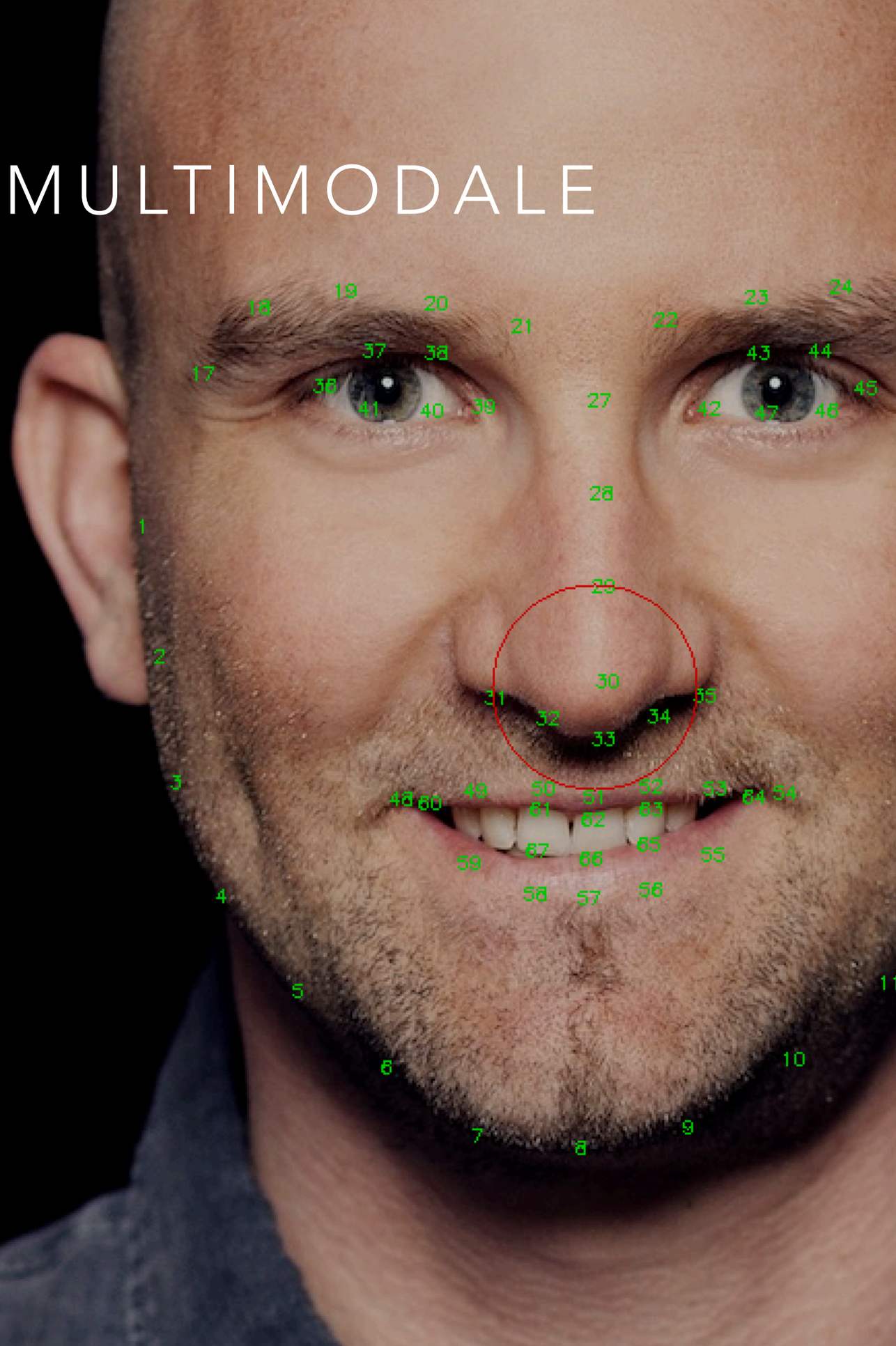
TELECOM PARISTECH - 2019

# RECONNAISSANCE MULTIMODALE D'ÉMOTIONS



TELECOM ParisTech x pôle emploi

FIL ROUGE

# CONTEXTE ET ENJEUX

# CONTEXTE

- Informatique affective : *Etude et développement de systèmes ayant les capacités de reconnaître, d'exprimer, de synthétiser et modéliser les émotions humaines.*

- Usages pour le relation avec conseiller :
  - Assistance aux conseillers
  - Personnalisation et catégorisation des échanges

# ENJEUX

- Tester et concevoir des solutions d'analyse des émotions :
  - Texte : Réponses à des questions en entretien
  - Audio : Enregistrements d'échanges sur une plateforme
  - Vidéo : Enregistrements d'échanges sur une plateforme
- Proposer une plateforme d'entraînement pour les candidats : réponse à des questions, entretien vidéo et audio

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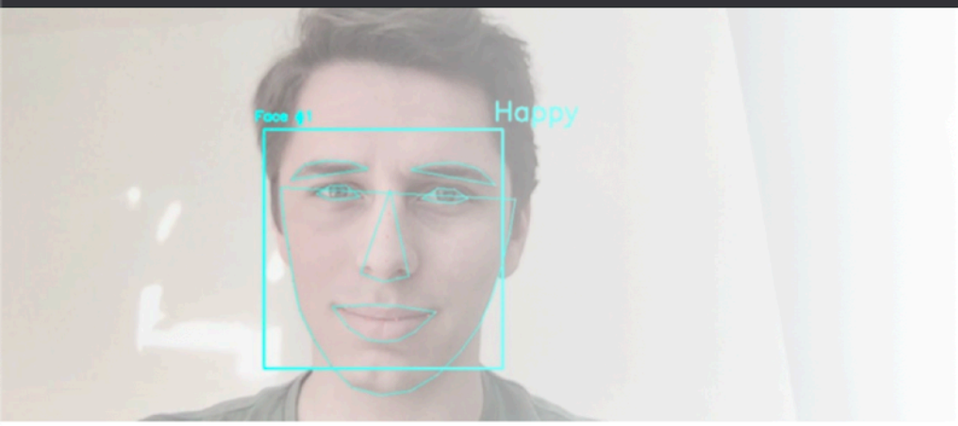
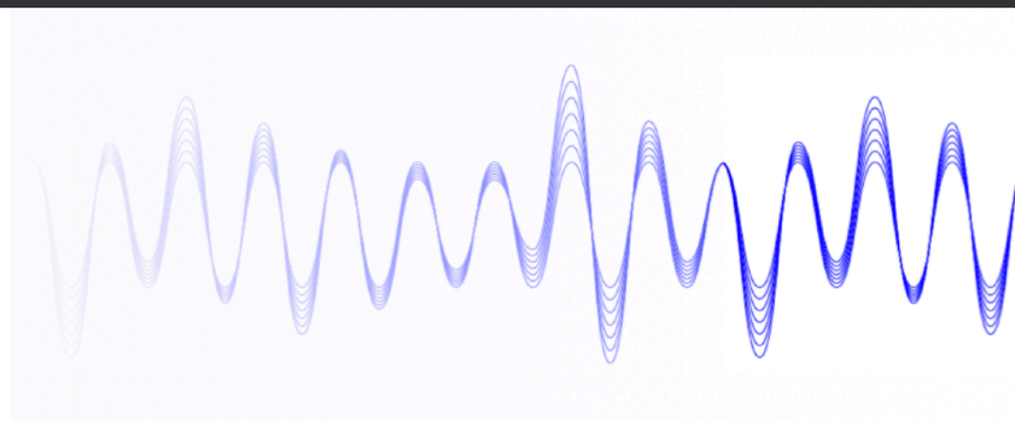



# INTERVIEW SIMULATOR



## VIDEO INTERVIEW

Use the video interview simulator and get a feedback on how our algorithm interprets your facial emotions compared to other candidates.

You will be provided a feedback on your facial emotions such as :

- Anger
- Happiness
- Fear
- Sadness
- Surprise
- Disgust

Video Interview

## AUDIO INTERVIEW

Use the audio interview simulator and get a feedback on how our algorithm interprets your vocal emotions compared to other candidates.

You will be provided a feedback on your vocal emotions such as :

- Anger
- Happiness
- Fear
- Sadness
- Surprise
- Disgust

Audio Interview

## TEXT INTERVIEW

Use the text interview simulator and get a feedback on how our algorithm interprets your psychological traits through compared to other candidates.

You will be provided a feedback on your Big Five Psychological traits, which include :

- Openness
- Conscientiousness
- Extraversion
- Agreeableness
- Neuroticism

Text Interview

# DONNÉES

- Entrainement des modèles à partir d'Open Data :
  - *Texte : Pennebaker and King daily essays (1999)*
  - *Audio : The Ryerson Audio-Visual Database of Emotional Speech and Song (RAVDESS)*
  - *Video : Facial Emotion Recognition 2013, Kaggle*

# APPROCHE

- Mesure des traits BigFive pour le texte
- Mesure des émotions pour la vidéo et le son
- Création d'un modèle d'ensemble et développement de métriques

**Table 1.** Categorical target depending on the input data type.

| Data Type | Categorical target |
|---|---|
| Textual | Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism |
| Sound | Happy, Sad, Angry, Fearful, Surprise, Neutral and Disgust |
| Video | Happy, Sad, Angry, Fearful, Surprise, Neutral and Disgust |

