

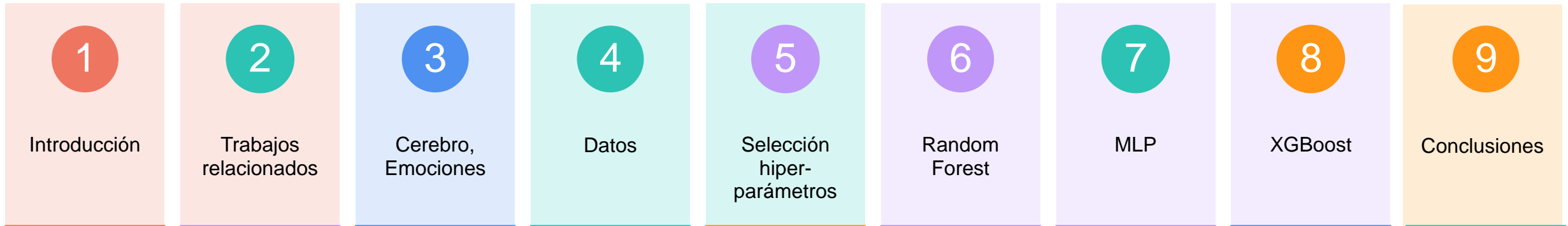


TFM

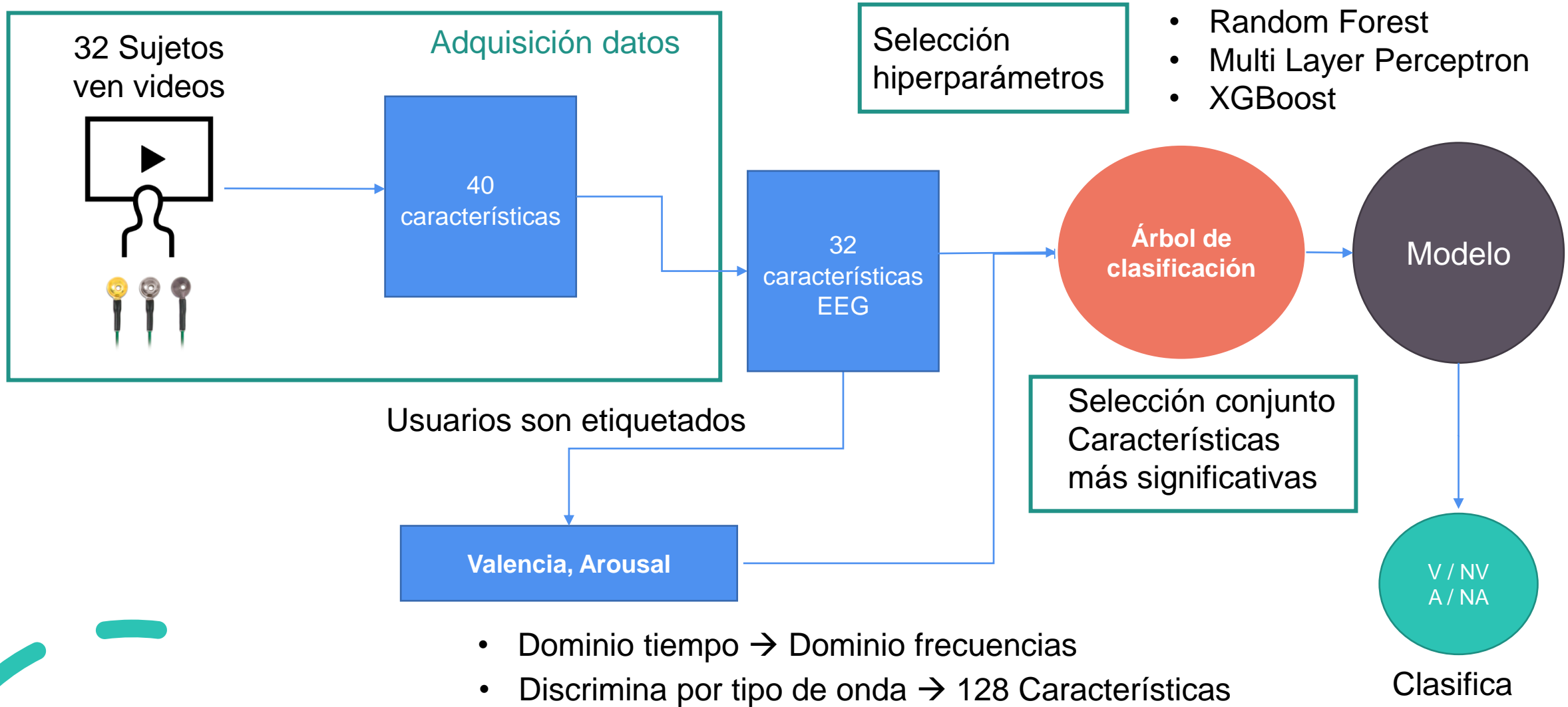
”Análisis de emociones de sujetos a partir de señales de EEG, una aproximación con modelos de aprendizaje automático”

José Javier Calvo Moratilla

Puntos



1. Introducción



2. Trabajos relacionados

Investigating the Use of Pretrained Convolutional Neural Network on Cross-Subject and Cross-Dataset EEG Emotion Recognition (2020)

Input data:

- Datos dominio tiempo

Modelo:

- InceptionResnetV2 (Obtener Caract.)
- Fully Connected (Clasificación)

Classification of Human Emotions from Electroencephalogram (EEG) Signal using Deep Neural Network (2017)

Input data:

- Power Spectral Density (PSD)
Dominio tiempo → frecuencias
- Frontal EEG Asymmetry

Modelo:

- Fully Connected, 4 hidden layers (2194, 1310, 786, 472)

Emotion Recognition Based on DEAP Database using EEGTime-Frequency Features and Machine Learning Methods (2019)

