

# Simulated ECGs for ML models

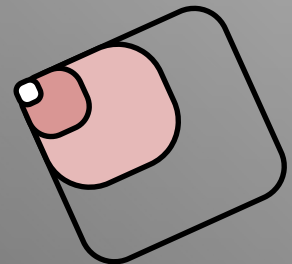
## Results on Left/Righth prediction

- Representation: raw signal (resampled 300 - 10 ms)
- Leads analysis
- Merging real and simulated samples: Cross Validation
- 
- Feature based representation



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## ■ Modelo I : Señal RAW

### ● Señales:

- 12 precordiales (12P)
- X pacientes x 12P x e Ectopicos x 10 muestreos
- Alineación al pico del QRS

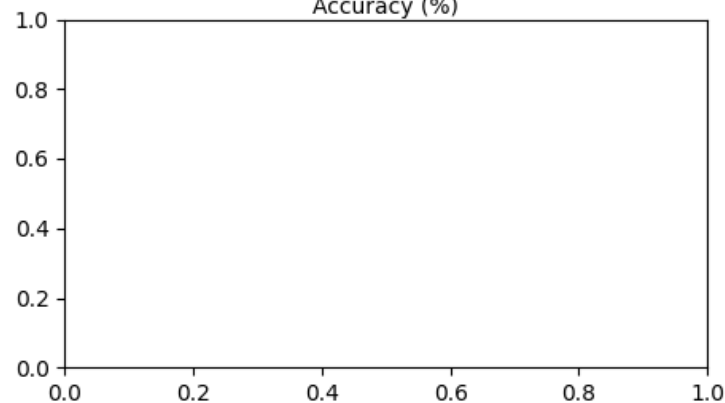
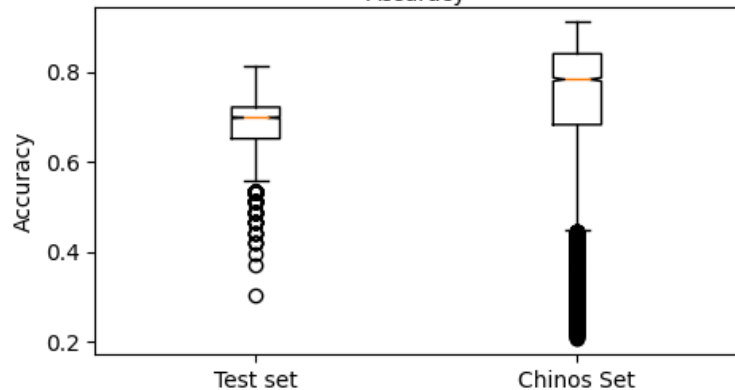
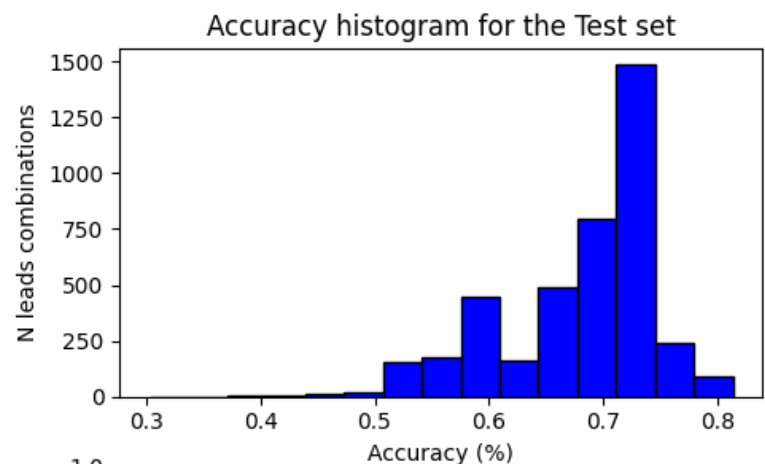
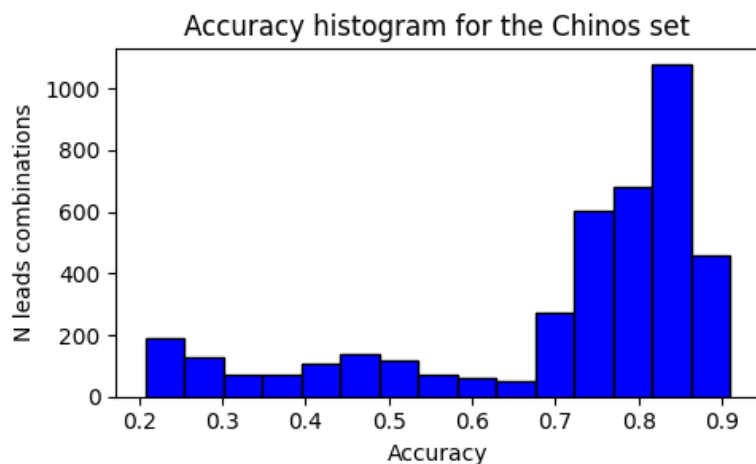
### ● Machine Learning:

- Modelo: SVM ( $\nu = 0.75$ )
- Vector de características  $\leftarrow$  señales concatenadas
  - Reducción de dimensionalidad: Remuestreo de las señales de 300 a 10 ms.
- Análisis de las precordiales:
  - Conjuntos de entrenamiento y modelos creados a partir de las combinaciones de 12 elementos (precordiales) tomados de 1 a 12.
  - Para cada combinación se entrena un modelo con las señales simuladas
    - $X_{\text{Sim}}[\text{combinacion\_precordiales}] = \text{señal-precordiales concatenadas}$
    - $Y_{\text{Sim}}[\text{combinacion\_precordiales}] = \text{L/R}$
- Conjuntos de test (Chinos, Clinic)

# Resultados: Global Accuracy

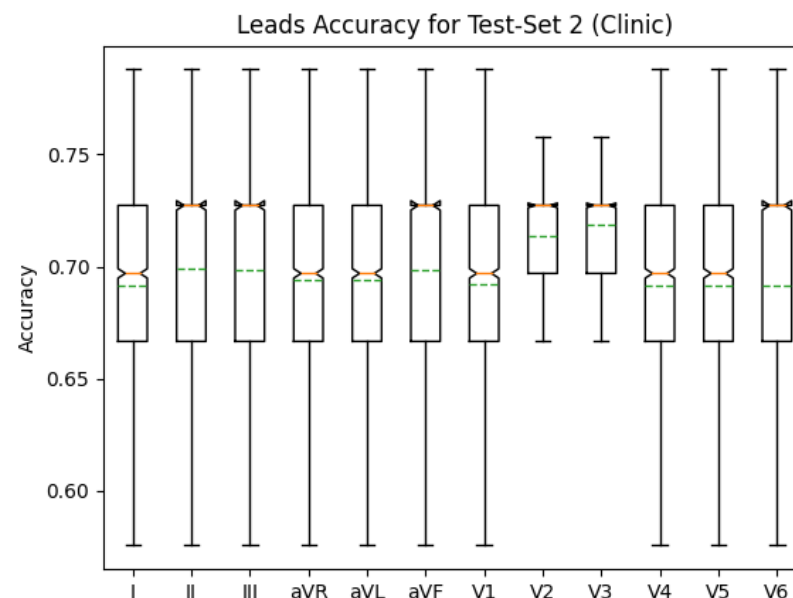
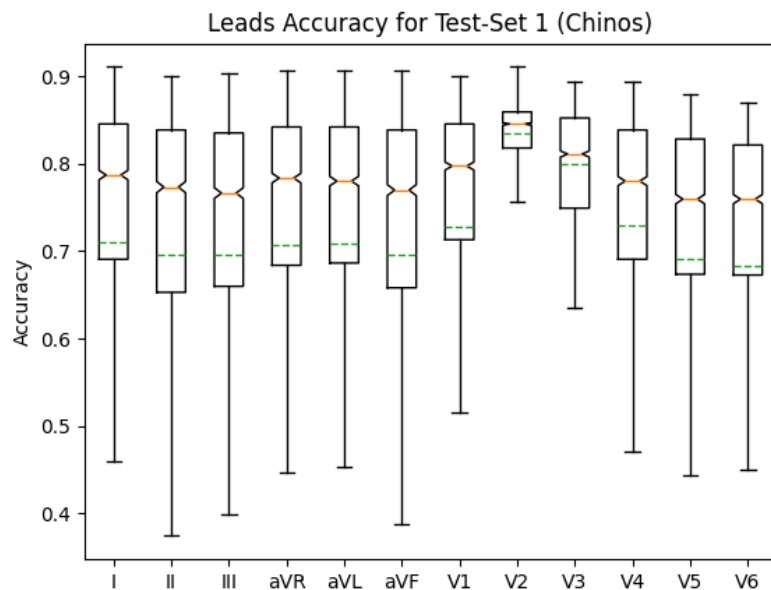
- Global Accuracy for all combinations (acc x number of combinations with this acc.)