FIL ROUGE

# TIMELINE

# TIMELINE

09.2018
Découverte du projet

10.2018
Premiers RDV + Littérature

12.2018
Premiers modèles

02.2019
Modèles Améliorés

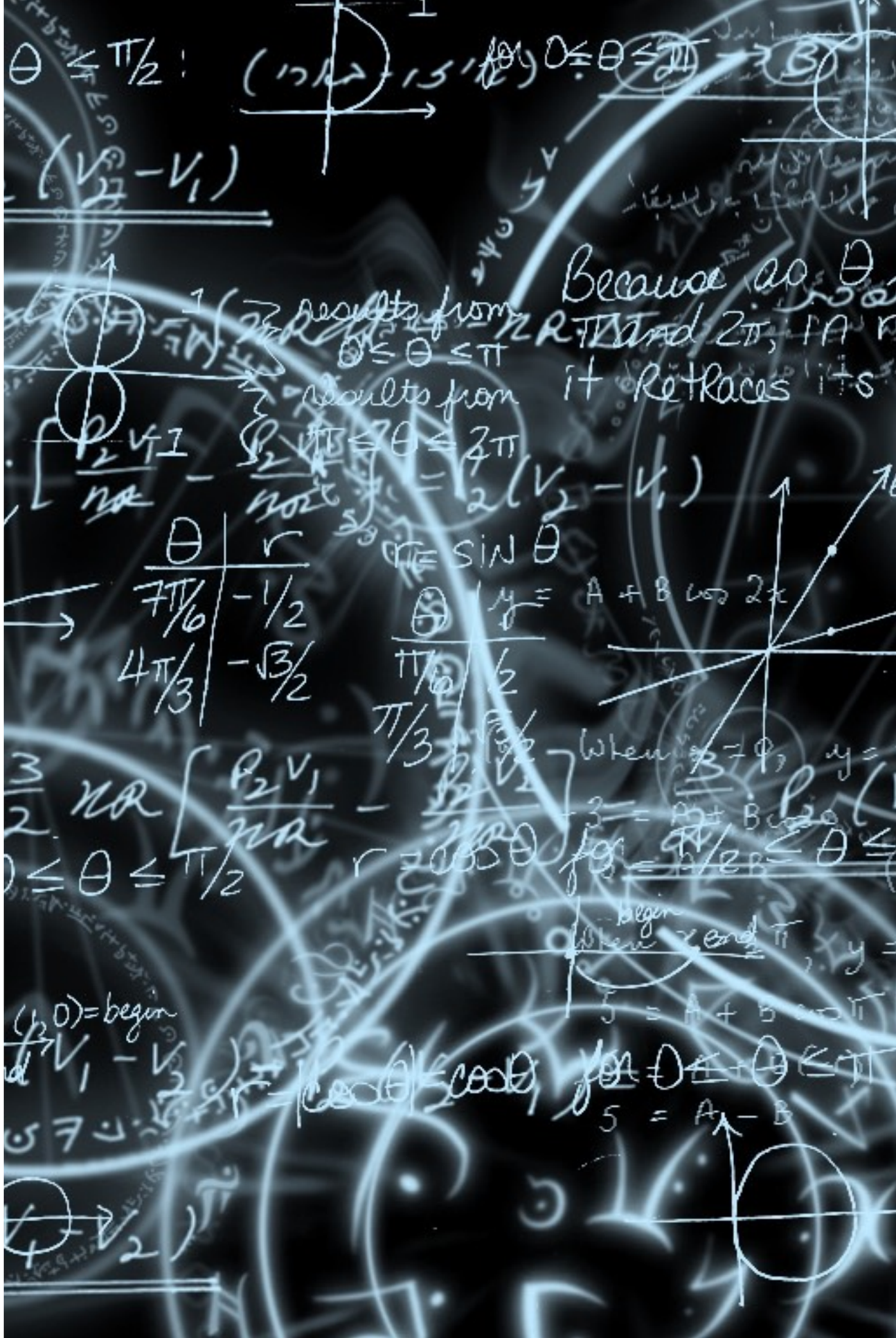
04.2019
Mise en prod des modèles

05.2019
Web App

06.2019
Tests, Améliorations, Rapport

FIL ROUGE

# RESULTATS



# QUELQUES CHIFFRES

**1**

WebApp

**4**

Contributeurs

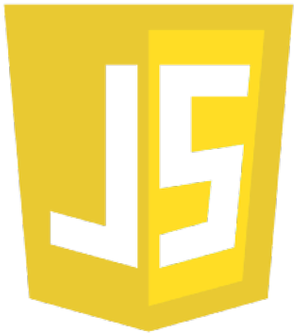
**23**

Stars

**6’000**

Lignes de code

# TECHNOLOGIES



# UN PROJET OPEN-SOURCE

# GitHub

https://github.com/maelfabien/Multimodal-Emotion-Recognition

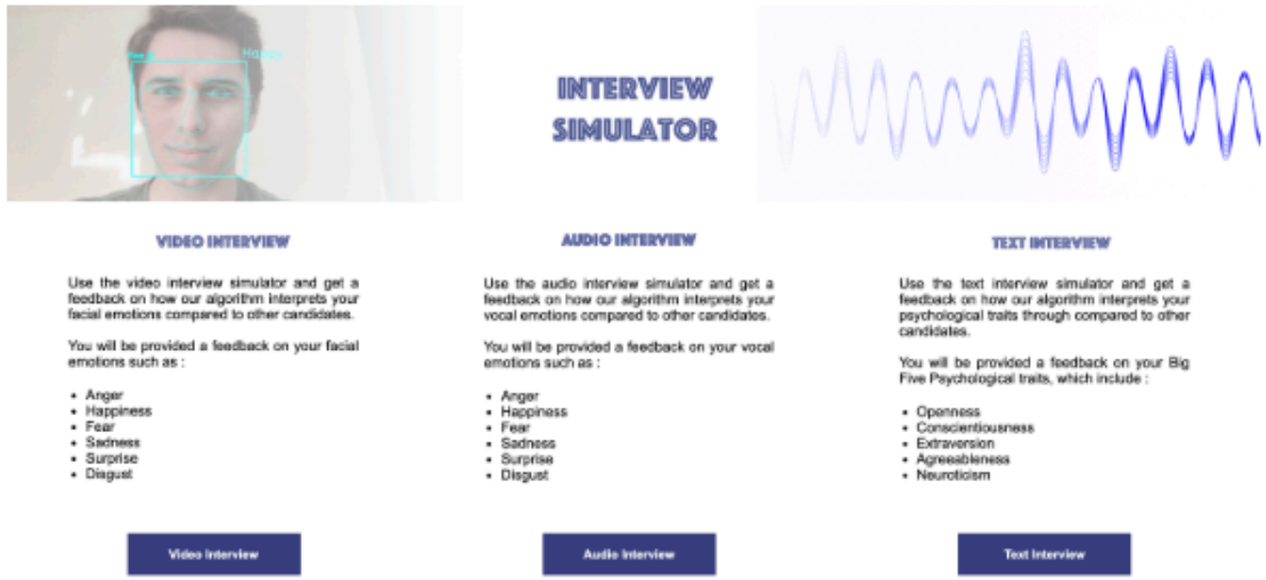
## Real-Time Multimodal Emotion Recognition

Followers 23 | contributors 4 | commit activity invalid | python 3.2 | 3.3 | 3.4

Don't hesitate to ⭐ the repo if you enjoy our work !

### In a nutshell

We developped a multimodal emotion recognition platform to analyze the emotions of job candidates, in partnership with the French Employment Agency. We analye facial, vocal and textual emotions, using mostly deep learning based approaches. We deployed a web app using Flask :




The tool can be accessed here : https://emotion.onrender.com/

We have also written a paper on our work : https://www.overleaf.com/read/xvtrrfpvzwhf

# RÉSULTATS

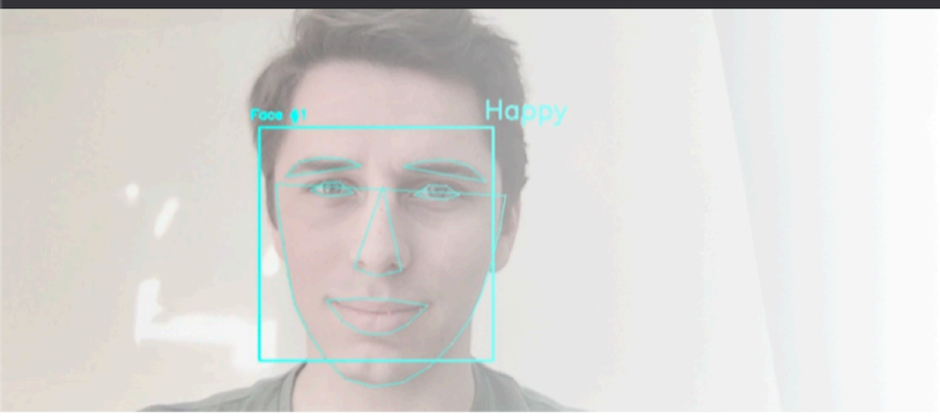
| Texte | Audio | Video |
| --- | --- | --- |
| **53%** | **75%** | **65%** |

# TEXTE

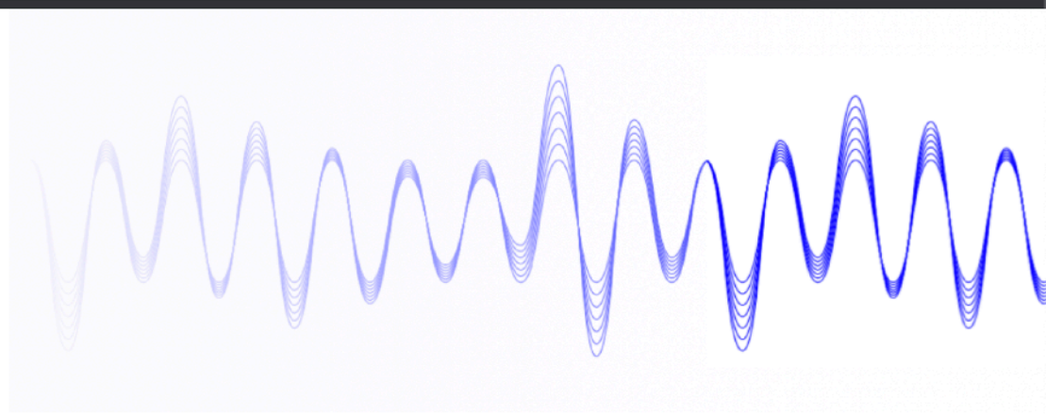
- Identifier des traits de personnalité (Big5) à partir de réponses à des questions spécifiques
- Natural Language Processing :
  - Pré-Traitement
  - Embedding
  - Classification

Chrome Fichier Modifier Afficher Historique Favoris Personnes Fenêtre Aide 100% Sam. 12:05

127.0.0.1:5000/text




# TEXT INTERVIEW



Tell us about the last time you showed leadership.

Start Analysis

Or upload your Cover Letter :

Choisir un fichier Aucun fichier choisi

Start Analysis

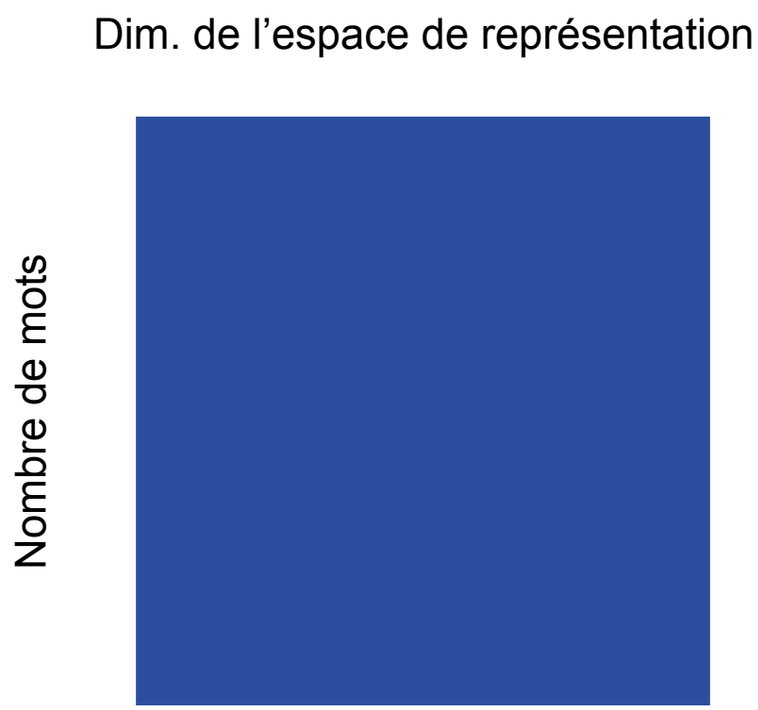
How does it work ?