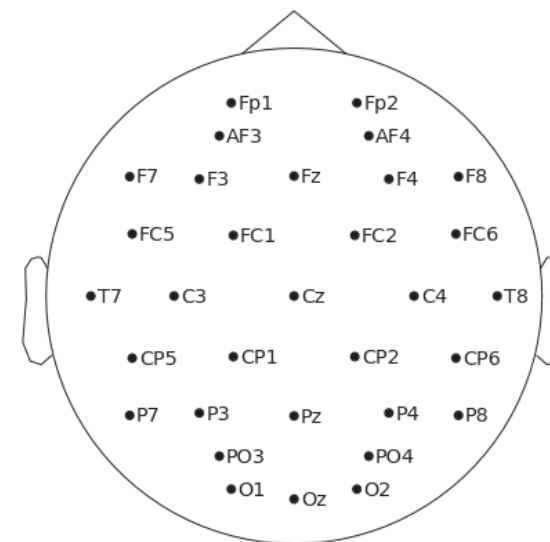
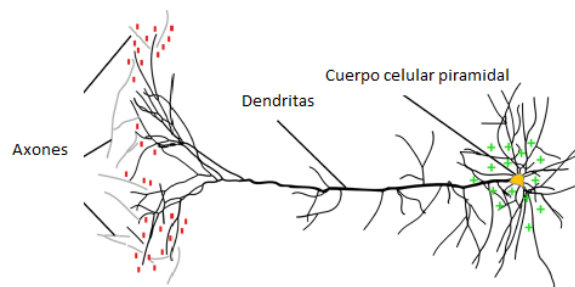
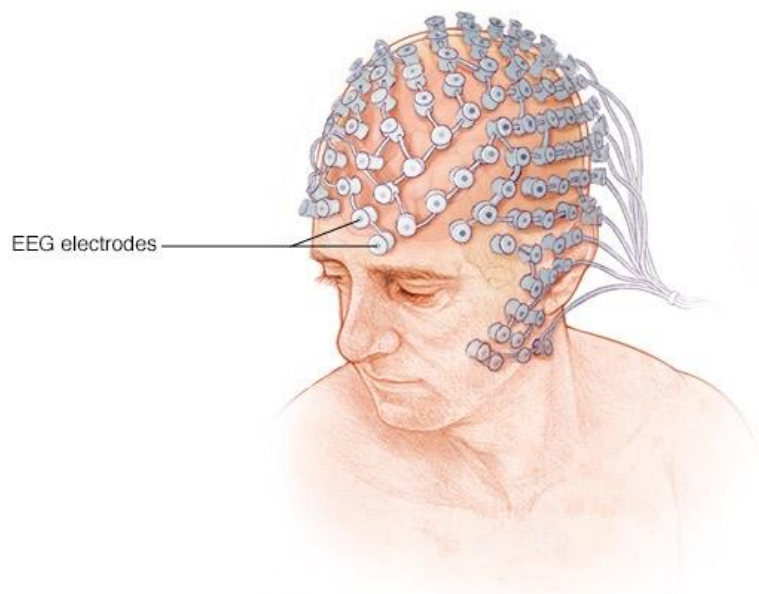
Input data:

- Dominio temporal (peak to peak mean, mean squared value, variance, maximum power spectral frequency, power spectral density and power sum)
- Dominio de frecuencia (parameters, complexity, mobility and activity)

Modelo:

- Random Forest

3. Cerebro, emociones

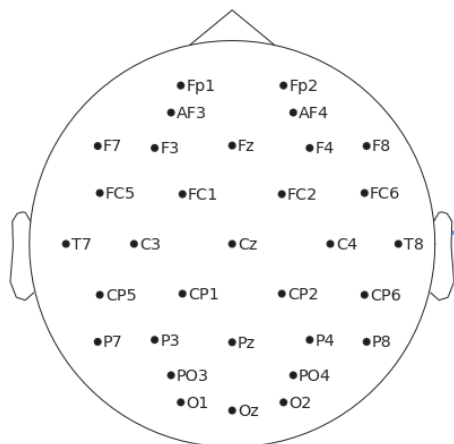


Nivel fisiológico de activación del cerebro:



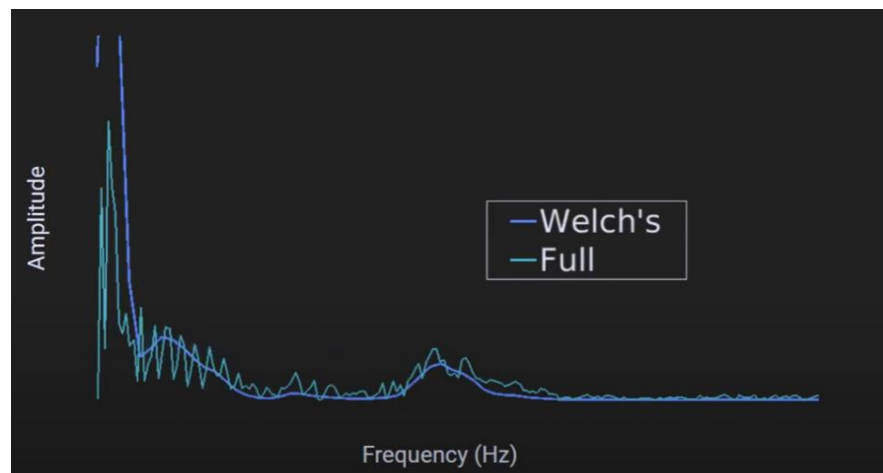
4. Datos

"DEAP: A Database for Emotion Analysis using Physiological Signals"



