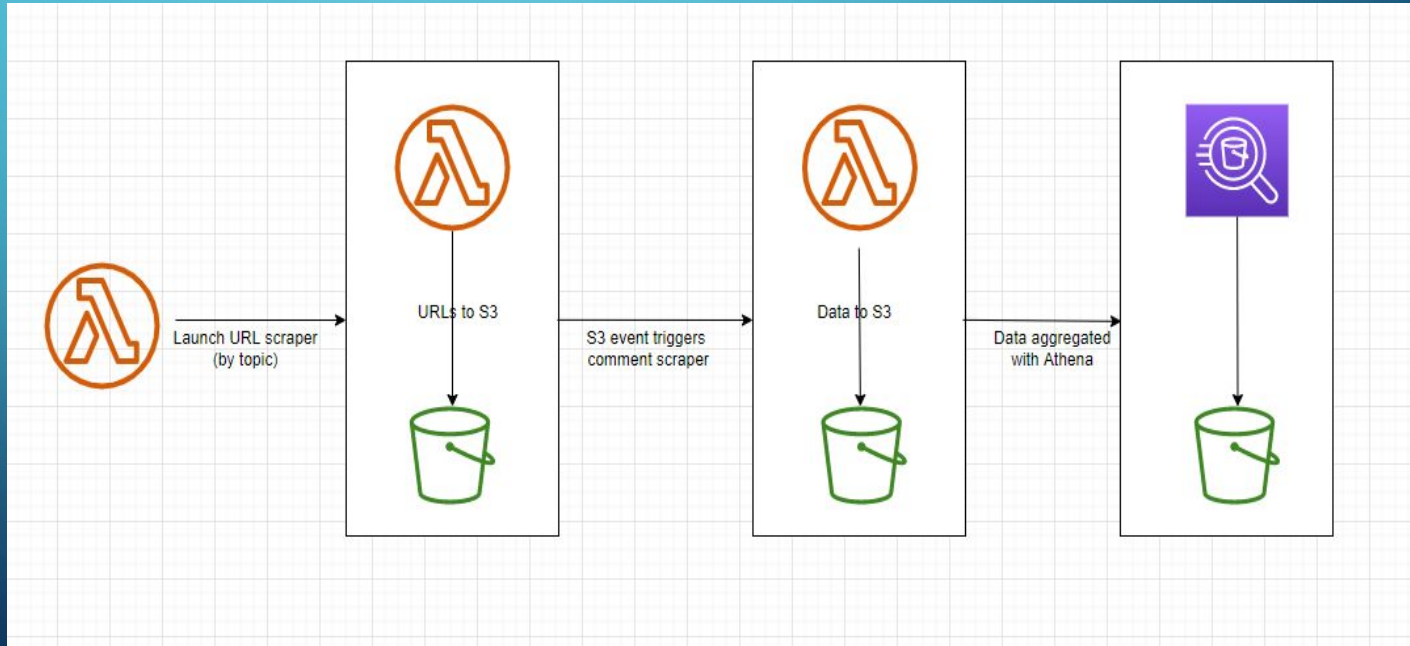
SOLUTION – The Doctissimo Forum

- Rich source of informal health discussion
- > 20 years historical data
- > 1,000,000 pages of conversations.

STAGE 1 - DATA SCRAPING - METHODOLOGY

- Massive parallel scraping required
- Code : BeautifulSoup/Selenium/requests
- Deployment : Docker / Lambda / S3 / Athena

- > 10,000,000 comments scraped
- Comment order preserved.
- Stored as Neo4j knowledge graph