**[ «** Je me suis préparé pendant plusieurs mois à courir un marathon. C’était un rêve que … » **]**

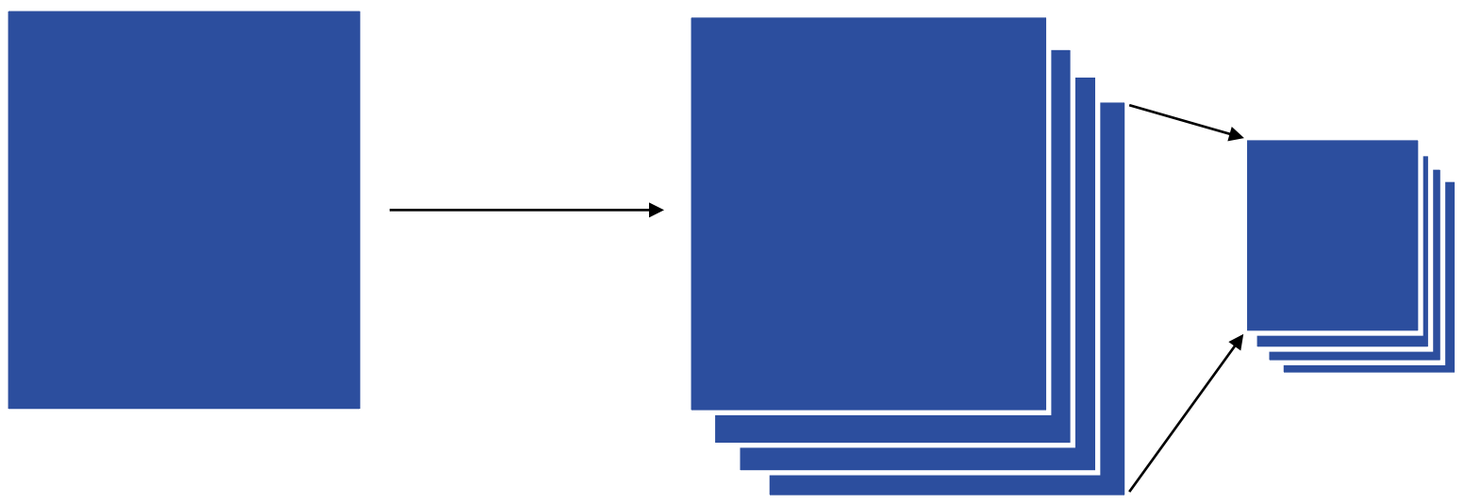
# 1. Extraire le texte

**[** « je », « être », « préparer », « plusieurs », « mois », « courir », « marathon » … **]**

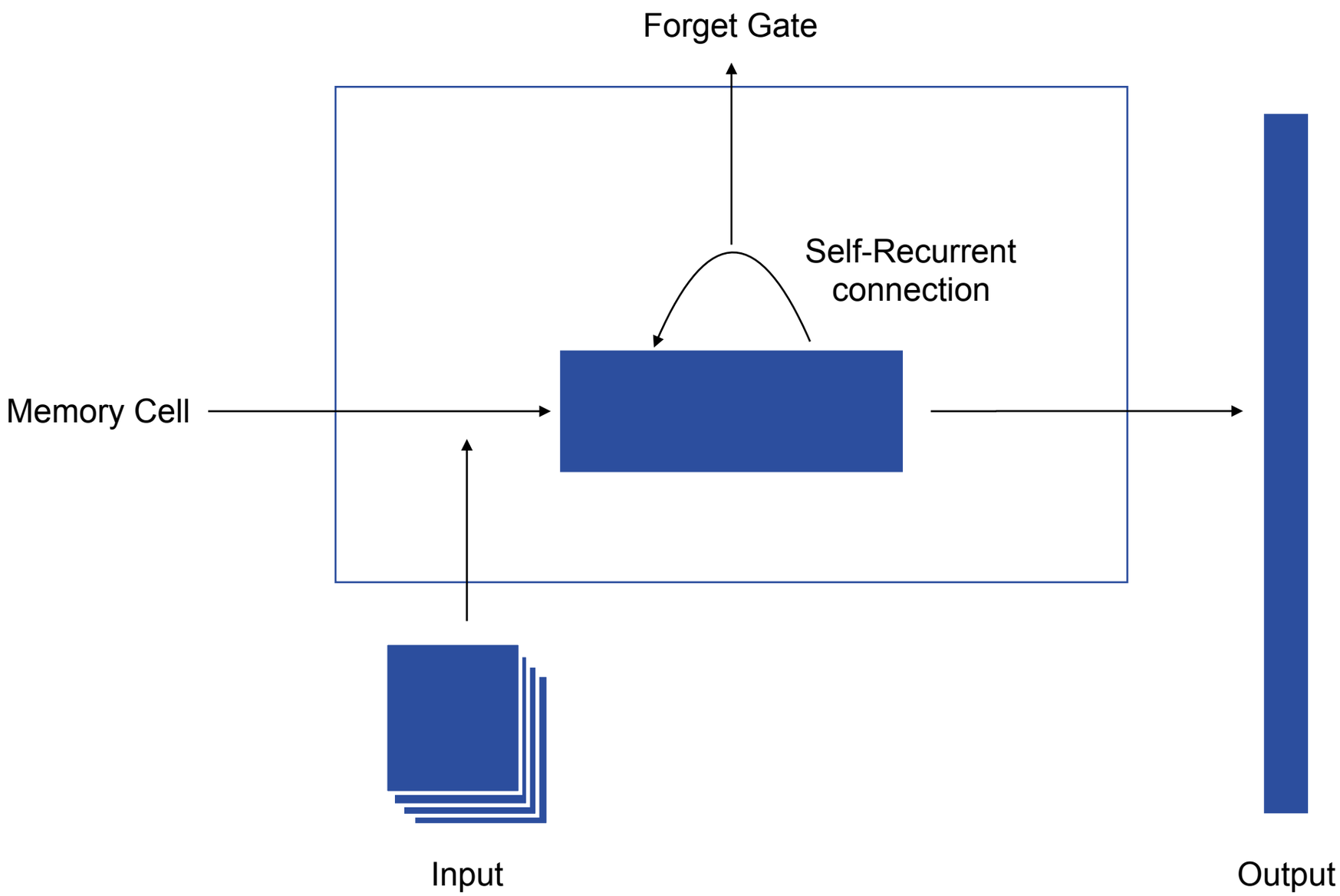
# 2. Pré-traitement



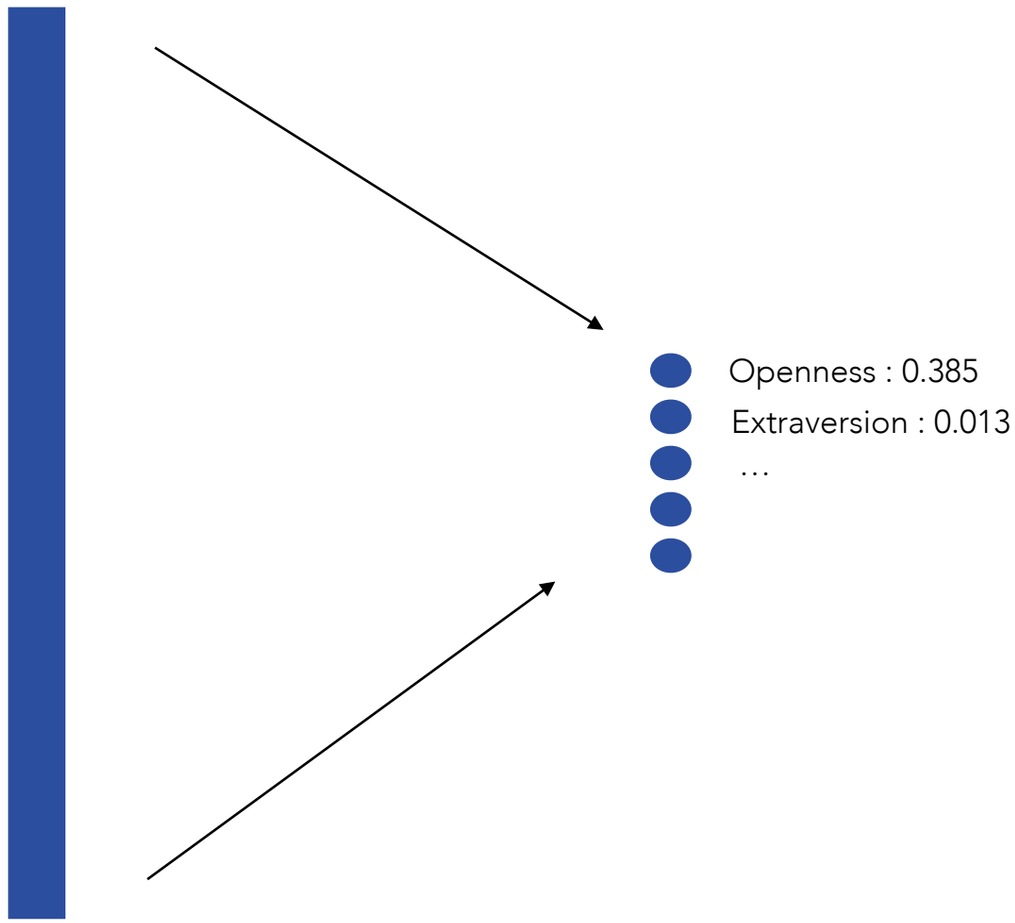

# 3. Word2Vec



# 4. Convolution, Pooling


Forget Gate
Self-Recurrent
connection
Memory Cell
Input
Output

# 5. LSTM

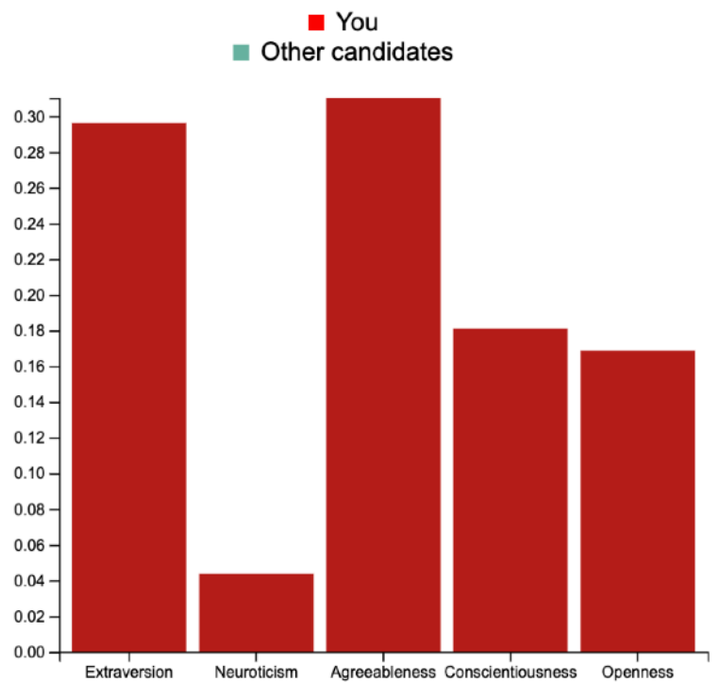



# 6. Dense network

# TEXTE

- Difficultés:
  - Très nombreuses options de **pré-traitement des données textuelles**
  - Corpus d’entrainement de relativement petite taille, en anglais

## *Perceived Psychological Traits*




Your most visible trait is :

**Agreeableness**

Psychological Traits :

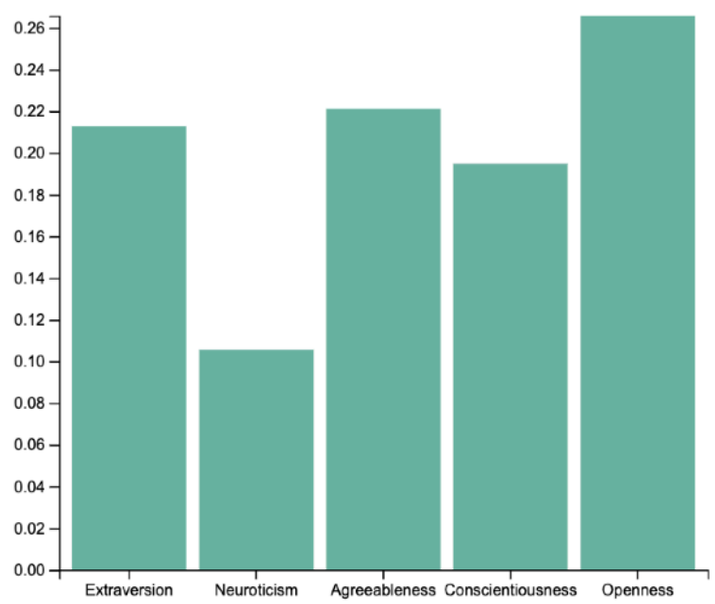
- Extraversion : 29%
- Neuroticism : 4%
- Agreeableness : 31%
- Conscientiousness : 18%
- Openness : 16%

Most common words :

- project
- game
- team
- developer
- work
- individually
- apps
- downloaded
- top
- since
- outcome
- happy
- part
- progress
- monitor

---

## *Other candidates*




Their most visible trait is :

**Openness**

Psychological Traits :

- Extraversion : 21%
- Neuroticism : 10%
- Agreeableness : 22%
- Conscientiousness : 19%
- Openness : 26%

Most common words :

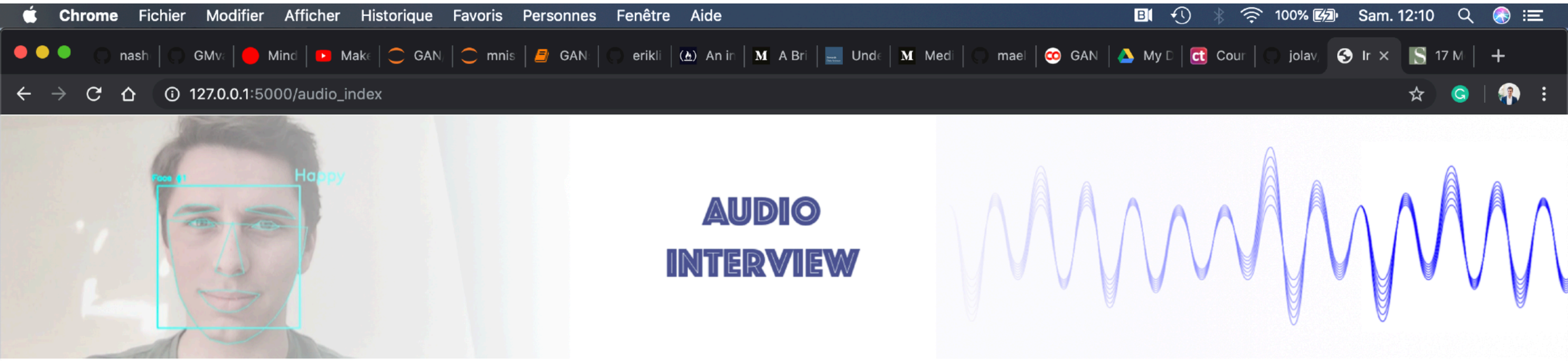
- project
- deutsche
- bank
- work
- market
- team
- study
- cover
- also
- letter
- learning
- internship
- class
- student
- take

# AUDIO

- Idée: identifier des émotions dans la voix.