32 Características
(Dominio temporal)

Método de Welch



32 características
Theta

32 características
Alpha

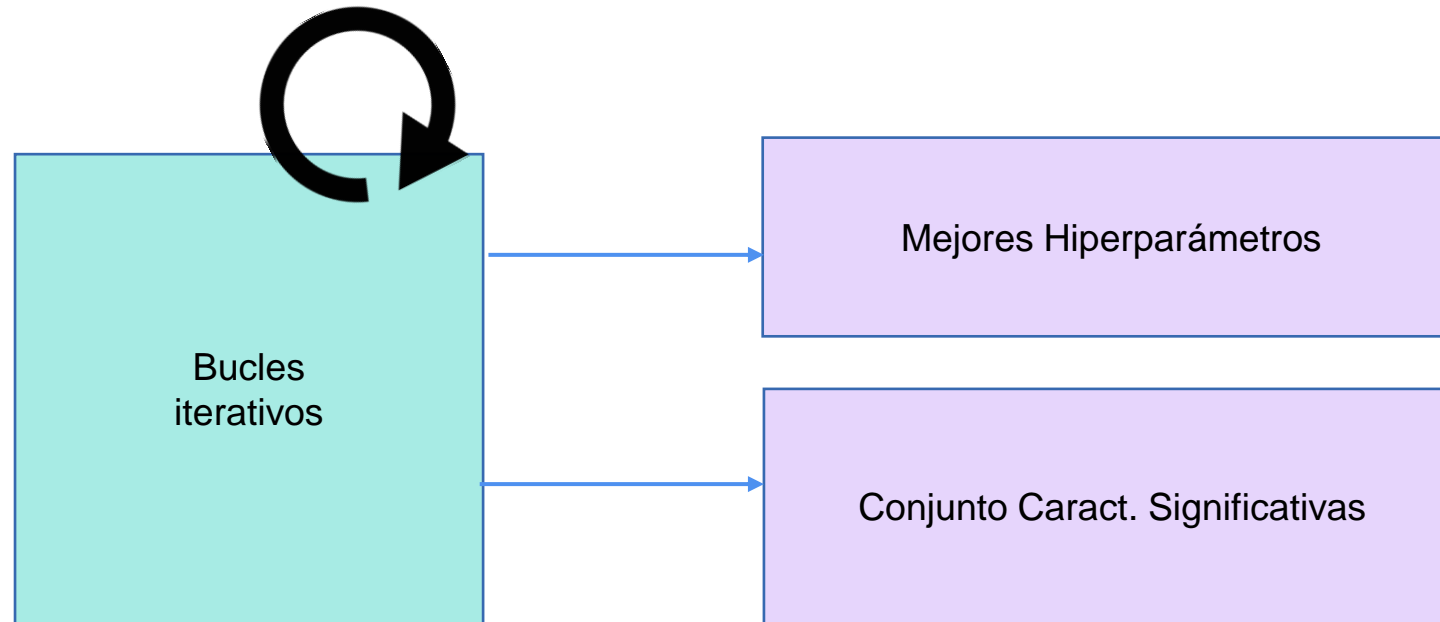
32 características
Beta

32 características
Gamma

128 Características
(Dominio frecuencia)

| Banda | Rango de frecuencias | Referencia |
|-------|----------------------|------------------------------|
| Delta | [1-4] Hz | Niedermeyer & da Silva, 2012 |
| Theta | [4-8] Hz | Niedermeyer & da Silva, 2012 |
| Alpha | [8-12] Hz | Hans Berger, 1929 |
| Beta | [12-25] Hz | Niedermeyer & da Silva, 2012 |
| Gamma | > 25 Hz | Dimigen, 2009 |

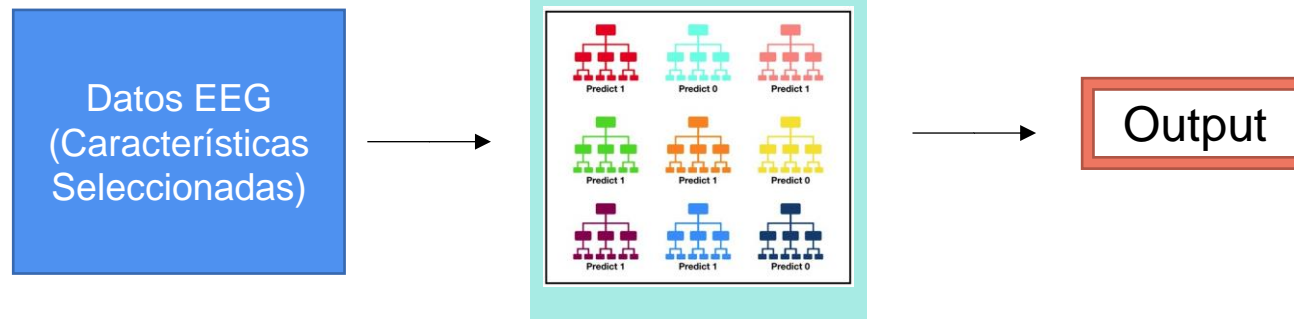
5. Selección hiperparámetros



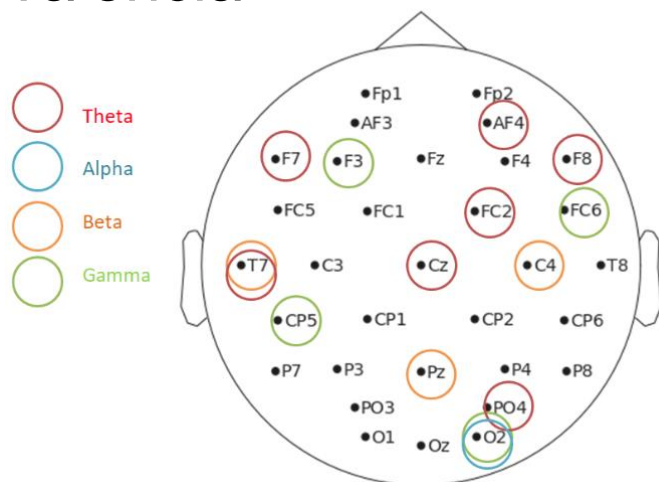
Alternativas:

- Optuna

6. Random Forest



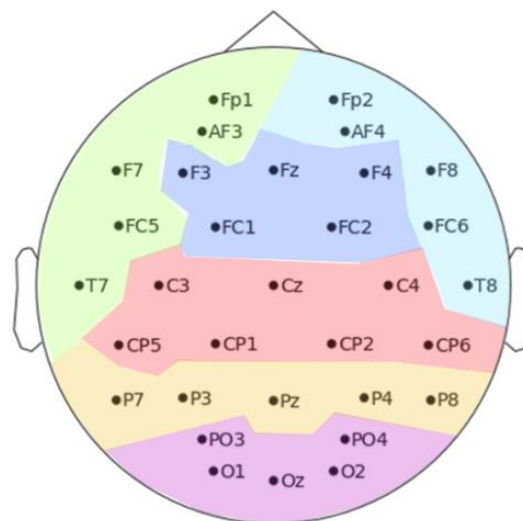
Valencia



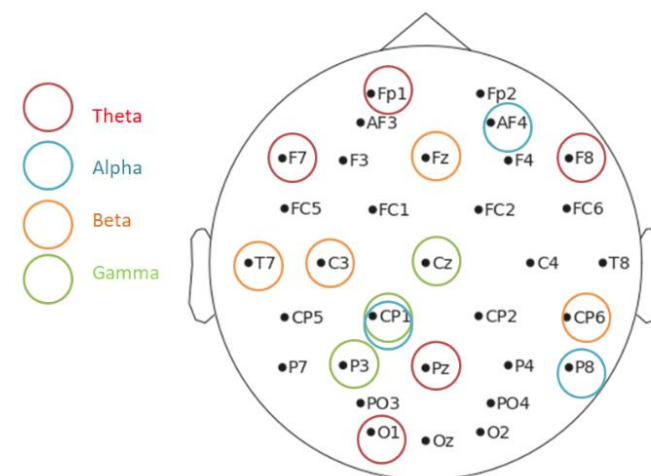
Onda: **Tetha**

Zonas: **Izquierda**, **Frontal**, **Derecha**

Zonas:
 Left
 Right
 Frontal
 Parietal
 Occipital
 Central



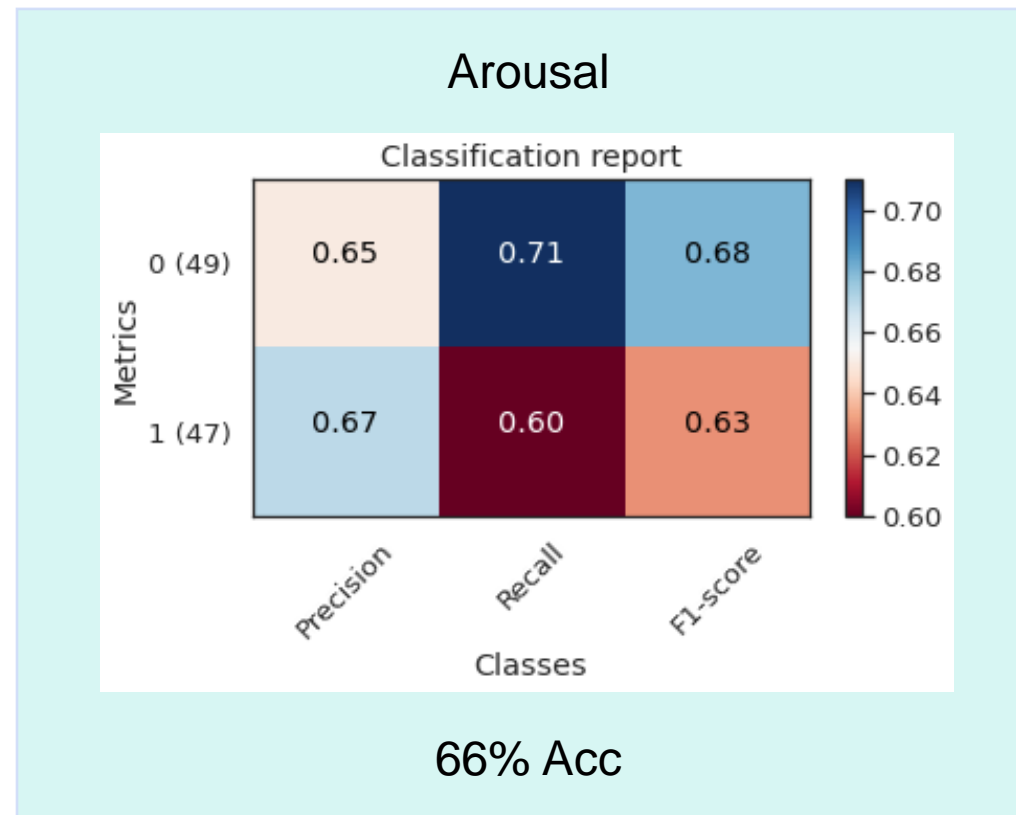
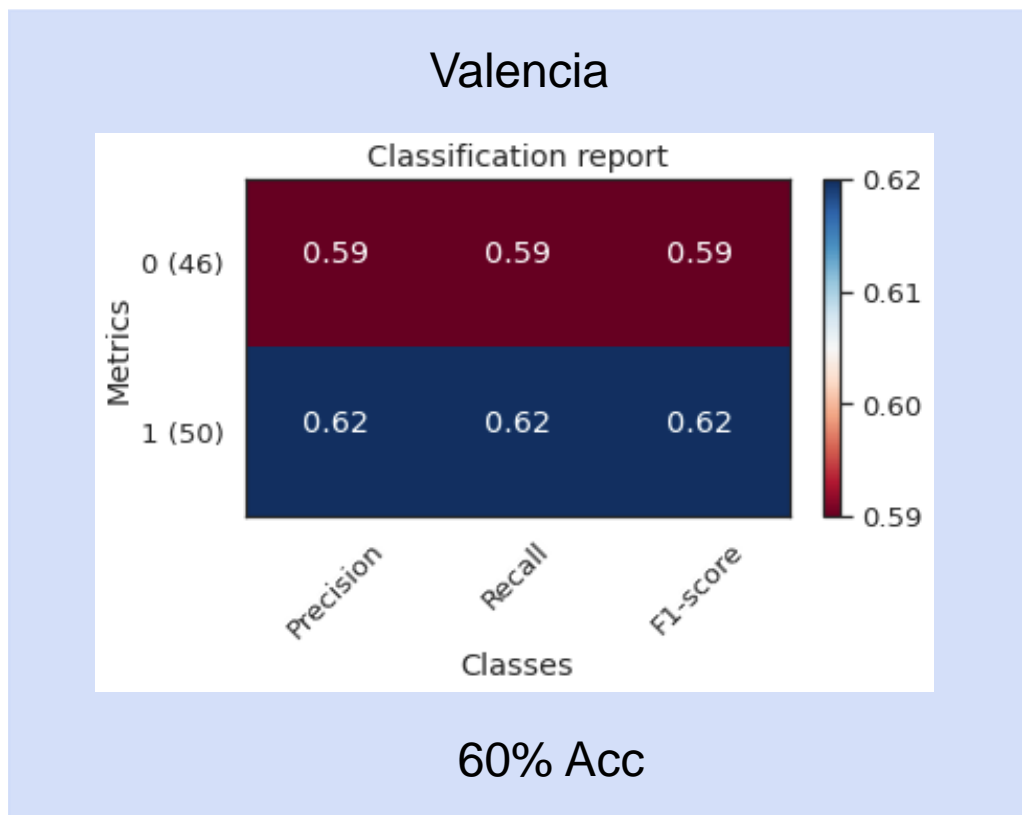
Arousal



