The background of the slide is a grayscale image of multiple EEG (Electroencephalogram) waveforms. These waveforms are arranged in a grid-like pattern, with each trace slightly offset from the others, creating a sense of depth and movement. The traces show various patterns of electrical activity, typical of EEG recordings. Some traces are labeled with electrode names like 'Z-PZ', 'Fp2-F4', '12 F4', '13', and '14 P4-O2' on the left side.

REpte IV

EPILEPSIA AMB ELECTROENCEFALOGRAMA

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POBLACIONAL

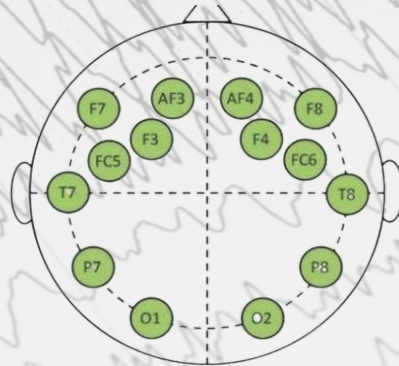
**MODELS
EXPERIMENTALS**

The background of the slide is a grayscale image of an EEG (Electroencephalogram) recording. It features multiple horizontal channels of brain activity, each represented by a jagged, wavy line. On the left side, some of the channel labels are visible, including 'Z', 'Z-PZ', 'Fp2-F4', '12 F4-C4', '13 C4-P4', and '14 P4-O2'.

INTRODUCCIÓ

DEFINICIÓ DEL

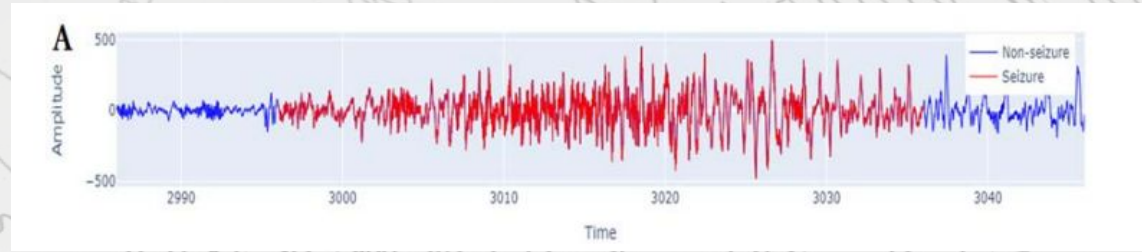
- **PROBLEMA** Detecció de convulsions epilèptiques mitjançant l'anàlisi d'enregistraments EEG.
- Eina no invasiva per explorar la funcionalitat del cervell.
- Registrant l'activitat elèctrica amb N electrodes sobre el cuir cabellut.



DEFINICIÓ DEL

- **PROBLEMA** Les senyals temporals són analitzats pel neuròleg per identificar:

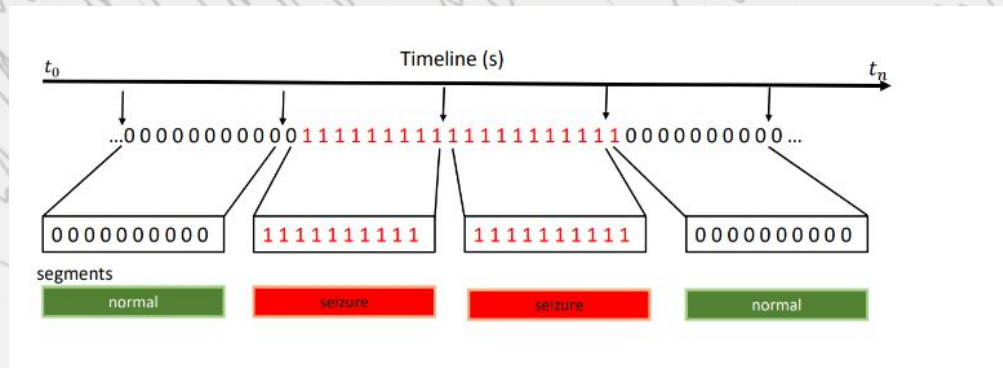
- Ones afilades
- Ones agudes
- Ones lentes



- L'objectiu és classificar aquests patrons segons si són epilèptics o no, explorant la combinació de canals EEG, context temporal i avaluar el nivell de generalització dels models.