- Méthode:
  - **Extraction** et **discrétisation** du signal audio
  - **Pré-traitement** du signal
  - **Classification** des émotions

- Modèle:
  - Variable: *Spectrogram*
  - Classifieur: *CNN+LSTM*

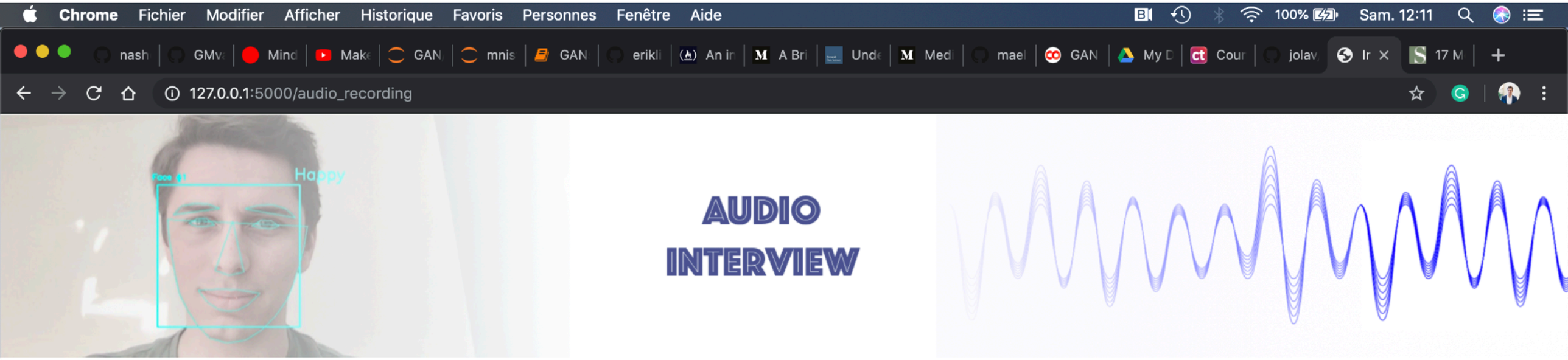



Tell us about the last time you showed leadership.

Start Recording

How does it work ?

Back




Tell us about the last time you showed leadership.

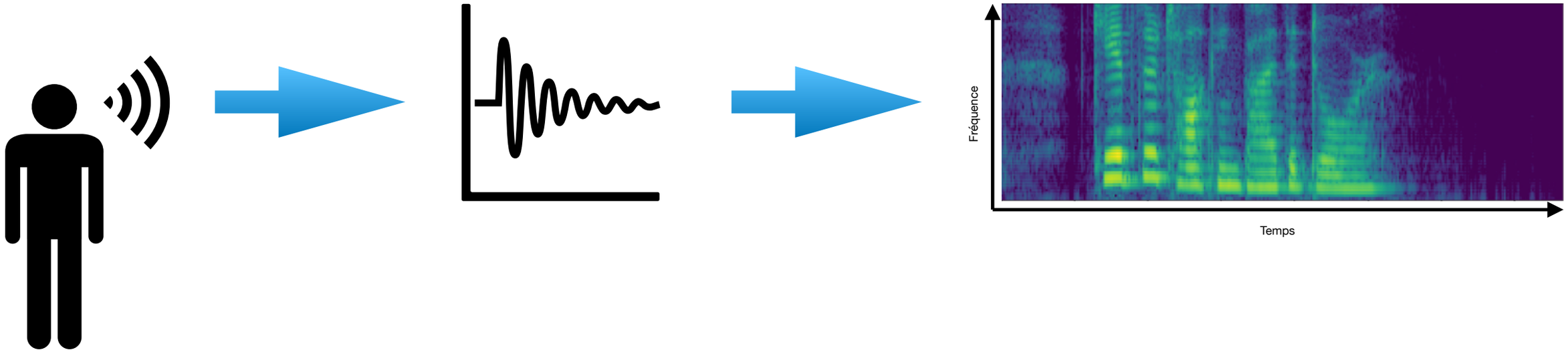
Start Recording

The recording is over! You now have the opportunity to do an analysis of your emotions. If you wish, you can also choose to record yourself again. ✖

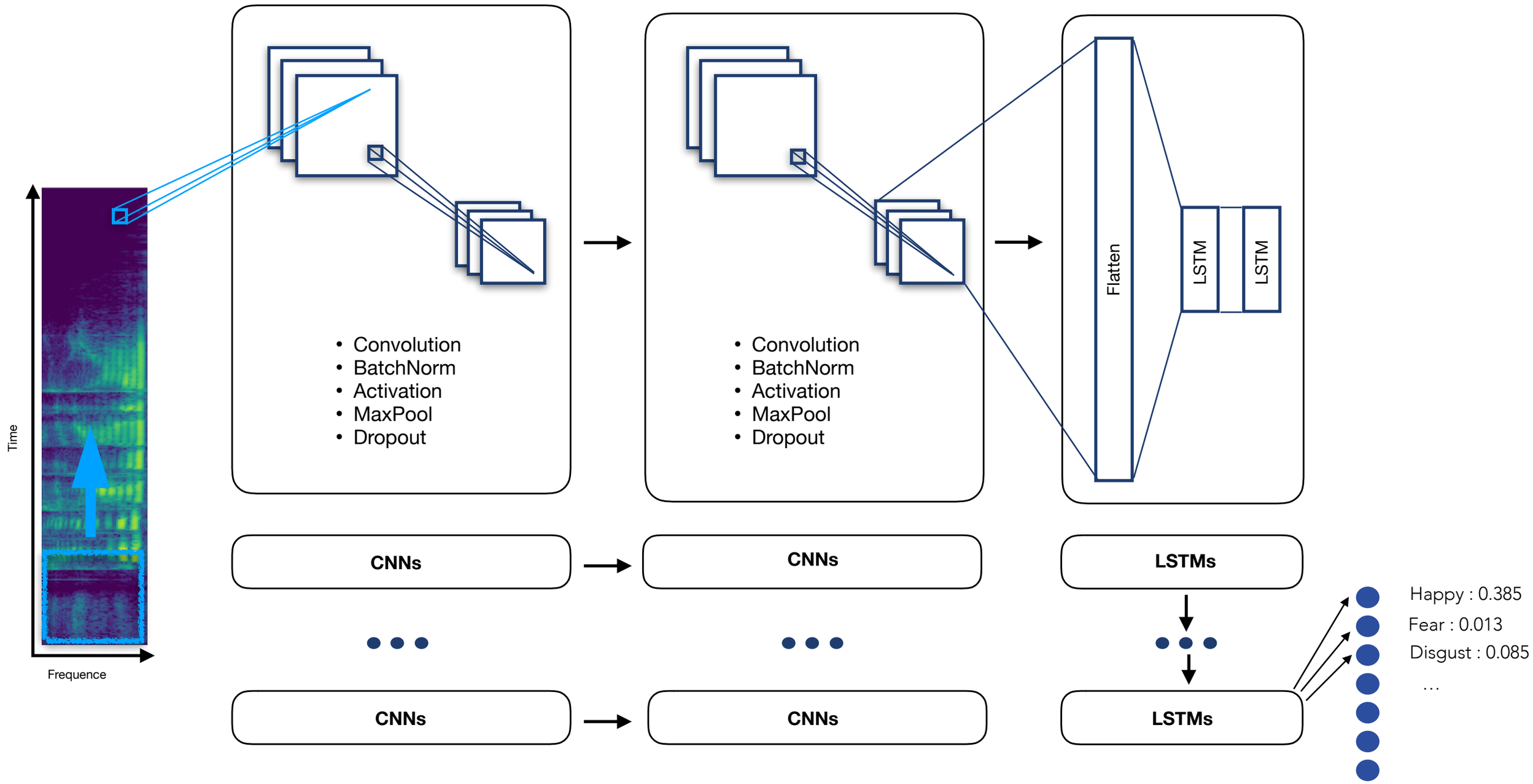
Get Emotion Analysis

How does it work ?

Back




# 1. Extraction du signal et du Spectrogram

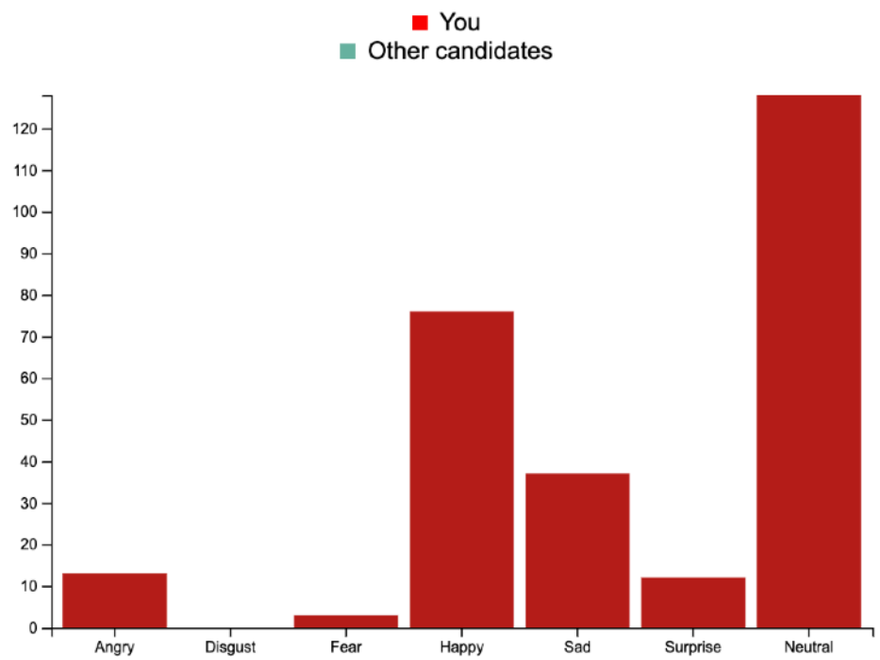

Time
Frequence
• Convolution
• BatchNorm
• Activation
• MaxPool
• Dropout
• Convolution
• BatchNorm
• Activation
• MaxPool
• Dropout
Flatten
LSTM
LSTM
CNNs
CNNs
LSTMs
CNNs
CNNs
LSTMs
Happy : 0.385
Fear : 0.013
Disgust : 0.085
...