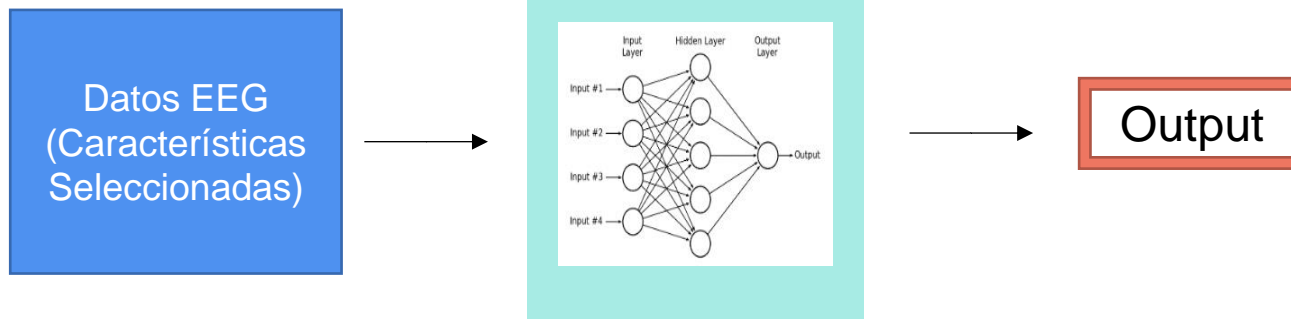
Onda: **Tetha**

Zonas: **Izquierda**, **Central**, **Parietal**

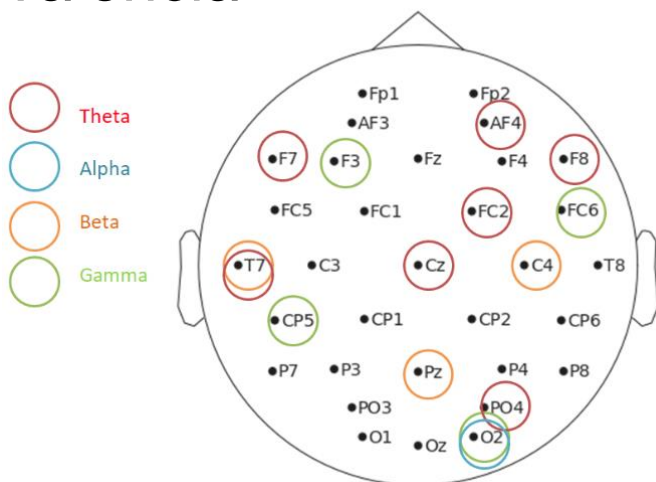
6.1 Resultados



7. MLP



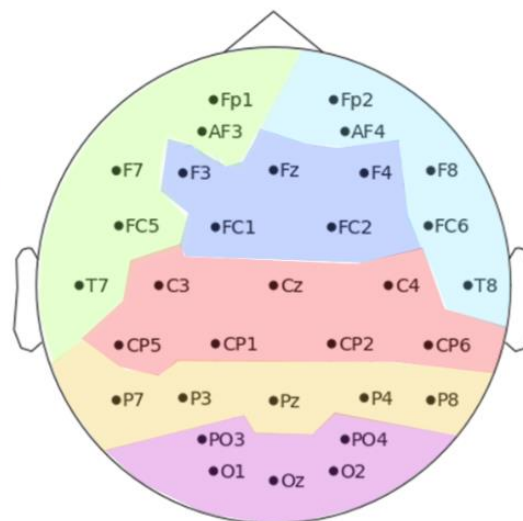
Valencia



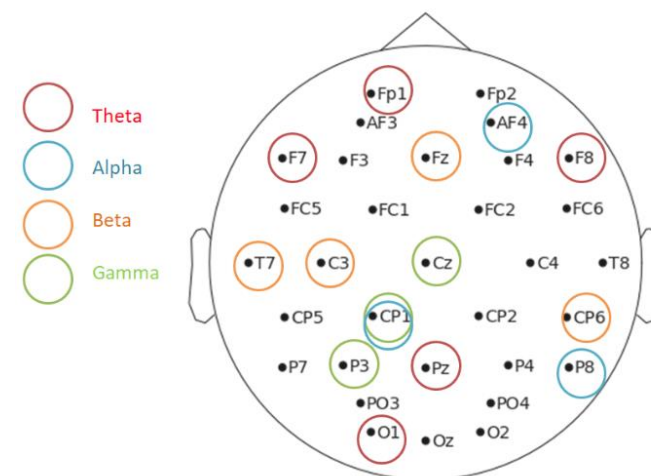
Onda: **Tetha**

Zonas: **Izquierda, Frontal, Derecha**

Zonas:
Left
Right
Frontal
Parietal
Occipital
Central



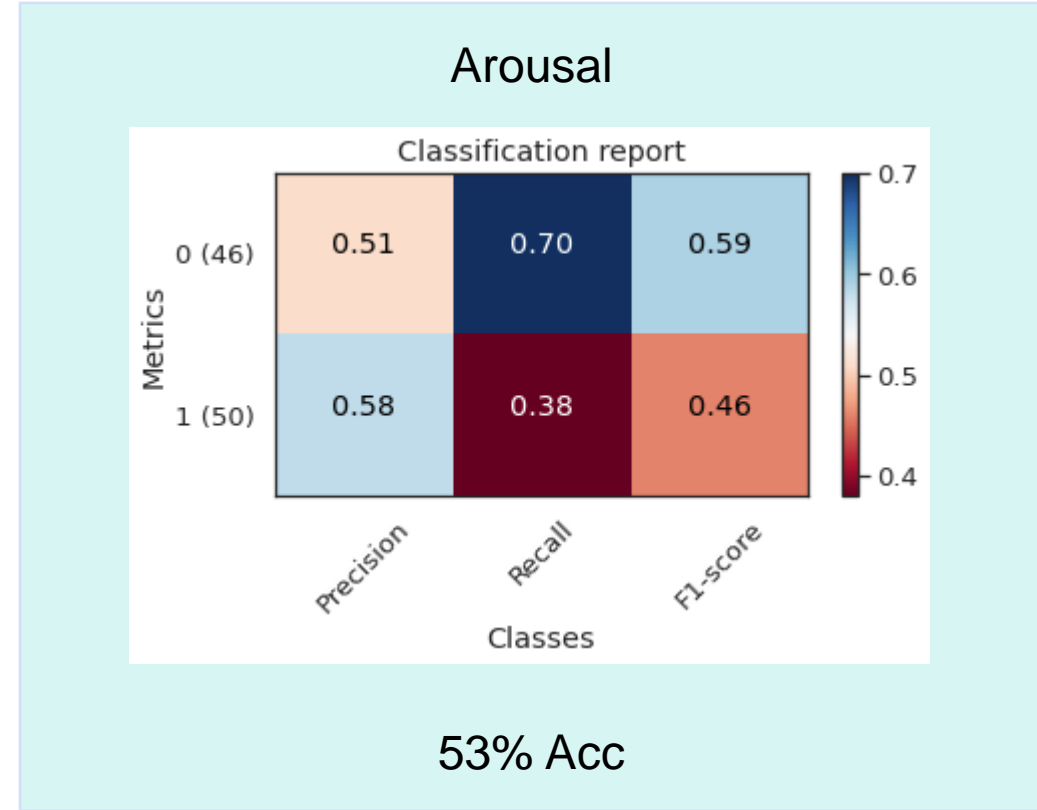
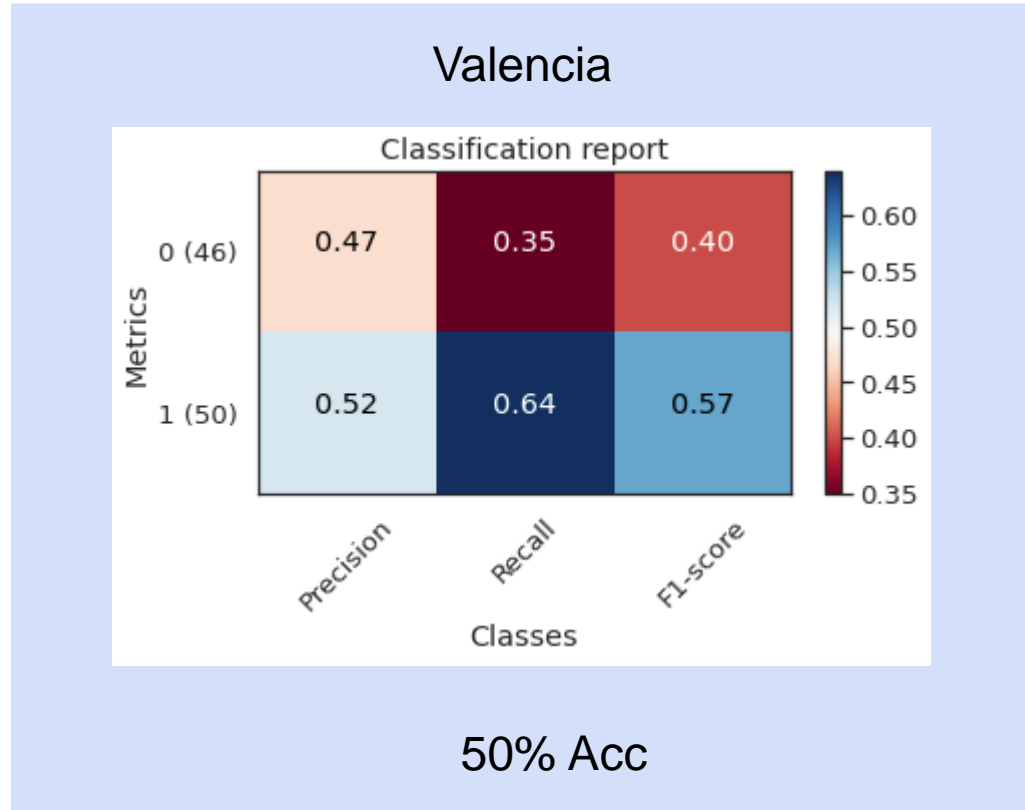
Arousal



