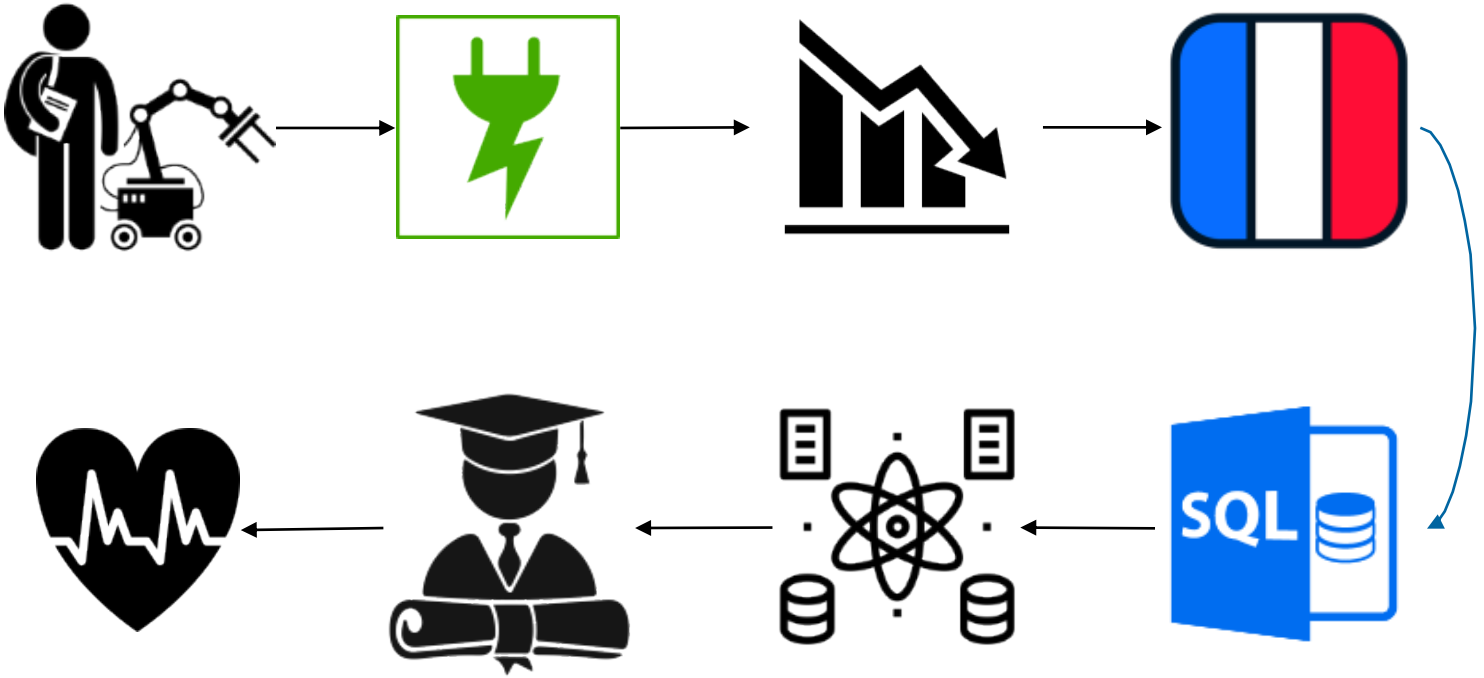
MACHINE LEARNING EN CARDIOLOGÍA

Víctor Vicente Palacios PhD (Data Scientist)
@victorvicpal