STAGE 2 - SENTIMENT AND EMOTION MODELS

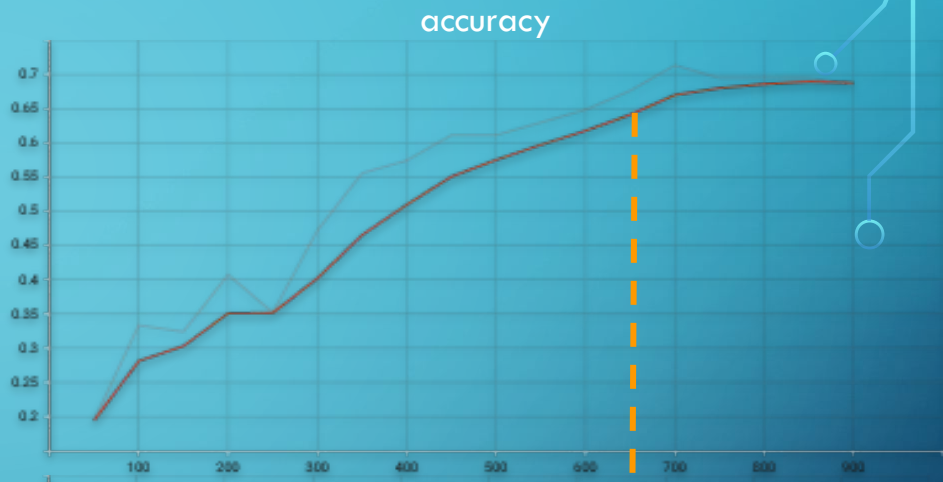
Sentiment Analysis with BERT

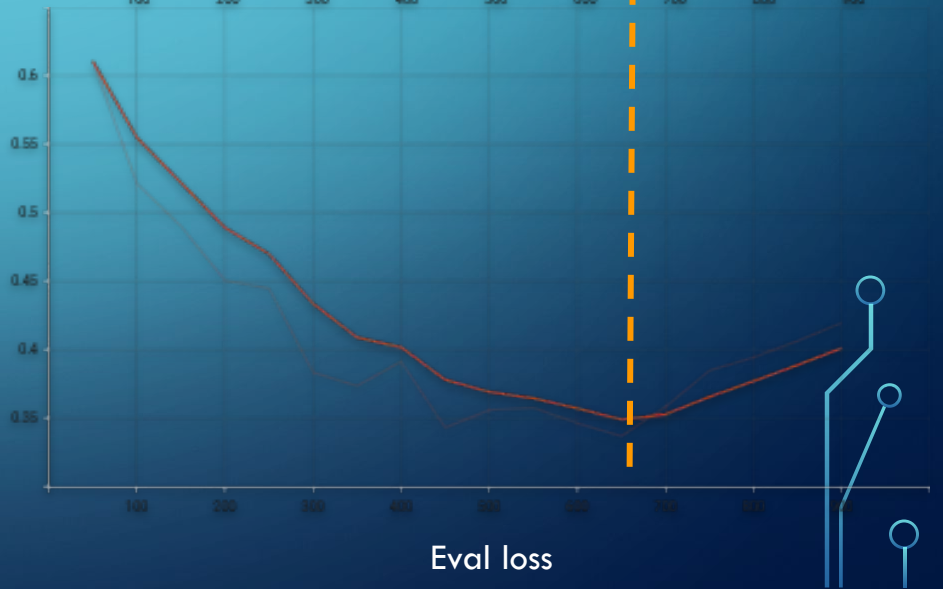
- **BERT** stands for Bidirectional Encoder Representations from Transformers.
- **BERT** is a deep learning model based based on **attention.**
- **Attention mechanism** can learn contextual relation between words in a sentence.
- **BERT** comes with many models (uncased, small vocabulary, etc)
- We use pre-trained **CamemBERT model,** the French based from RoBERTa.