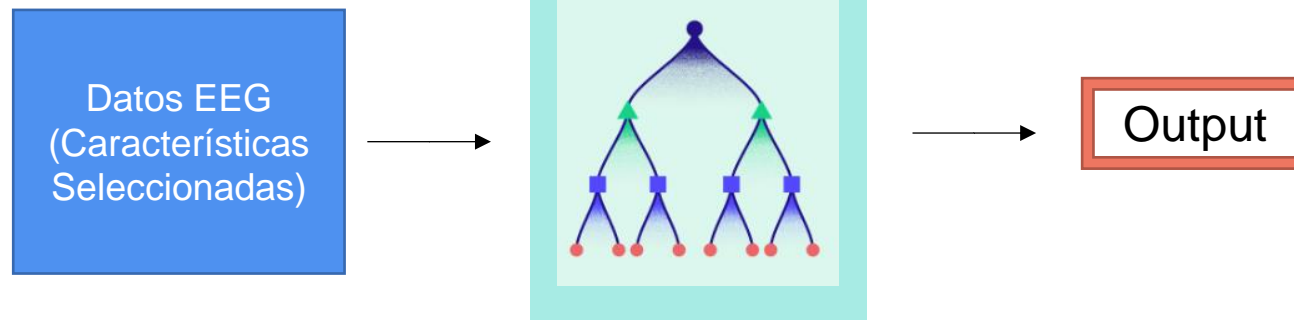
Onda: **Tetha**

Zonas: **Izquierda, Central, Parietal**

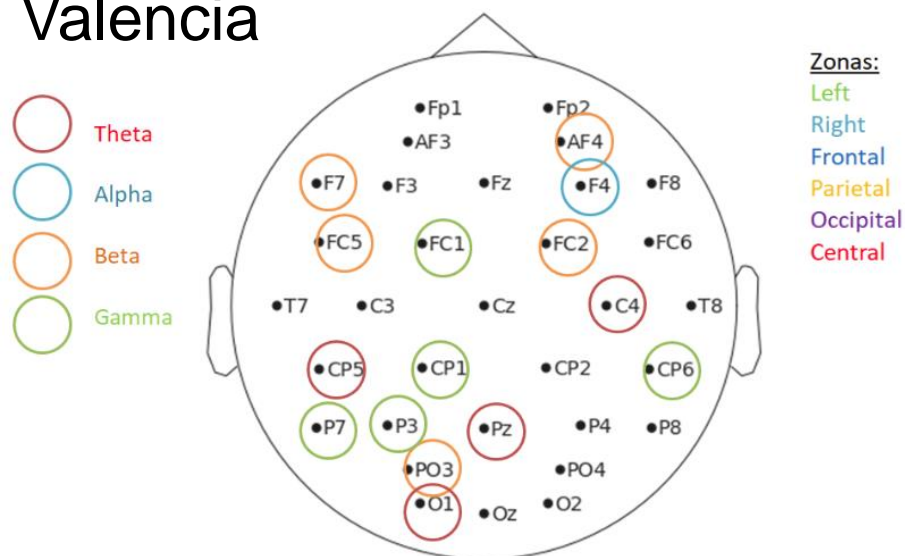
7.1 Resultados



8. XGBoost