Global accuracy (GA) for all Leads combinations



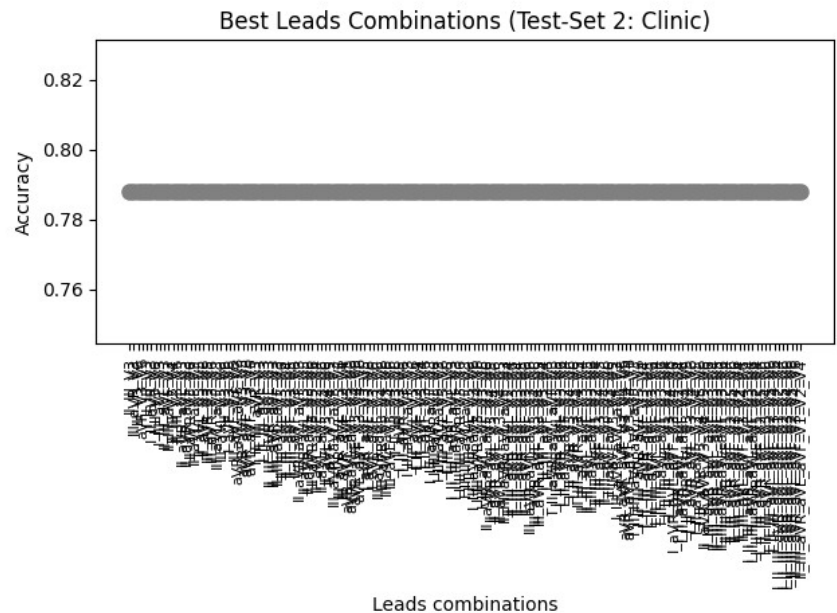
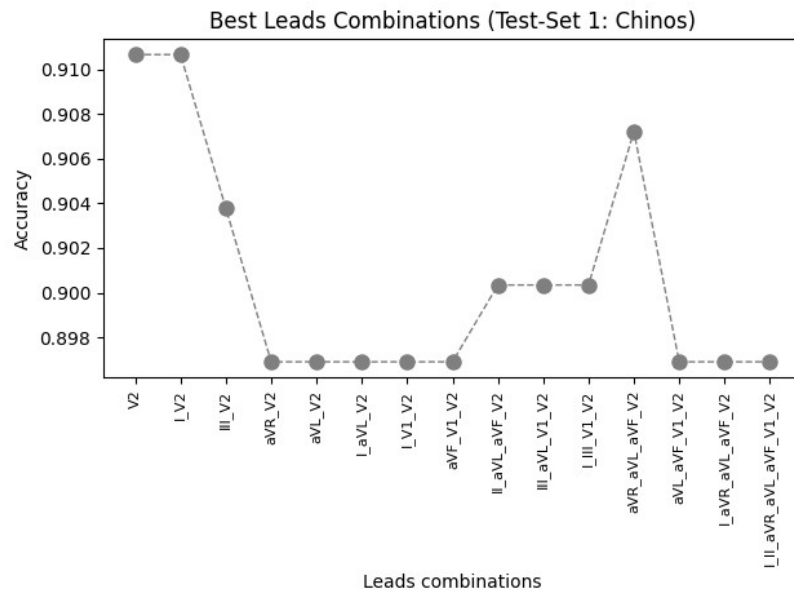
# Resultados: Leads accuracy