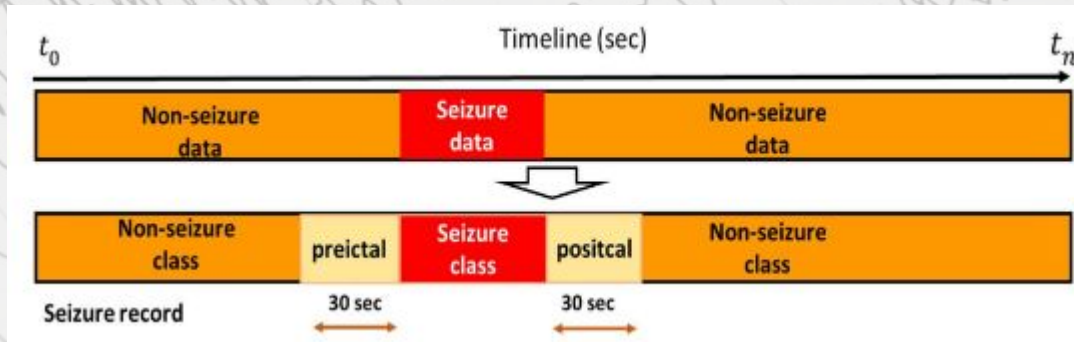
DATASET ANNOTATED WINDOWS

- Children's Hospital Boston-MIT 24 patients amb convulsions severes; 23 pediàtrics i 1 adult
- Senyals re-mostrades a 128 Hz, escapçades en finestres d'un segon.
- Classificació binària:
 - 0: normal
 - 1: ictal (convulsió)



DATASET ANNOTATED WINDOWS

- Les finestres properes a una crisi presenten un patró de transició diferent.
- Per els intervals on hi ha convulsió, hi ha un 80% de finestres superposades per augmentar les dades
- Finestres en arxius .npz