# 2. CNNs + LSTMs

# AUDIO

- Difficultés:
  - **Spectrogramme** le plus « propre » possible
  - **Architecture** la plus performante
- Solutions:
  - Suppression des fréquences **> 4k Hz**
  - **Augmentation** des données d'apprentissage
  - Distinction de **genre**

## *Perceived emotions*




### Facial Emotions

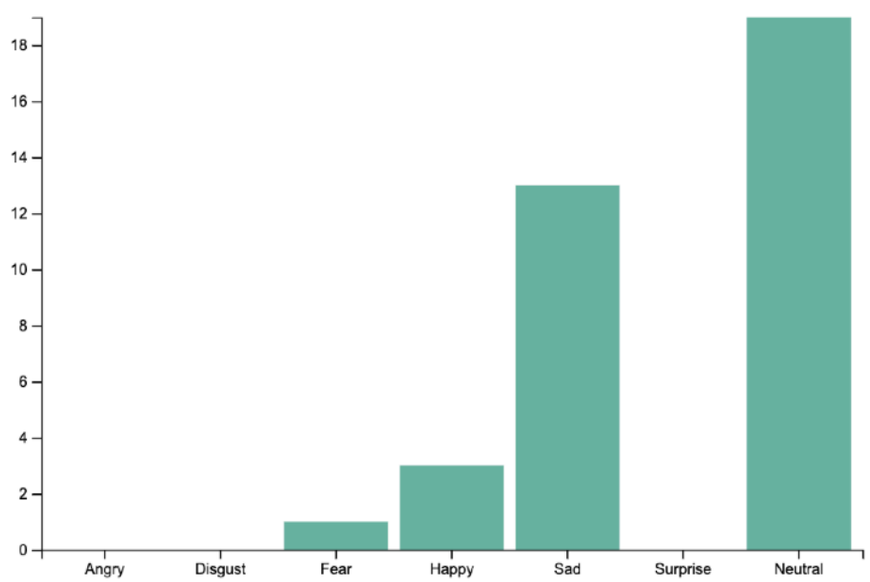
Your most frequent emotion is :

**Neutral**

- Anger : 0%
- Disgust : 0%
- Fear : 2%
- Happiness : 8%
- Sadness : 36%
- Surprise : 0%
- Neutrality : 52%

---

## *Other candidates*




Other candidates most frequent emotion is :

**Neutral**

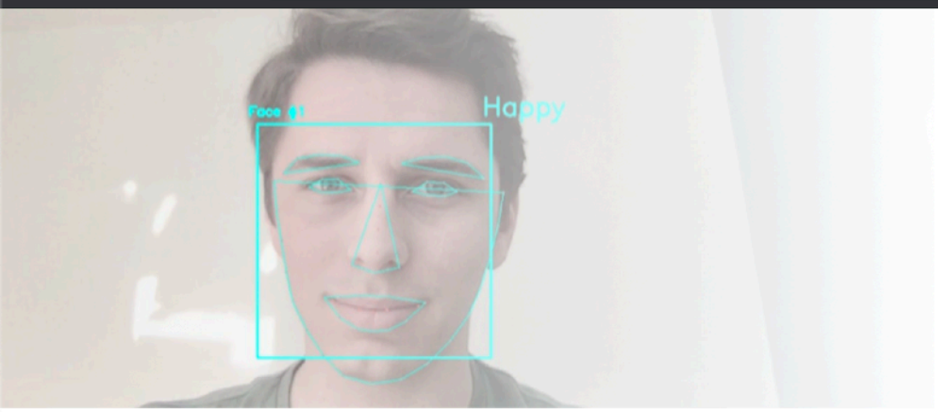
- Angry : 4%
- Disgust : 0%
- Fear : 1%
- Happy : 28%
- Neutral : 13%
- Sad : 4%
- Surprise : 47%

# VIDEO

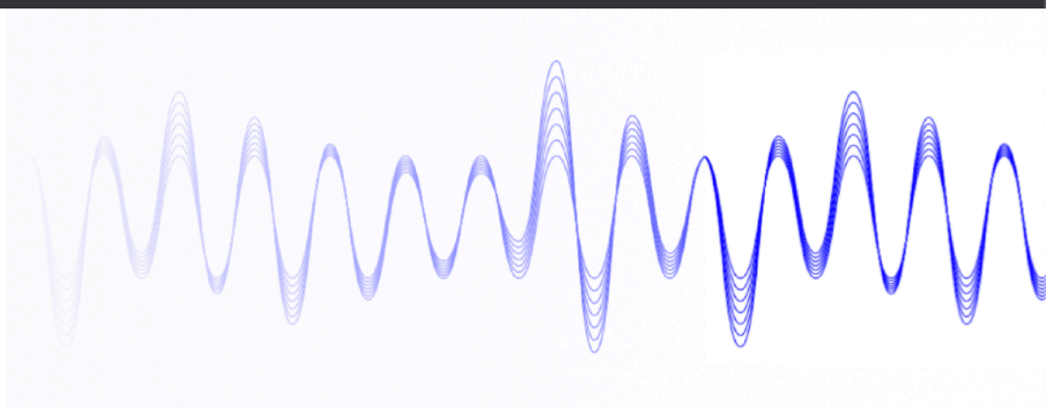
- Identifier des émotions à partir d'une vidéo
- Traitement de l'image :
  - Pré-Traitement de l'image : Identification, extraction du visage
  - Filtres manuels + SVM
  - CNN, XCeption

Chrome Fichier Modifier Afficher Historique Favoris Personnes Fenêtre Aide 100% Sam. 12:15

127.0.0.1:5000/video




# VIDEO INTERVIEW



Tell us about the last time you showed leadership.

Start Recording

You will have 45 seconds to discuss the topic mentioned above. Due to restrictions, we are not able to redirect you once the video is over. Please move your URL to /dash instead of /video_1 once over. You will be able to see your results then.

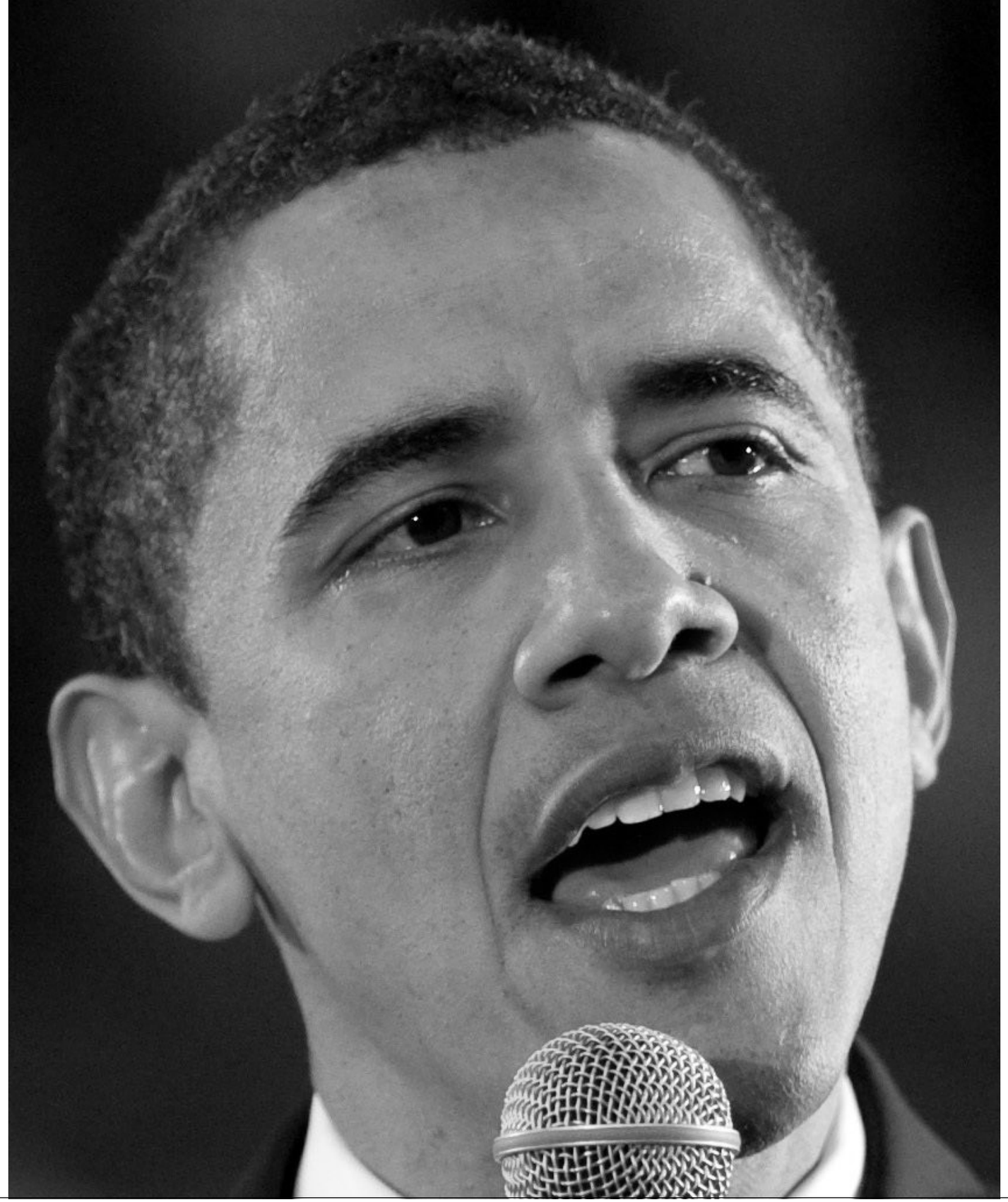
How does it work ?

Back

1. Extraire chaque image

2. Appliquer un filtre gris

# 3. Identifier un visage (Histogramme de Gradients Orientés)



4. Zoomer sur le visage

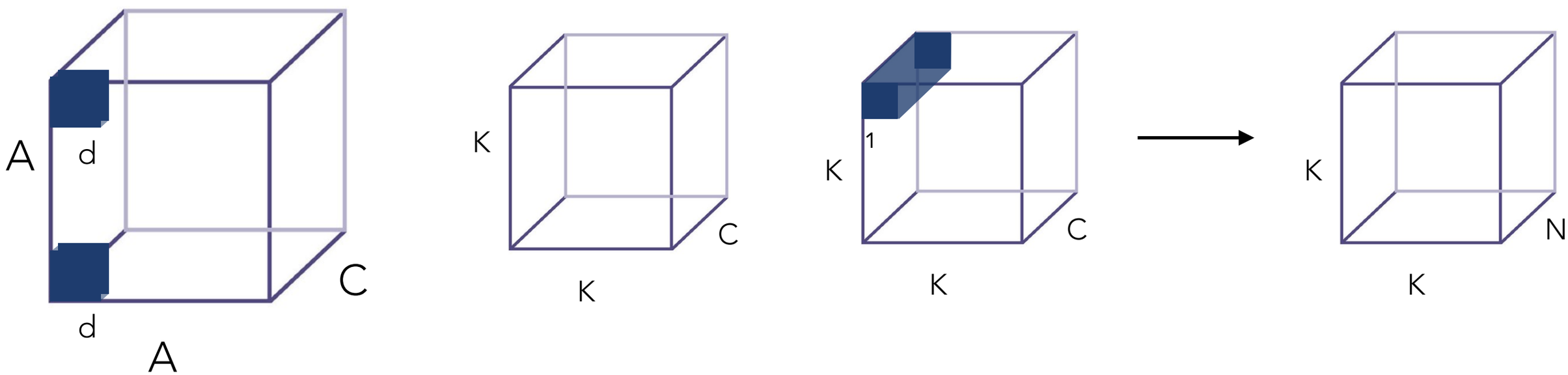
# 5. Réduire la dimension

## DepthWise Separable Convolutions

Approche en 2 étapes :