## ■ Análisis de precordiales: Leads Accuracy



# Resultados: Best Leads

## ■ Best Leads combinations



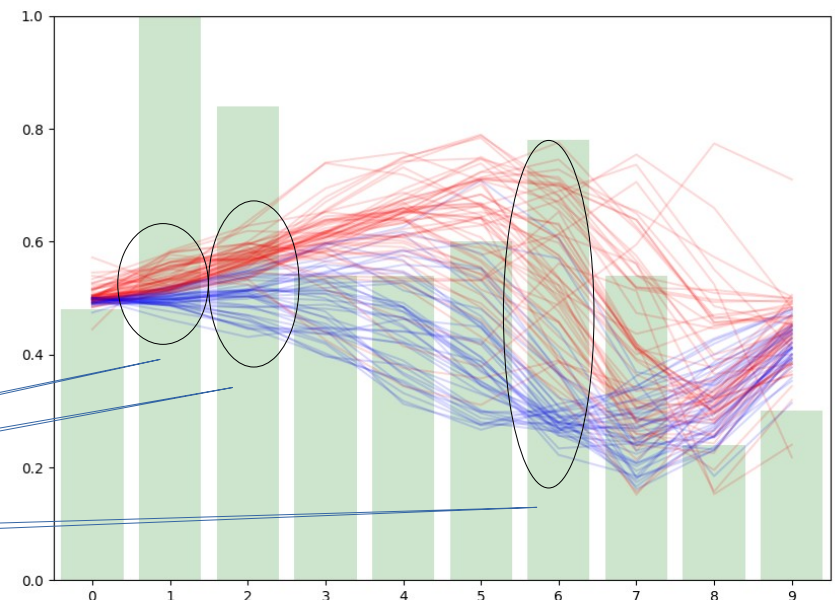
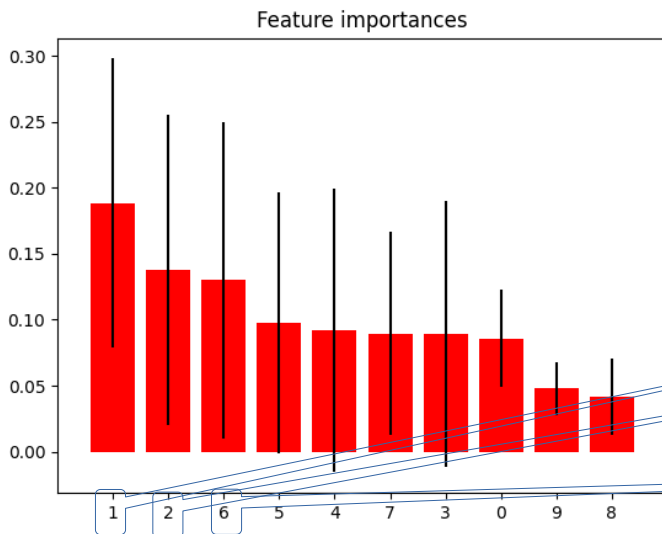
# Mezclando muestras simuladas y reales (Cross Validation). Feat. Vector = V2 (dim = 10)

Validación cruzada con “V2” (nfold = 5)

Cjto entr: [MSim + MClinic]	$acc_{cv}=0.95$
Cjto entr: [MSim + MChinos]	$acc_{cv}=0.94$
Cjto entr: [MSim]	$acc_{cv}=0.96$
Cjto entr: [MChinos]	$acc_{cv}=0.91$

Test con el/los conjunto/s restantes

test(chinos) =	0.92
test(clinic) =	0.67
test(clinic) =	0.70, test(Chinos) = 0.9
test(clinic) =	0.67, test(Sim) = 0.76



Señales : Left (rojo) – Right (Azul);  
Barras: Importancia del punto (escalado)

# Feature based models

## ■ Señales:

- Features: 356 (wavelets, leads diffs, ...)
- Feature Selection methods: no differences are observed

## ● **Machine Learning:**      Modelo: RandomForest (ntrees = 100)

- M1: [ Tr.set = sim-samples,                      Test-set = (Chinos, Clinic) ]
- M2: [ Tr.set = sim-samples + Clinic,              Test-set = Chinos ]
- M3: [ Tr.set = sim-samples + Chinos,              Test-set = Clinic ]
  
- M1 – Accuracy: 0.73 (Clinic), 0.84 (Chinos),              0.95 (CV, nfolds=5)
- M2 – Accuracy: 0.85 (Chinos),                      0.93 (CV, nfolds=5)
- M3 – Accuracy: 0.79 (Clinic),                      0.94 (CV, nfolds=5)

# Feature based models

## ■ Features importance (top 10)