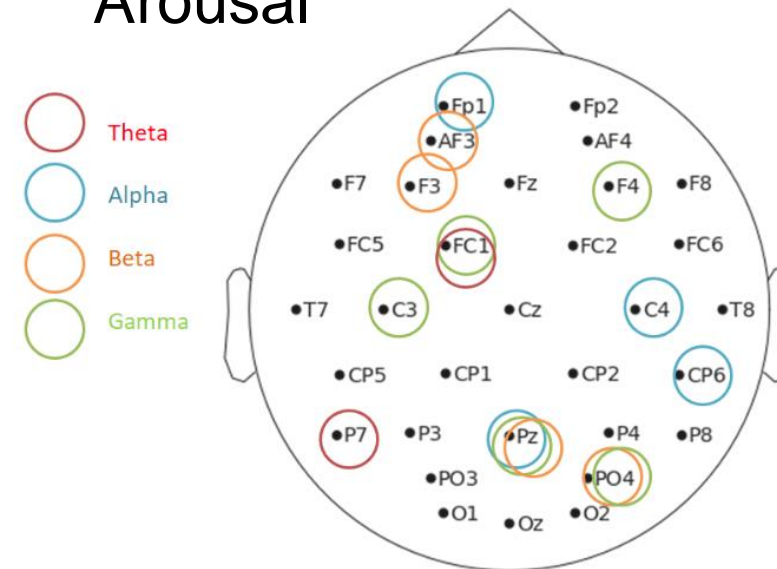


Valencia



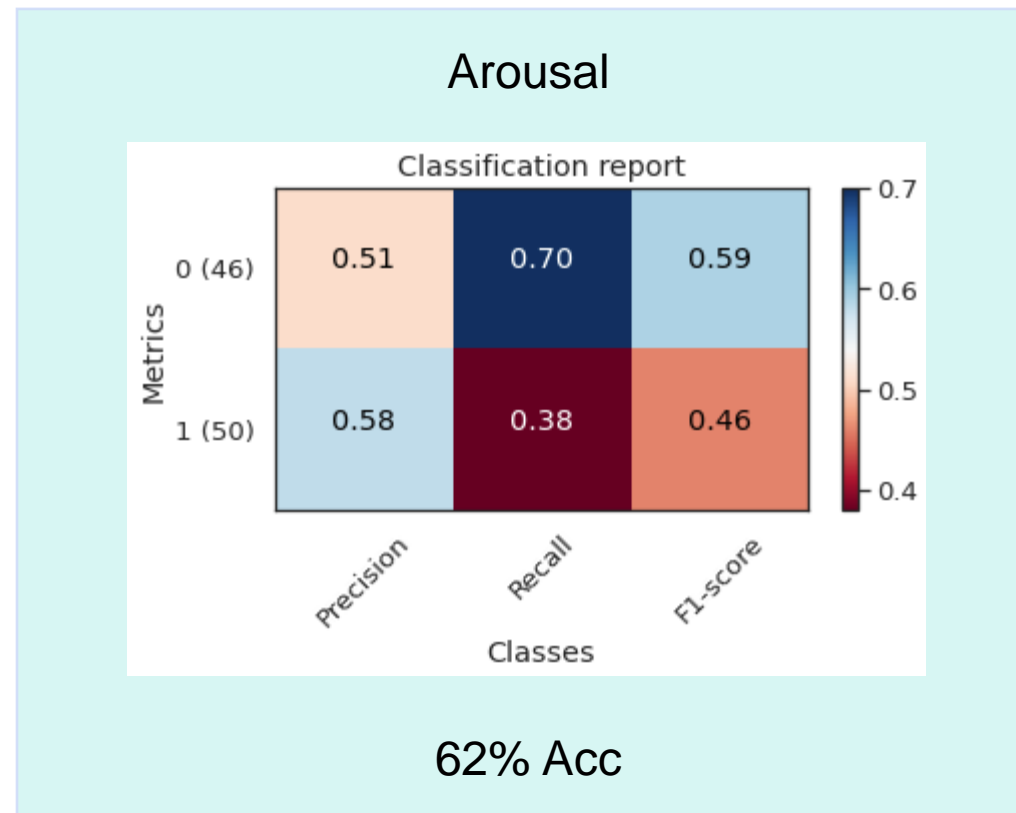
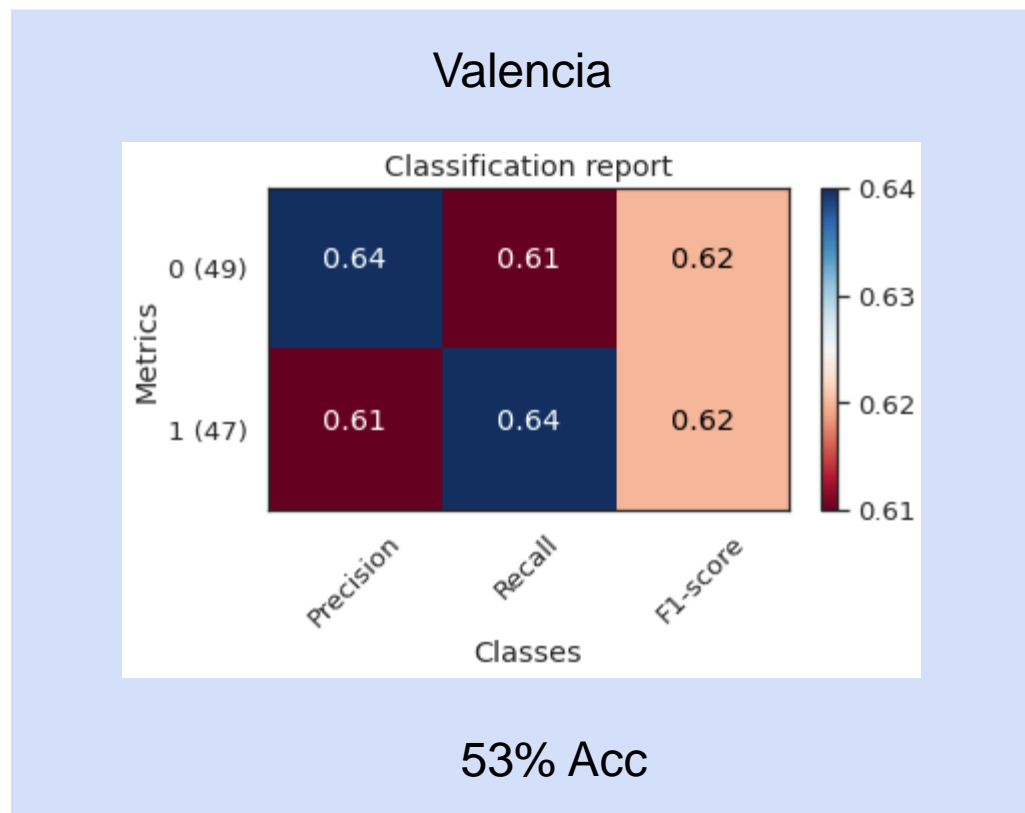
Onda: **Beta**
Zonas: **Parietal, Occipital**