*Etape 1* : Depthwise convolution

*Etape 2* : Pointwise convolution




Permet de réduire le nombre de paramètres et accélérer le temps d'entrainement

*± 2h sur GPU*

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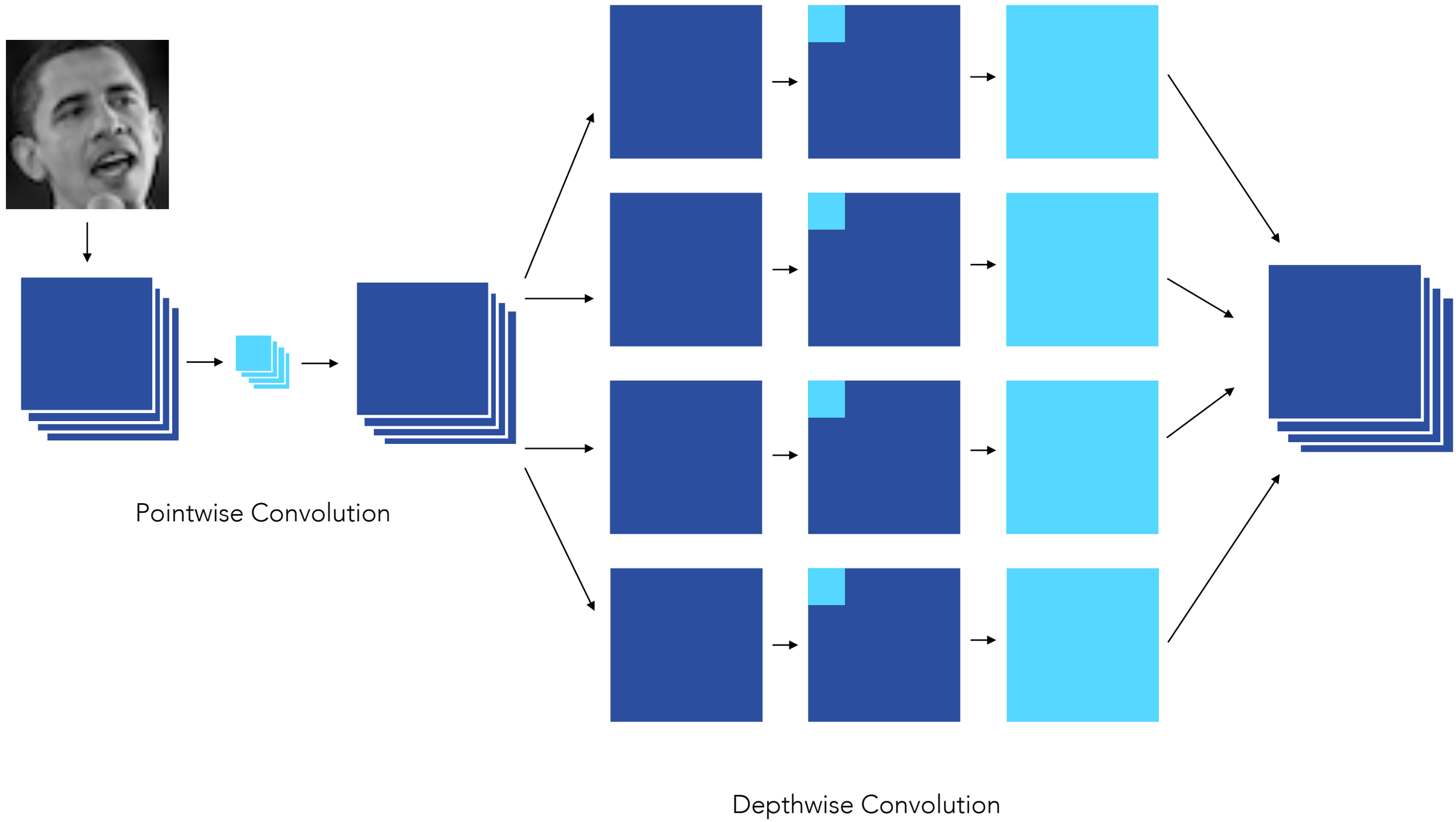
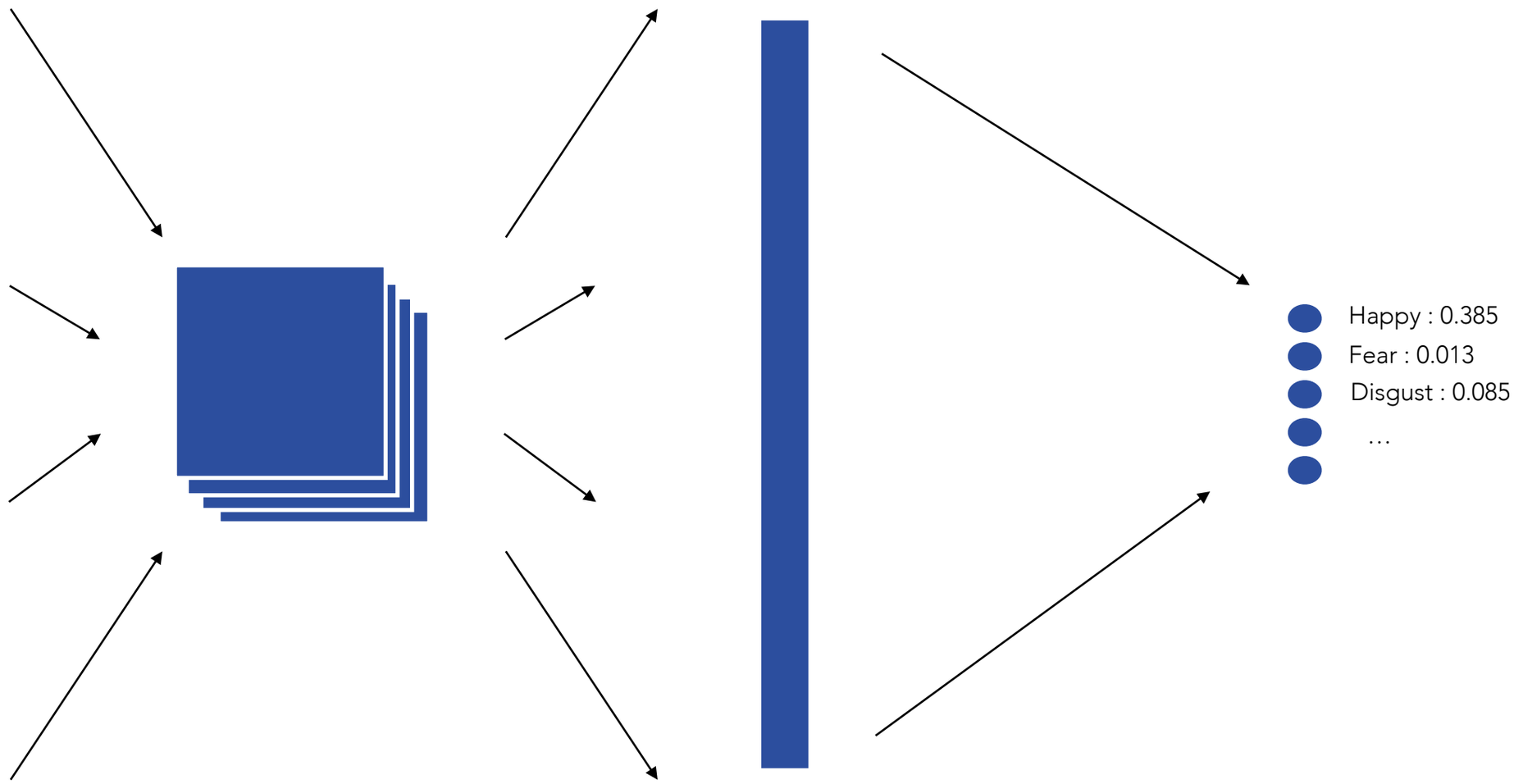
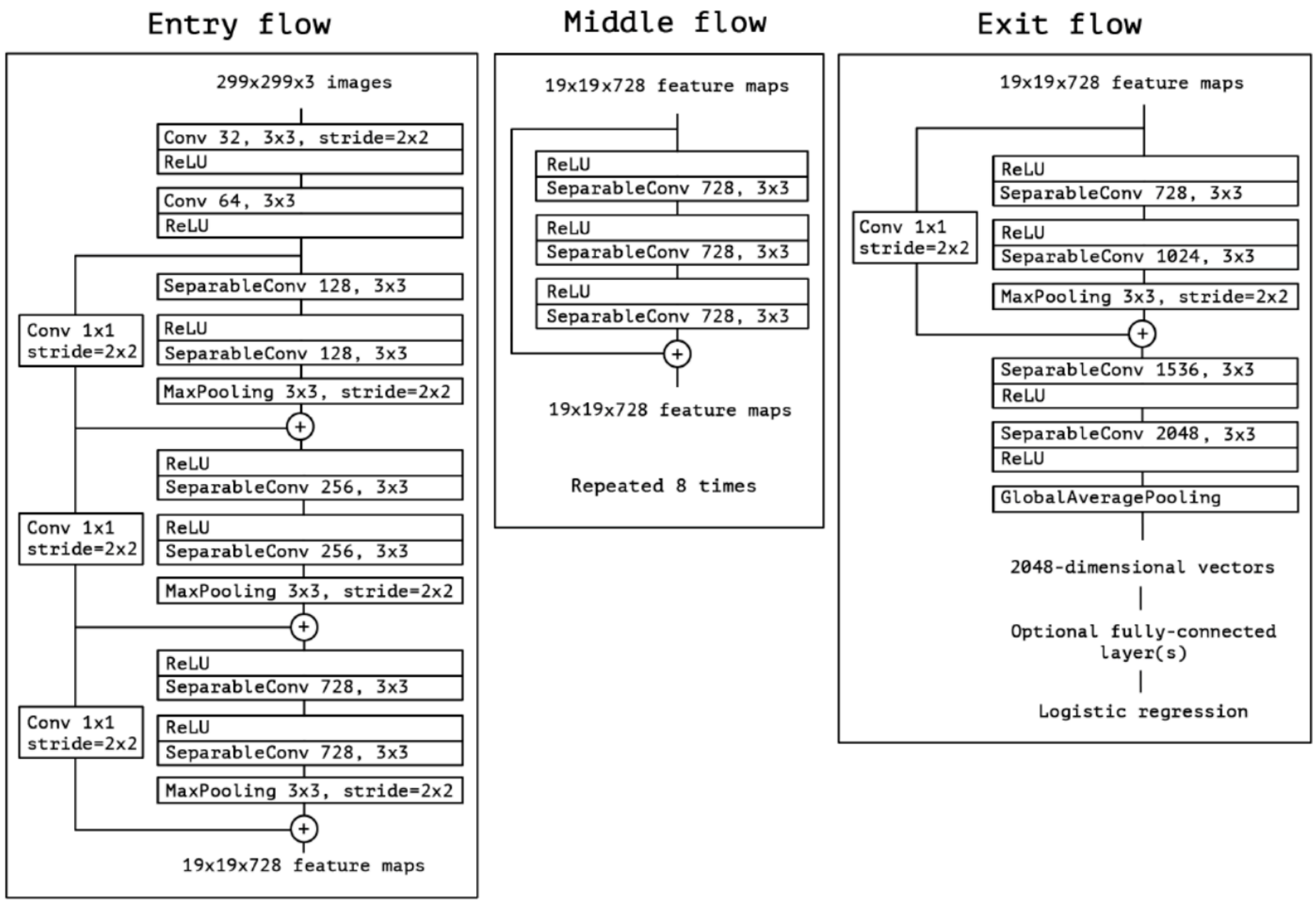
# 6. Appliquer des filtres convolutifs (XCeption)