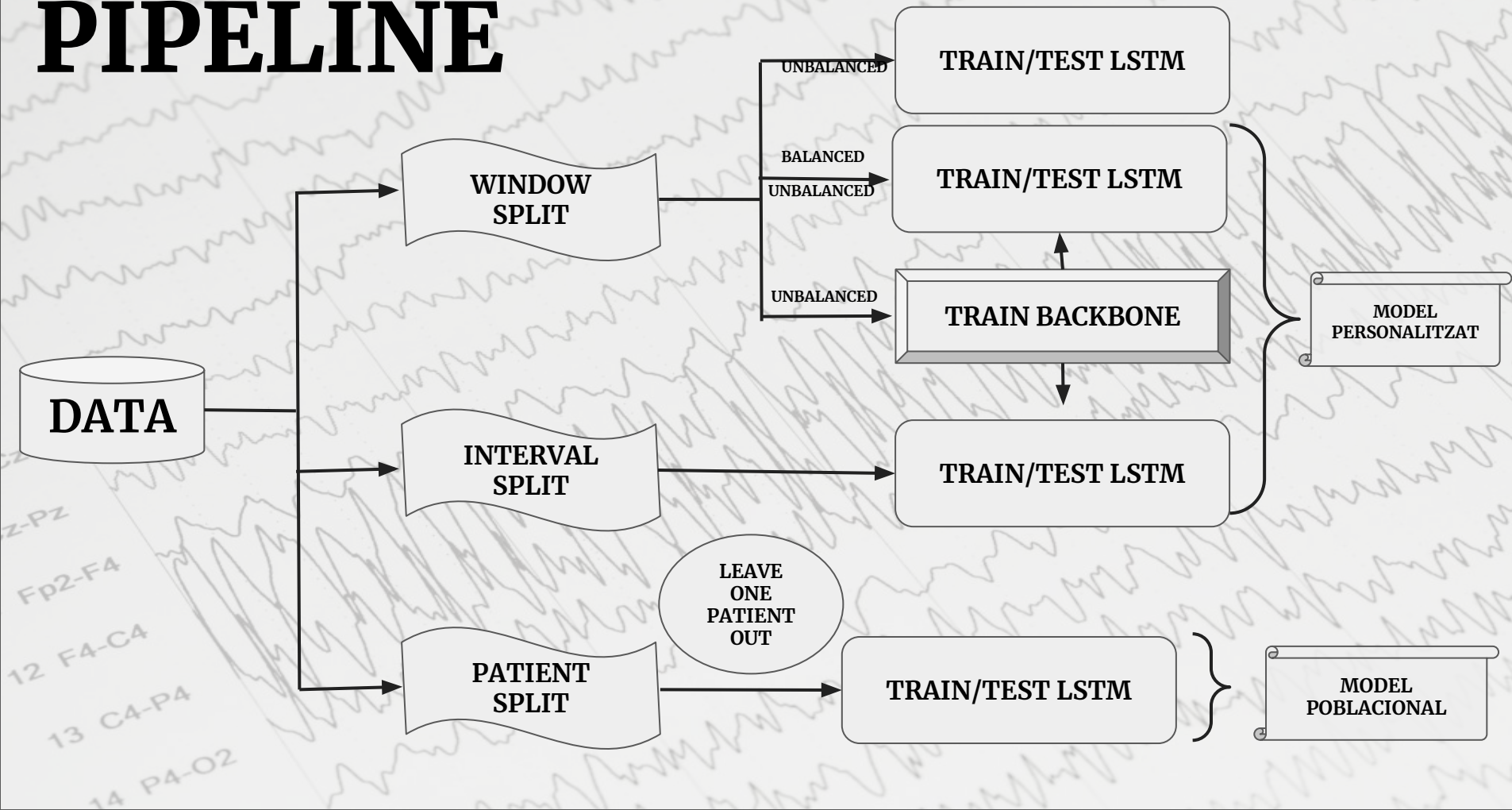


DATASET **ANNOTATED WINDOWS**

	class	filename_interval	global_interval	filename
0	0	1	1	chb01_03.edf
1	0	1	1	chb01_03.edf
2	0	1	1	chb01_03.edf
...	
26525	1	2	7	chb01_26.edf
26526	1	2	7	chb01_26.edf
26527	1	2	7	chb01_26.edf
26528	1	2	7	chb01_26.edf