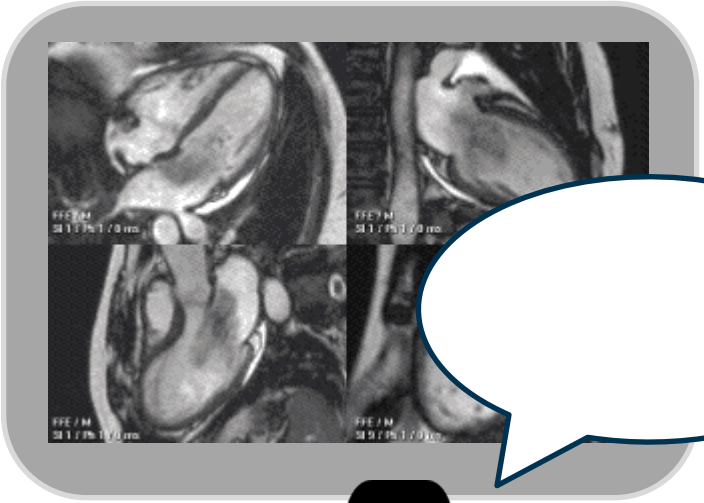
innovation you

PHILIPS

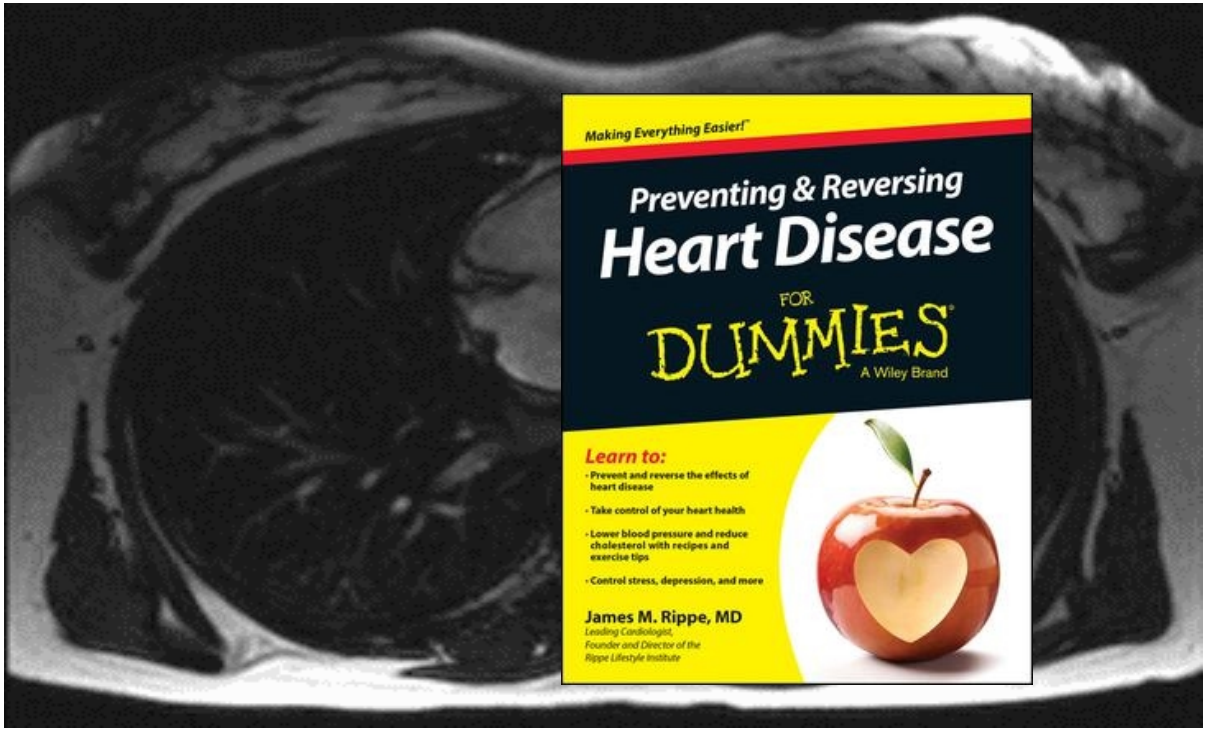
¿Quién soy?