Sentiment model

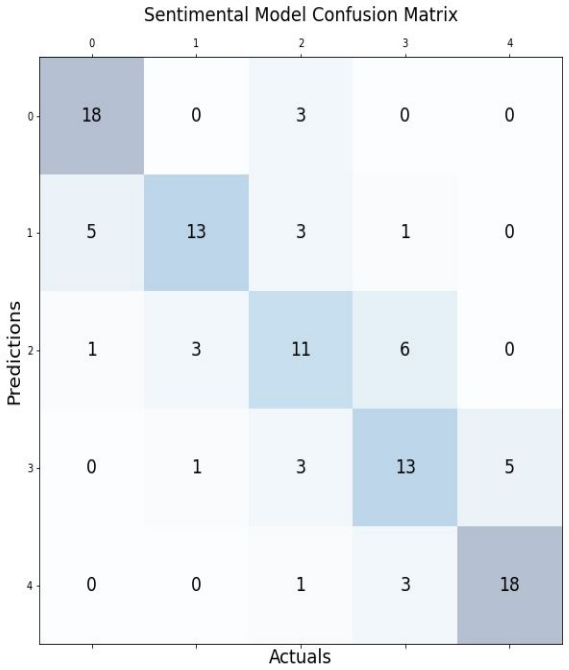
Metrics & Plots

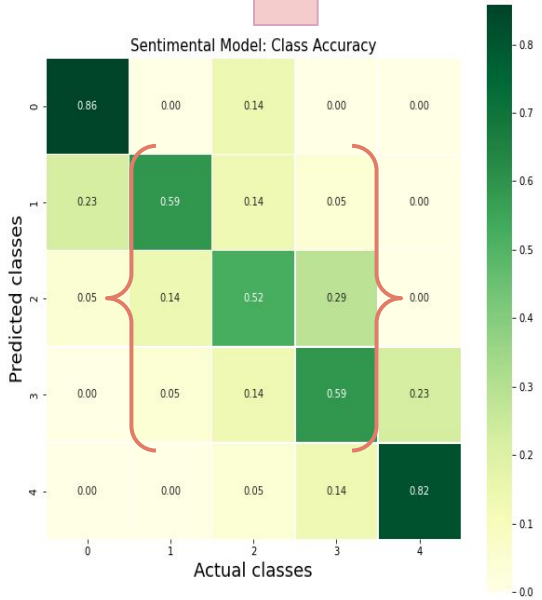
- Num examples (train) : 536
- Num examples (test) : 121
- Num epochs : 13
- Global steps : 900
- Best score : 0.37 (best)
- Train loss : 0.27 (best)
- Avg accuracy : 65