metadades en fitxer parquet

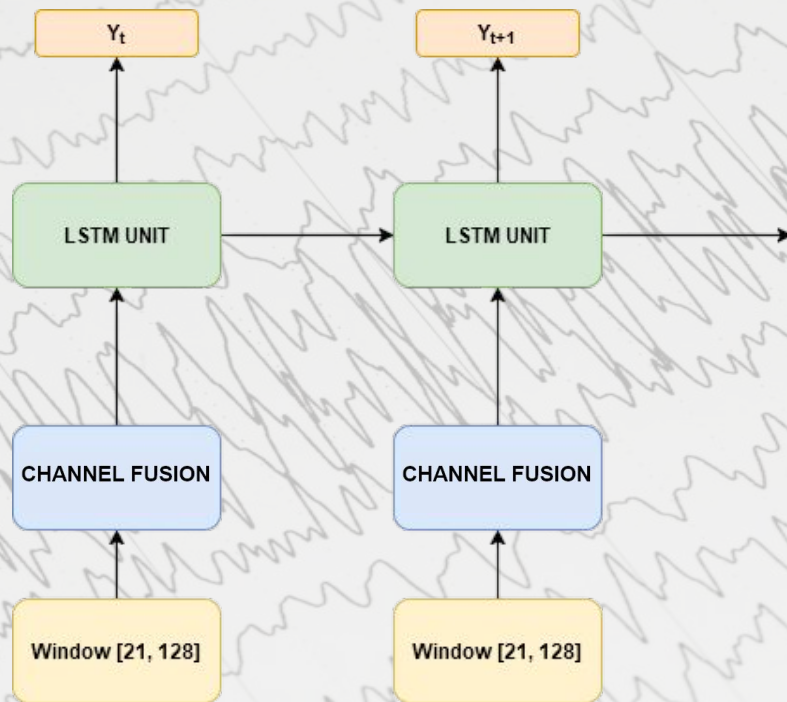
PIPELINE



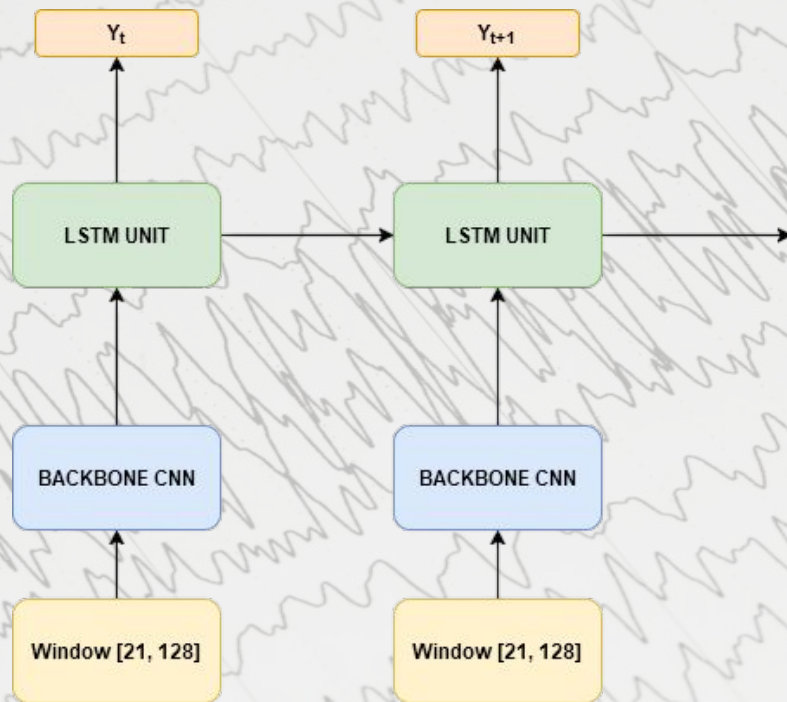
The background of the image is a grayscale EEG (electroencephalogram) recording. It features multiple horizontal channels, each displaying a continuous, jagged waveform representing brain electrical activity. On the left side, several electrode labels are visible, including 'Z', 'Z-PZ', 'Fp2-F4', '12 F4-C4', '13 C4-P4', and '14 P4-O2'.