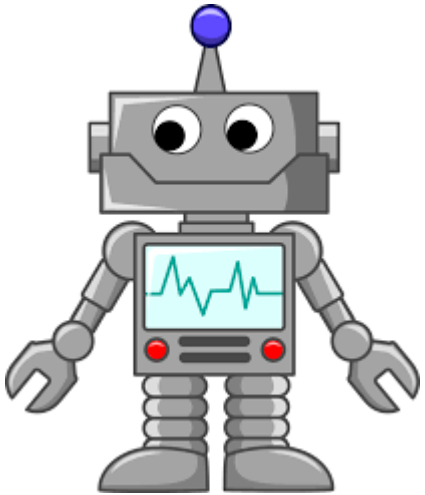
Mi vida en el hospital

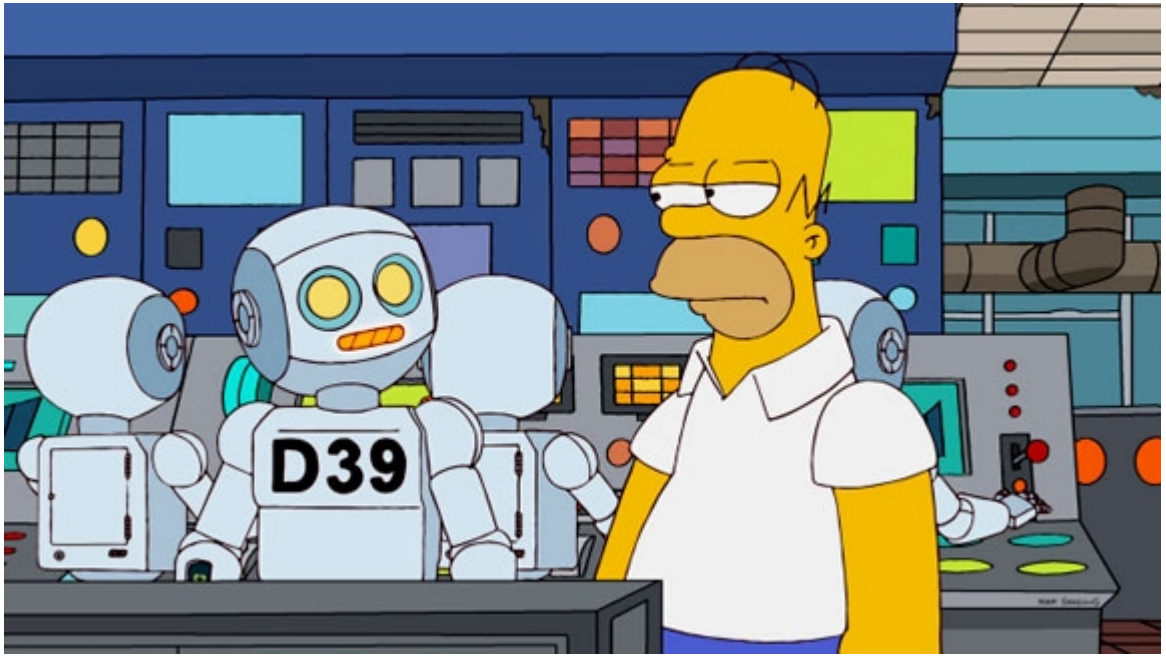


¿Cardiología?



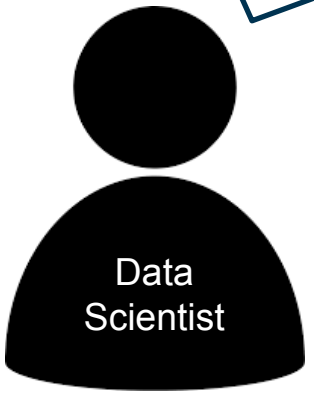
¿Machine Learning?





Machine Learning vs Estadística

Tenéis unos datos increíbles. Estoy deseando empezar a ajustar modelos!!



Sí, eso está genial. Pero… ¿Puedes darme tablas de SPSS también, no?