Arousal



Onda: **Alpha**
Zonas: **Izquierda, Parietal, Occipital**

8.1 Resultados



9. Conclusiones



Random Forest 60% Valencia



Random Forest 66% Arousal

| Modelo | Precisión |
|---|-----------|
| Random Forest, Nuestra aproximación, Arousal | 66 % |
| T.D. Kusumaningrum [5] Valencia, Arousal | 62 % |
| Random Forest, Nuestra aproximación, Valencia | 60 % |



MLP 50% Valencia



MLP 53% Arousal

| Modelo | Precisión |
|-------------------------------------|-----------|
| Al-Nafjan [6], Valencia, Arousal | 82 % |
| Yucel Cimtay[4], Valencia, Arousal | 72 % |
| MLP, Nuestra aproximación, Arousal | 53 % |
| MLP, Nuestra aproximación, Valencia | 50 % |

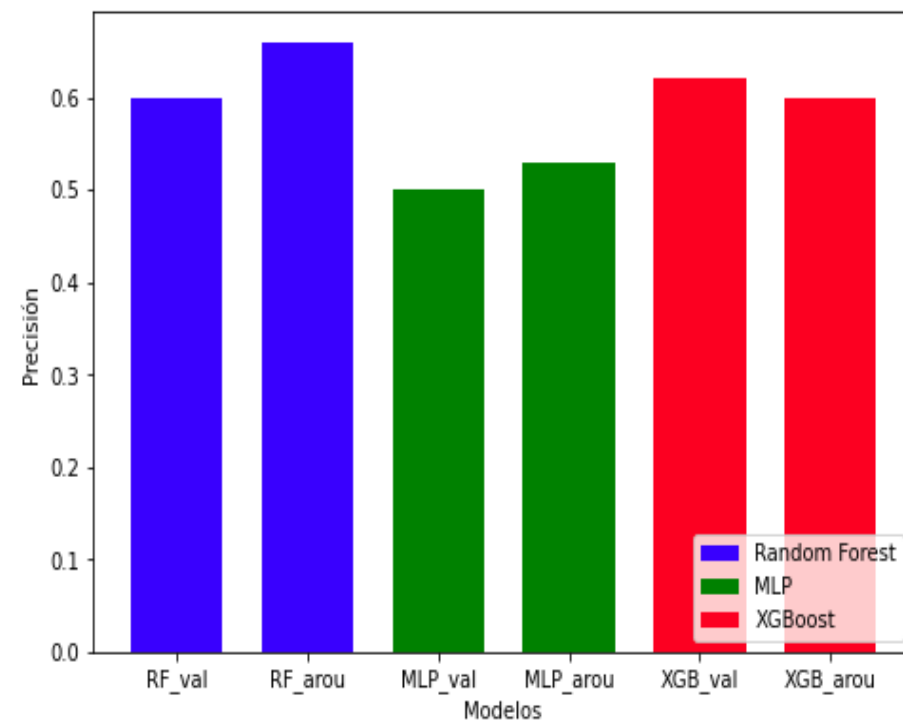


XGBoost 62% Valencia



XGBoost 60% Arousal

| Modelo | Precisión |
|---|-----------|
| T.D. Kusumaningrum, Valencia, Arousal [5] | 62 % |
| XGBoost, Nuestra aproximación, Valencia | 62 % |
| XGBoost, Nuestra aproximación, Arousal | 60 % |





Gracias

José Javier Calvo Moratilla

Jocalmo@upv.es