ARQUITECTURES

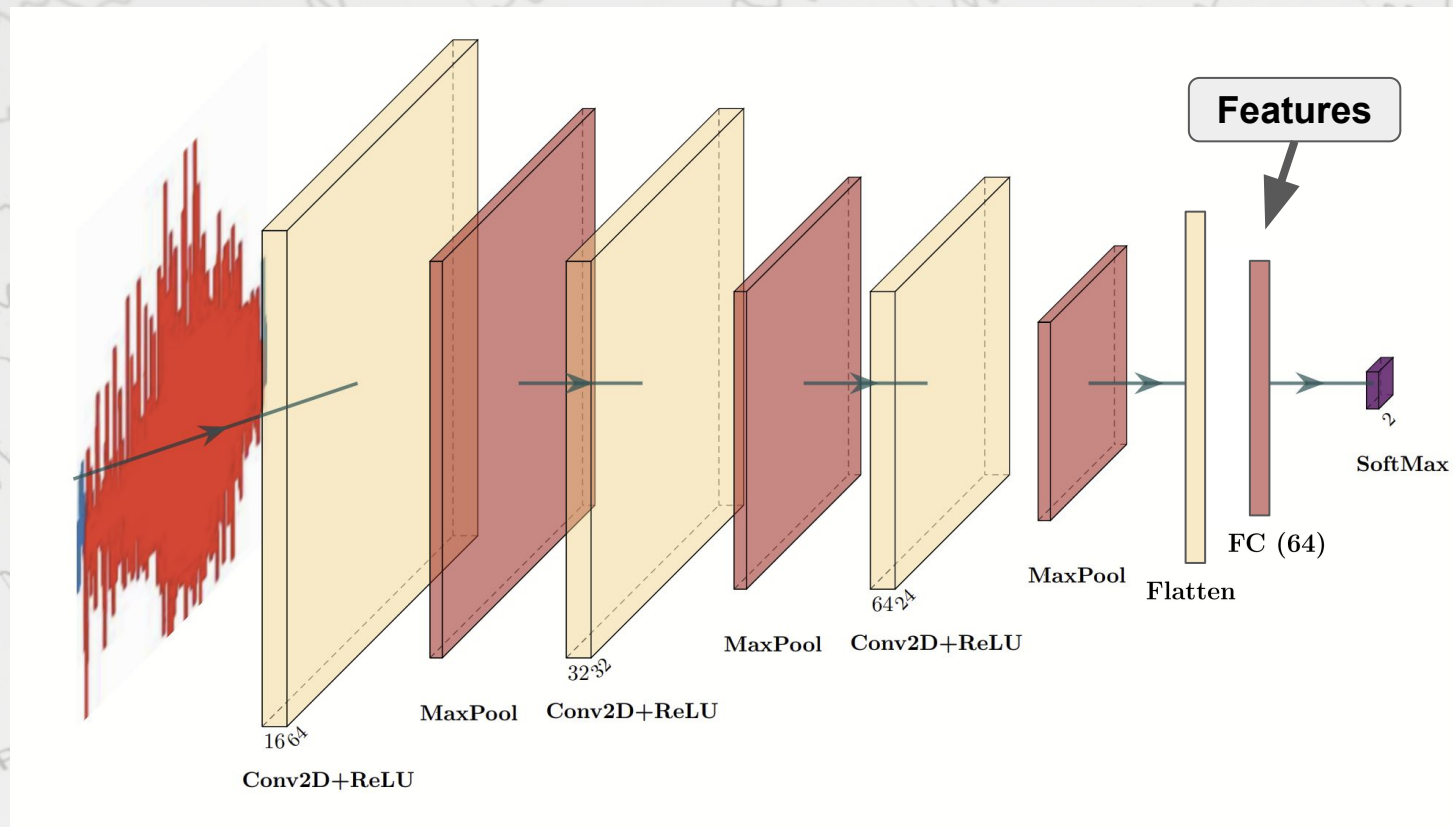
LSTM



LSTM



BACKBONE



The background of the slide is a grayscale image of multiple EEG (electroencephalogram) waveforms. These waveforms are arranged in a grid-like pattern, with each trace slightly offset from the others to create a sense of depth. The traces show various patterns of electrical activity, including sharp peaks and troughs. On the left side of the image, there are labels for specific EEG channels: 'Z', 'Z-PZ', 'Fp2-F4', '12 F4-C4', '13 C4-P4', and '14 P4-O2'.

DISSENY EXPERIMENTAL

NIVELL FINESTRA

Entrenem la LSTM amb Kfold
5 particions train/test sense agrupacions

1. Flatten

2. Backbone

- Dades no balancejades
- Dades balancejades

NIVELL INTERVAL

- GroupKfold de la LSTM + Backbone amb dades filtrades
- Agrupem per label, global interval i pacient
- Preservació del context temporal
- Prevenció de fugues de dades

NIVELL PACIENT

- Kfold de la LSTM + Backbone amb dades balancejades
- Leave-one-patient-out
- Model poblacional, el model és una població i el testegem amb un pacient desconegut

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RESULTATS

NIVELL FINESTRA - Unbalanced

Model	Accuracy	F1-Score	AUC
Backbone	0.8857 ± 0.0117	0.7267 ± 0.0338	0.8675 ± 0.0205
Flatten	0.8940 ± 0.0046	0.7431 ± 0.0107	0.8624 ± 0.0037