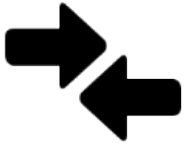
innovation you

PHILIPS

Pregunta Clínica (Modelo PICO)

Patient

Intervention



Control

Outcome

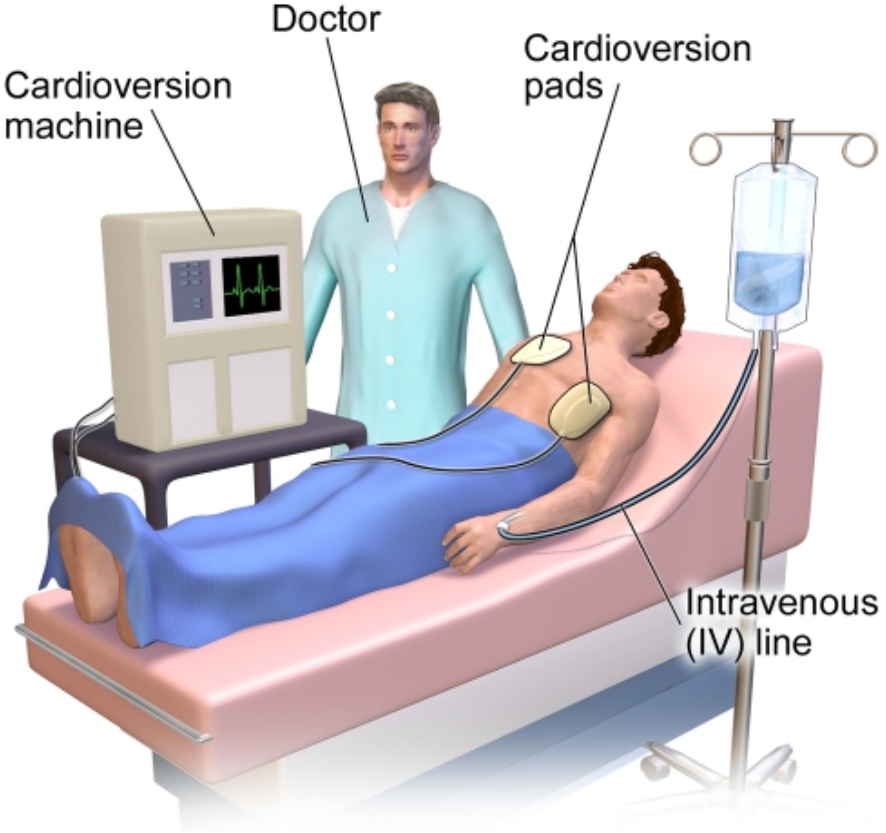
Cardioversión

Revertir arritmias

Terapia de choque eléctrico

¿Efectiva o no?

A los 6 meses de su aplicación no ha habido eventos



Estenosis Aórtica

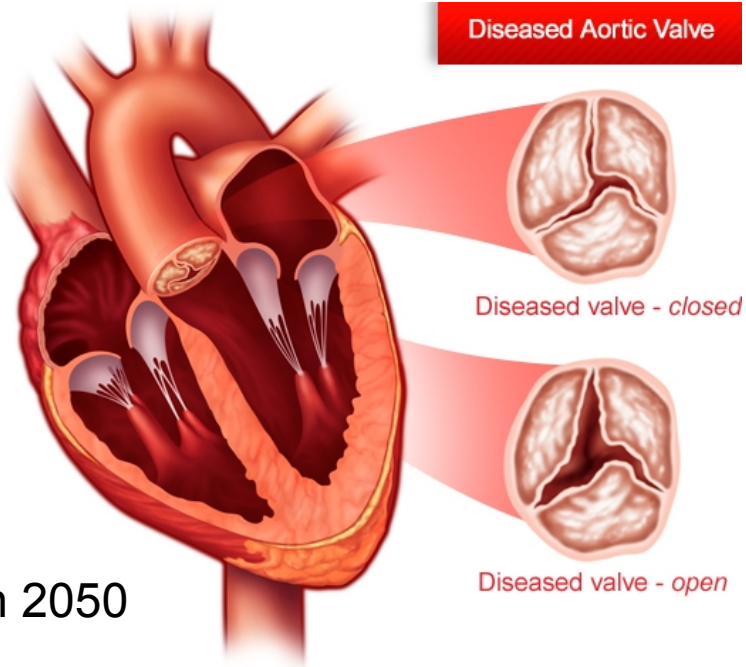
Prevalencia (España)