# 6. Appliquer des filtres convolutifs (DenseNet, Inception, ResNet, XCeption…)

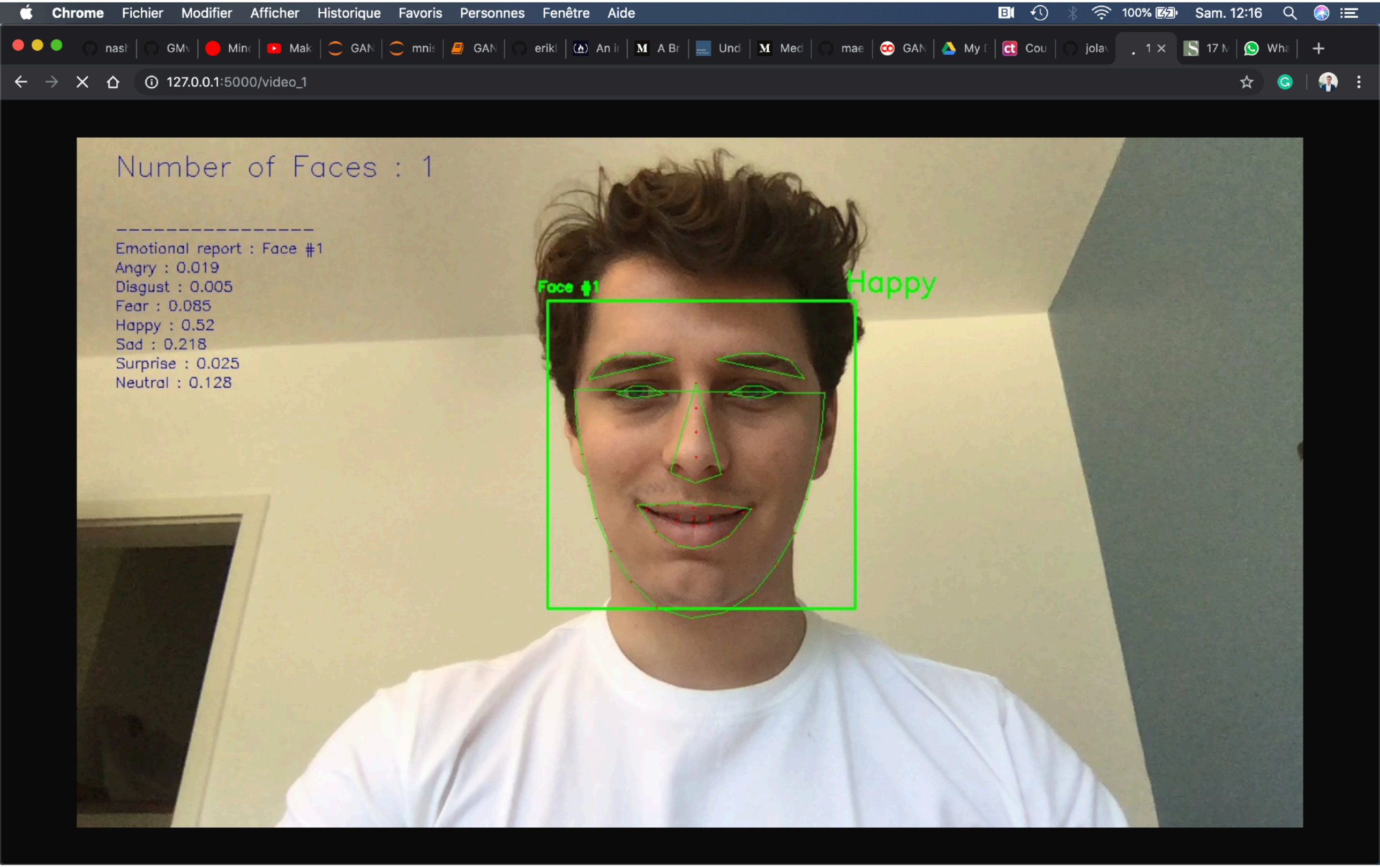


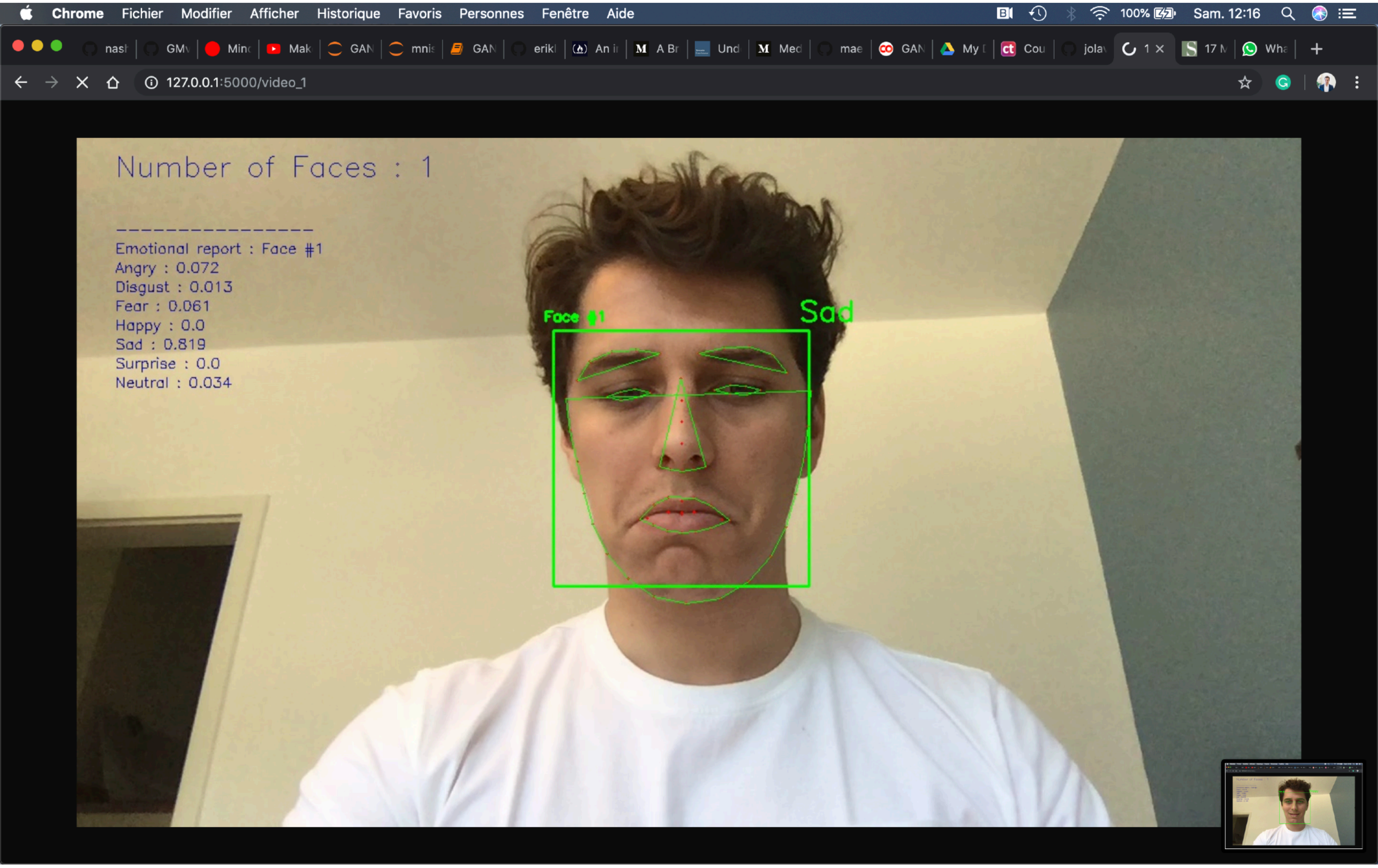

# 7. Classification




**Overall Architecture of Xception (Entry Flow > Middle Flow > Exit Flow)**

# 8. Structure du modèle

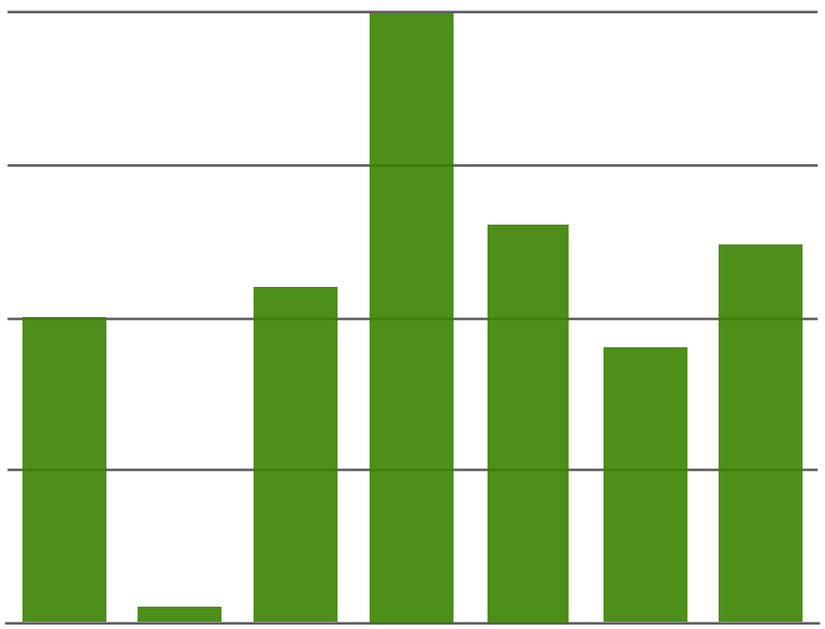

Chrome Fichier Modifier Afficher Historique Favoris Personnes Fenêtre Aide
100% Sam. 12:16
127.0.0.1:5000/video_1
Number of Faces : 1
---
Emotional report : Face #1
Angry : 0.019
Disgust : 0.005
Fear : 0.085
Happy : 0.52
Sad : 0.218
Surprise : 0.025
Neutral : 0.128
Face #1
Happy


Chrome Fichier Modifier Afficher Historique Favoris Personnes Fenêtre Aide
100% Sam. 12:16
127.0.0.1:5000/video_1
Number of Faces : 1
---
Emotional report : Face #1
Angry : 0.072
Disgust : 0.013
Fear : 0.061
Happy : 0.0
Sad : 0.819
Surprise : 0.0
Neutral : 0.034
Face #1
Sad

# VIDEO

- Difficultés:
  - **Label des données** d'entrainement
  - **Passage à l'échelle** (images/secondes)

- Solutions:
  - Data Augmentation
  - Early Stopping
  - Réduction du « Learning Rate » sur plateau
  - L2-Regularization
  - Class Weight