:Train

Test:

Model	Recall_0	Recall_1	Precision_0	Precision_1	F1_0	F1_1	Accuracy
Backbone	0.94 ± 0.12	0.25 ± 0.28	0.88 ± 0.06	0.66 ± 0.25	0.90 ± 0.05	0.24 ± 0.18	0.83 ± 0.07
Flatten	0.93 ± 0.02	0.32 ± 0.08	0.89 ± 0.03	0.47 ± 0.10	0.91 ± 0.02	0.38 ± 0.08	0.84 ± 0.03

N	250.022	16.978
P	37.889	9.670

CF acum. 5 folds backbone

N	249.016	17.640
P	31.836	16.067

CF acum. 5 folds flatten

NIVELL FINESTRA- Balanced Backbone

	Accuracy	F1-Score	AUC
Mean ± Std	0.7804 ± 0.0117	0.7799 ± 0.0117	0.8329 ± 0.0195

:Train

Test:

Fold	Recall_0	Recall_1	Precision_0	Precision_1	F1_0	F1_1	Accuracy
1	0.29	0.98	0.93	0.57	0.45	0.72	0.6274
2	0.36	0.98	0.95	0.57	0.52	0.72	0.6442
3	0.68	0.66	0.67	0.67	0.67	0.67	0.6697
4	0.86	0.30	0.50	0.72	0.63	0.42	0.5506
5	0.31	0.95	0.86	0.58	0.46	0.72	0.6323
Mean ± Std	0.5 ± 0.26	0.77 ± 0.29	0.78 ± 0.19	0.62 ± 0.06	0.55 ± 0.09	0.65 ± 0.13	0.63 ± 0.04

N	41.527	43.256
P	20.360	64.423

CF acum. 5 folds

NIVELL INTERVAL- Backbone

	Accuracy	F1-Score	AUC
Mean ±Std	0.7553 ± 0.0532	0.7604 ± 0.0186	0.8431 ± 0.0285

:Train

Test:

N	142.143	27.673
P	35.0.92	51.580

CF acum. 5 folds

Fold	Recall_0	Recall_1	Precision_0	Precision_1	F1_0	F1_1	Accuracy
1	0.84	0.45	0.77	0.57	0.81	0.50	0.72
2	0.72	0.66	0.71	0.66	0.71	0.66	0.69
3	0.88	0.71	0.87	0.74	0.88	0.72	0.83
4	0.77	0.56	0.78	0.55	0.78	0.55	0.7
5	0.94	0.56	0.85	0.77	0.89	0.65	0.83
Mean ± Std	0.83 ± 0.08	0.59 ± 0.10	0.80 ± 0.07	0.66 ± 0.09	0.81 ± 0.07	0.62 ± 0.08	0.75 ± 0.07

NIVELL PACIENT- backbone balancejades

	Accuracy
Mean ± Std	0.7428 ± 0.0823

:Train

Test:


N	5.956	9.532
P	1.635	13.853

CF acum. 5 folds

Fold	Recall_0	Recall_1	Precision_0	Precision_1	F1_0	F1_1	Accuracy
1	0.54	1.00	1.00	0.68	0.70	0.81	0.7681
2	0.11	0.90	0.52	0.50	0.18	0.64	0.5041
3	0.59	0.74	0.70	0.65	0.64	0.69	0.6691
4	0.72	0.94	0.92	0.77	0.81	0.85	0.8297
5	0.17	0.86	0.55	0.51	0.26	0.64	0.5155
Mean ± Std	0.43 ± 0.27	0.89 ± 0.10	0.74 ± 0.22	0.62 ± 0.12	0.52 ± 0.28	0.73 ± 0.10	0.66 ± 0.15

CONCLUSIONS I MILLORES

- Implementació de dues architectures per la detecció de patrons.
- Entrenament i validació de tres dissenys experimentals.
- Optimització de paràmetres
- Millores estadístiques

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