5 % población > 65 (años)
7 % población > 85 (años)

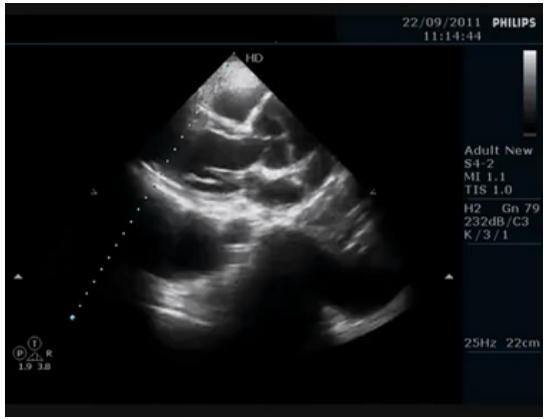
Más de **150,000 pacientes** (España)

Envejecimiento de la Población

La población de España se reducirá un **11%** en 2050



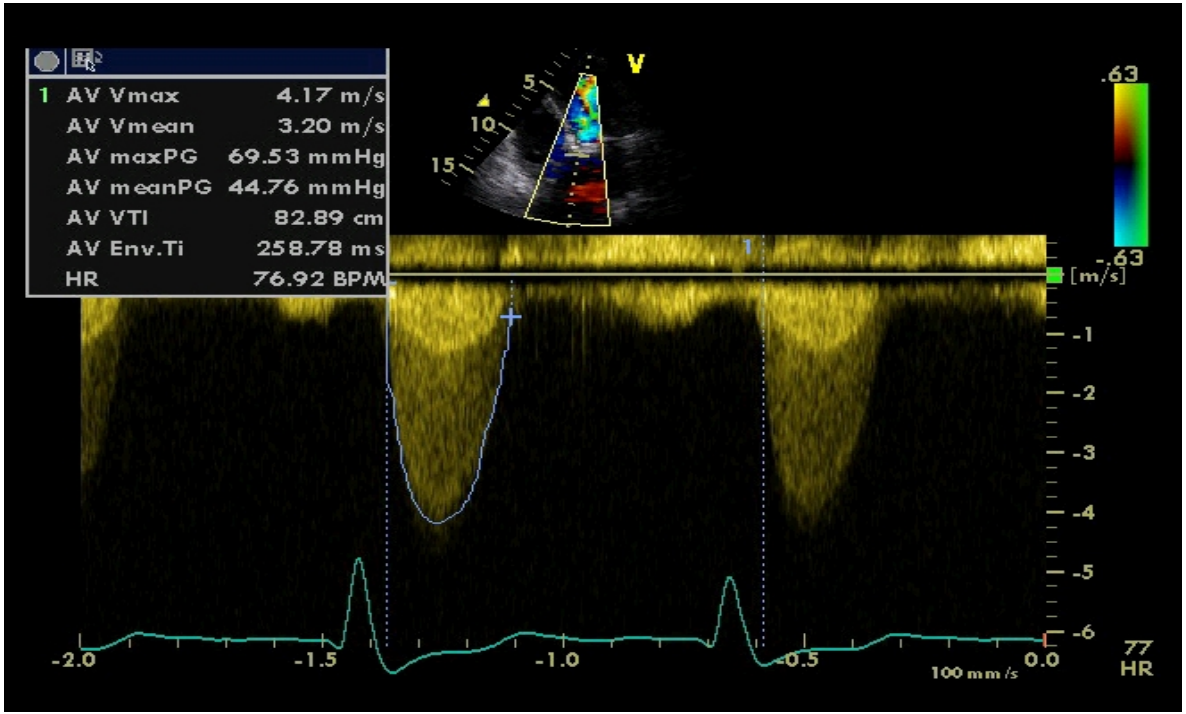
Ecocardiografía



innovation you

PHILIPS

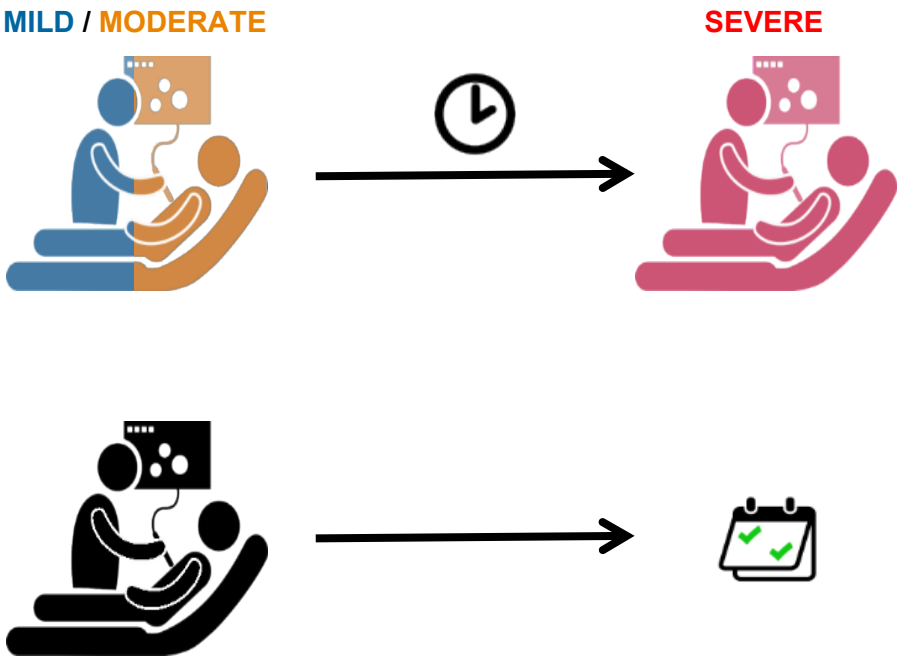
Ecocardiografía



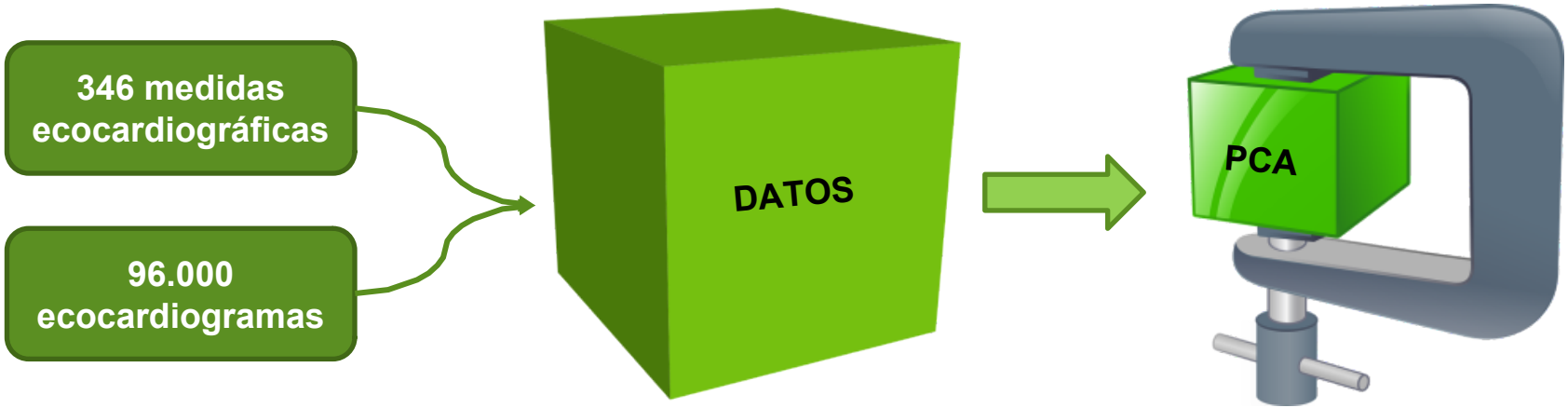
Guías médicas