Sentiment model : Confusion matrix



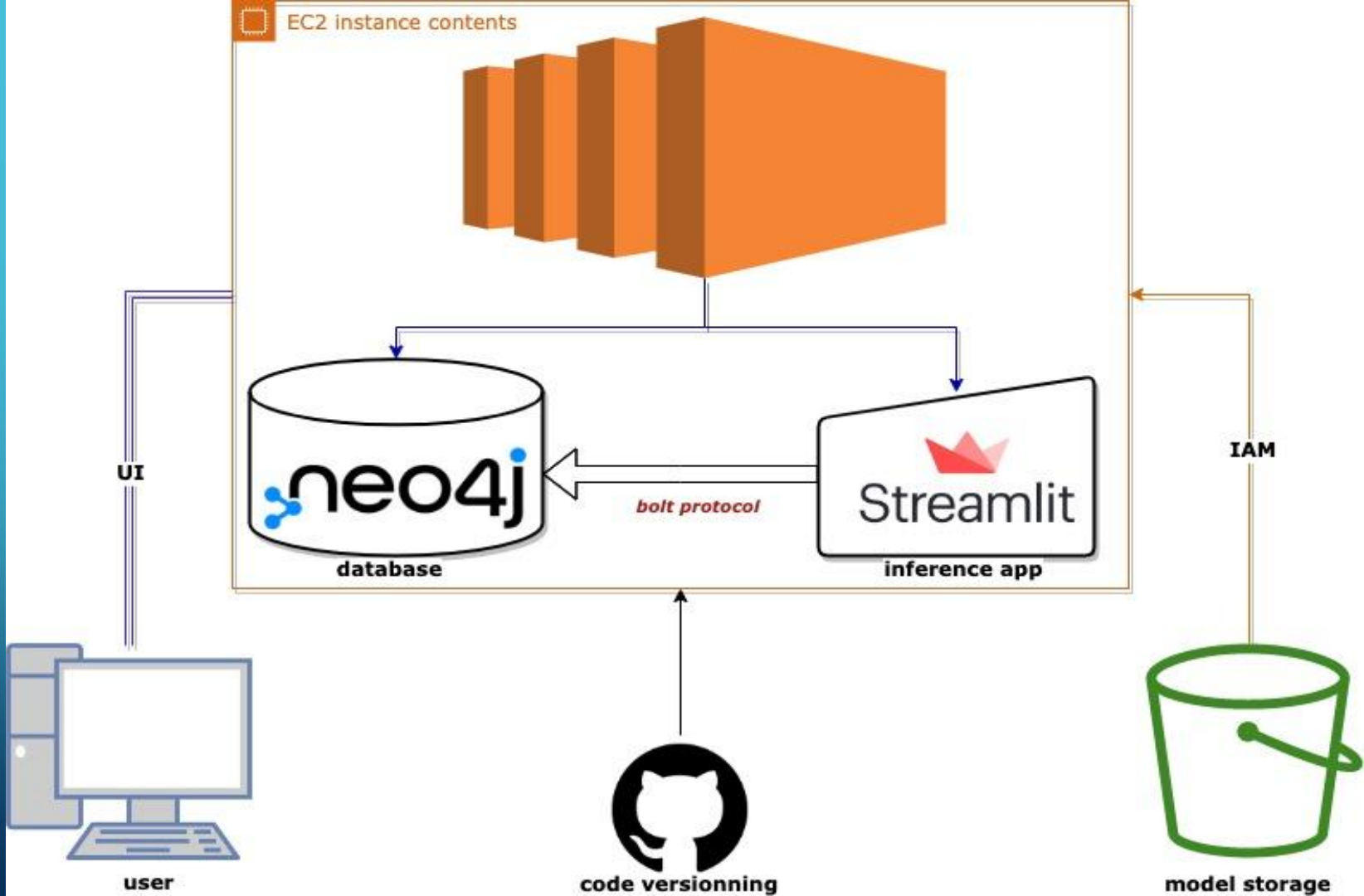


- Significant **confusion** between **Moderately Positive** or **Moderately Negative** and **Neutral** classes
- Same issuse between NEUTRAL and HAPPY classes when training emotional model
- Need to review and improve the labeling step and/or reduce classes

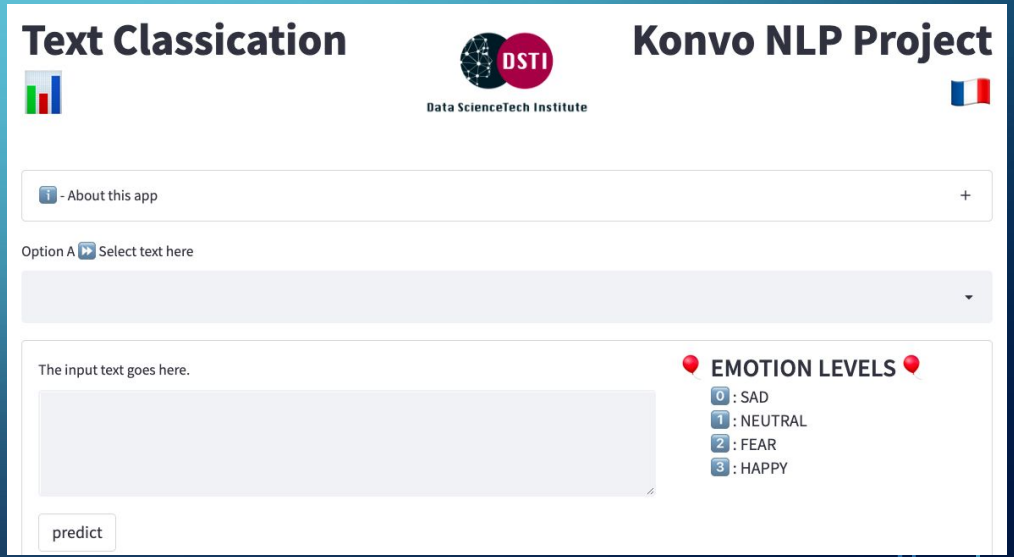
Training set has 5 classes
- 0: Highly Negative
- 1: Moderately Negative
- 2: Neutral,
- 3: Moderately Positive
- 4: Highly Positive

NLP APP

Deployment Architecture



DEMO – NLP MODELS



STAGE 3 - KONVOO APP – PROOF OF CONCEPT

DEMO APP

- Simple Flask application (Python / HTML /Javascript) with video call capability and integration of emotion/sentiment model (rest api)

ARCHITECTURE (DEV phase)

- Free-tier EC2 instance
- Self-signed certificate, no domain name (yet), bare WSGI (gunicorn)

ARCHITECTURE (Future options)

- Option 1 - Remain on EC2 – but more (and/or better) instances, nginx, load balancer & shared storage.
- Option 2 – Microservices and container orchestration for better flexibility & scaling.

DEMO – KONVOO APP

FUTURE WORK - WELCOME S22 !

- Incorporate real-time sentiment/emotion analysis – capture speech during video call and query the models in real time.
- Improve architecture in preparation for move to production.
- Data security and further analysis of GDPR requirements – potential move to Azure ☹

QUESTIONS ?