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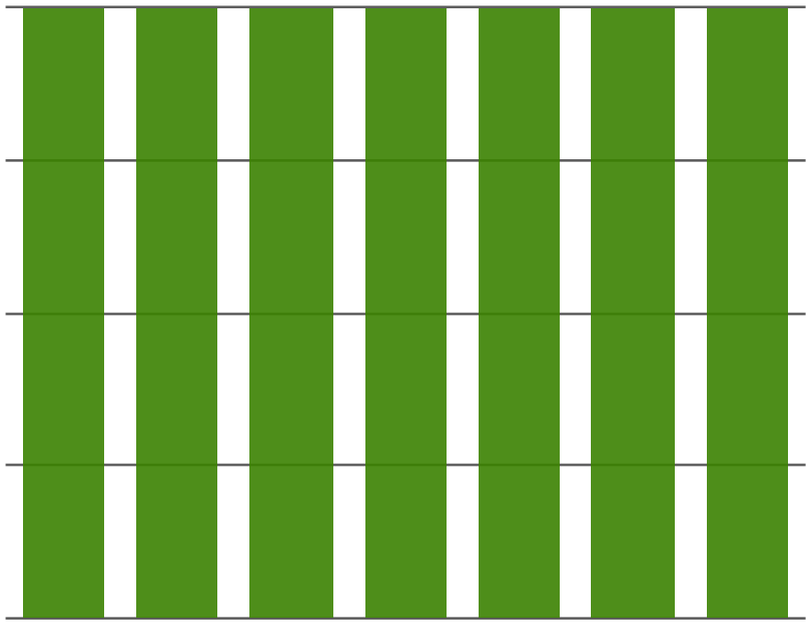
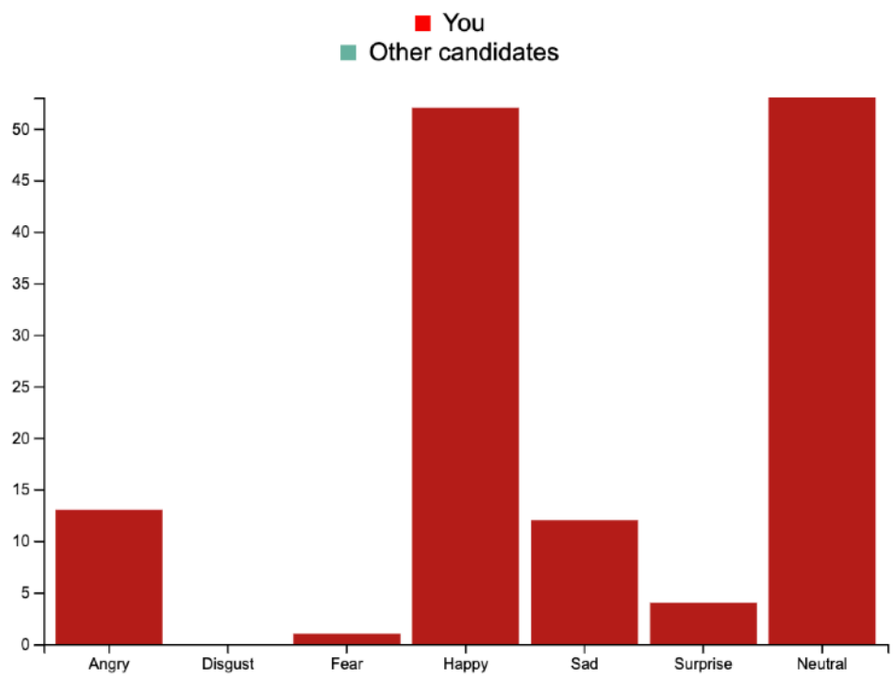


## *Perceived emotions*




### Facial Emotions

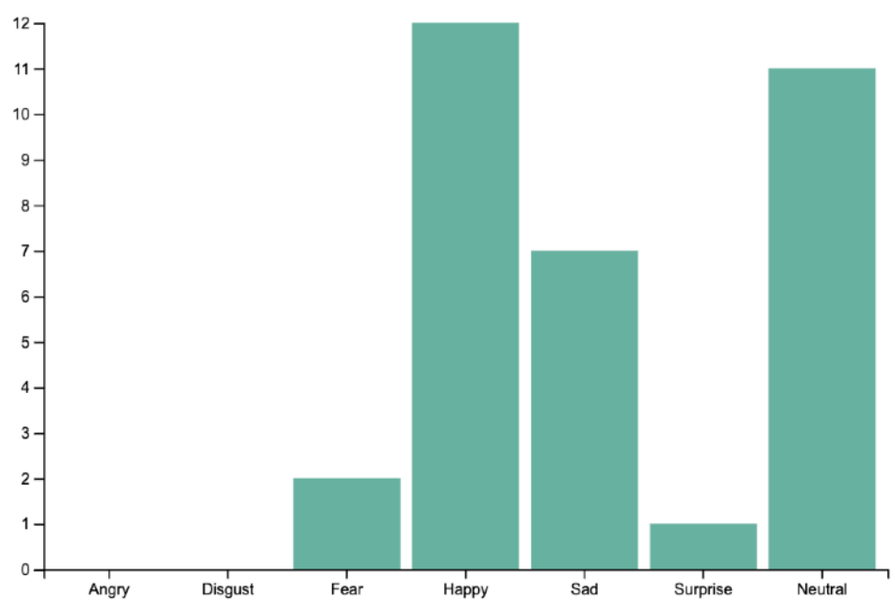
Your most frequent emotion is :

**Neutral**

- Anger : 0%
- Disgust : 0%
- Fear : 0%
- Happiness : 24%
- Sadness : 36%
- Surprise : 0%
- Neutrality : 39%

---

## *Other candidates*




Other candidates most frequent emotion is :

**Happy**

- Angry : 7%
- Disgust : 0%
- Fear : 1%
- Happy : 38%
- Neutral : 11%
- Sad : 2%
- Surprise : 38%

FIL ROUGE

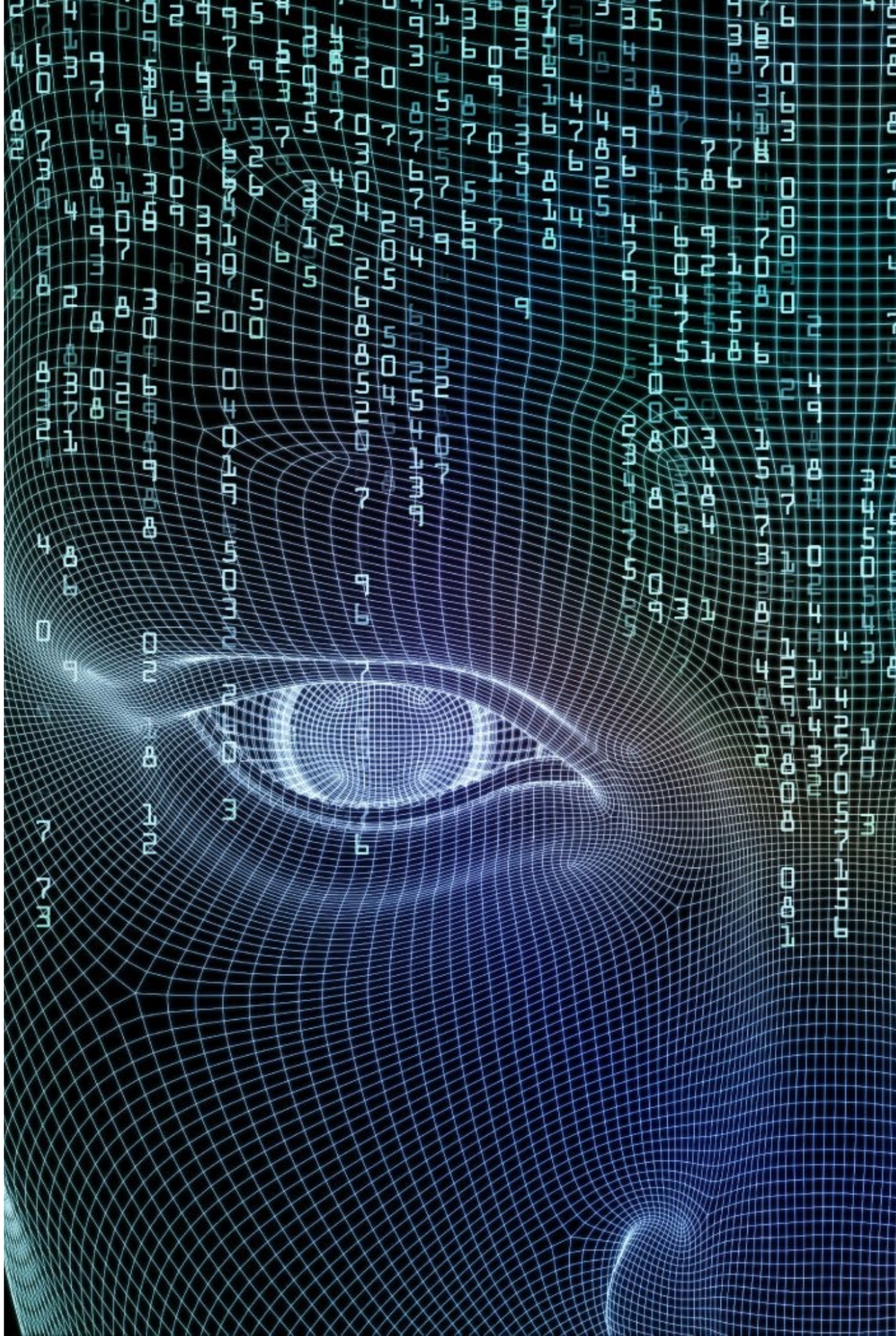
# PERSPECTIVES

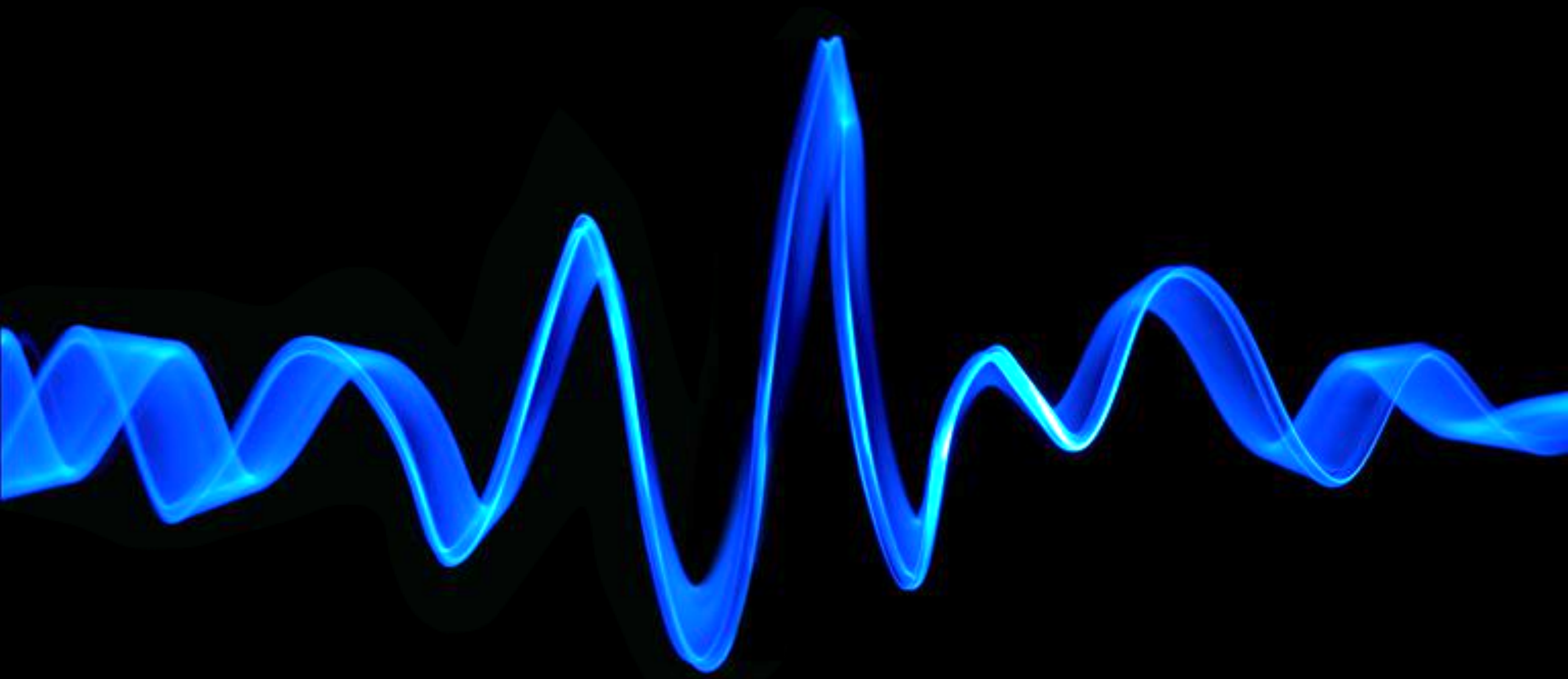
# AMÉLIORATIONS

- Déploiement de la Web App en ligne
- Meilleure visualisation avec D3.js
- Mise en place de bases de données SQL pour les scores des candidats
- Fluidifier l’app Flask

FIL ROUGE

# CONCLUSION



TELECOM PARISTECH - 2019

# MULTIMODAL EMOTION RECOGNITION