	Velocidad Máx (m/s)	Gradiente medio (mm Hg)	AVA (cm^2)	VISITAS (años)	
					
LEVE	2.5 – 2.9	<20	> 1.5	1	3
MODERADA	3.0 – 4.0	20 – 40	1.0 – 1.5	1	1
GRAVE	> 4.0	> 40	< 1.0	0,5	0,5

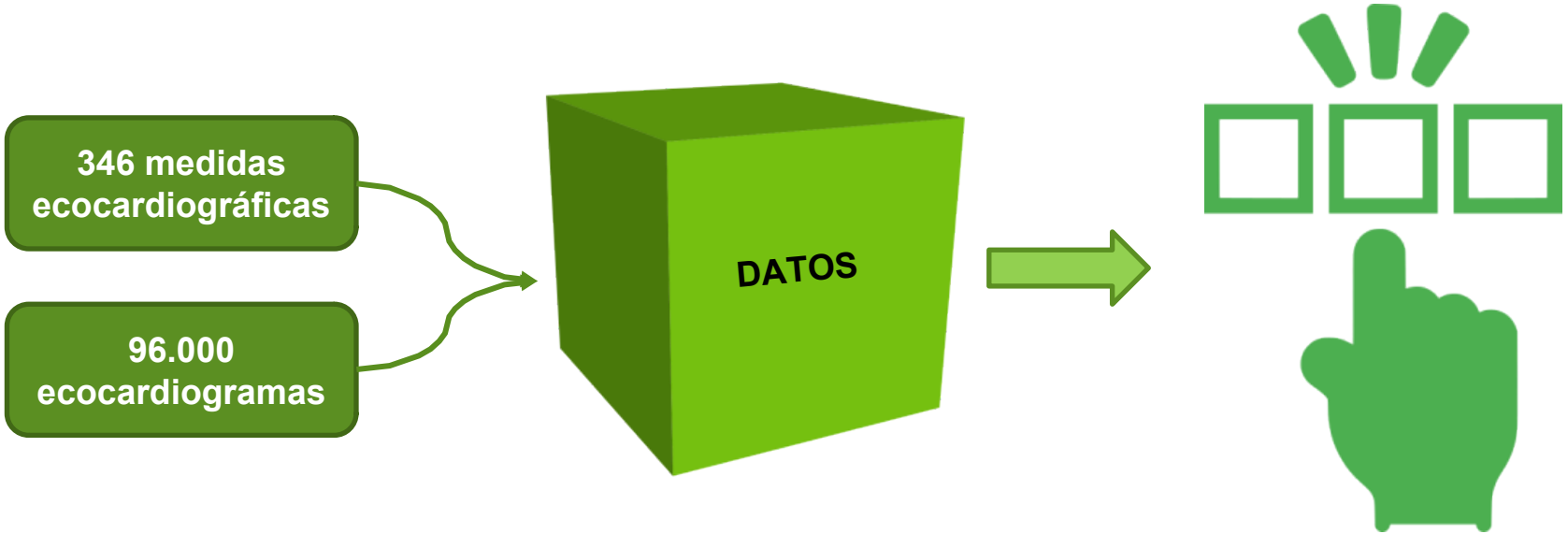
Objetivos



Selección de variables



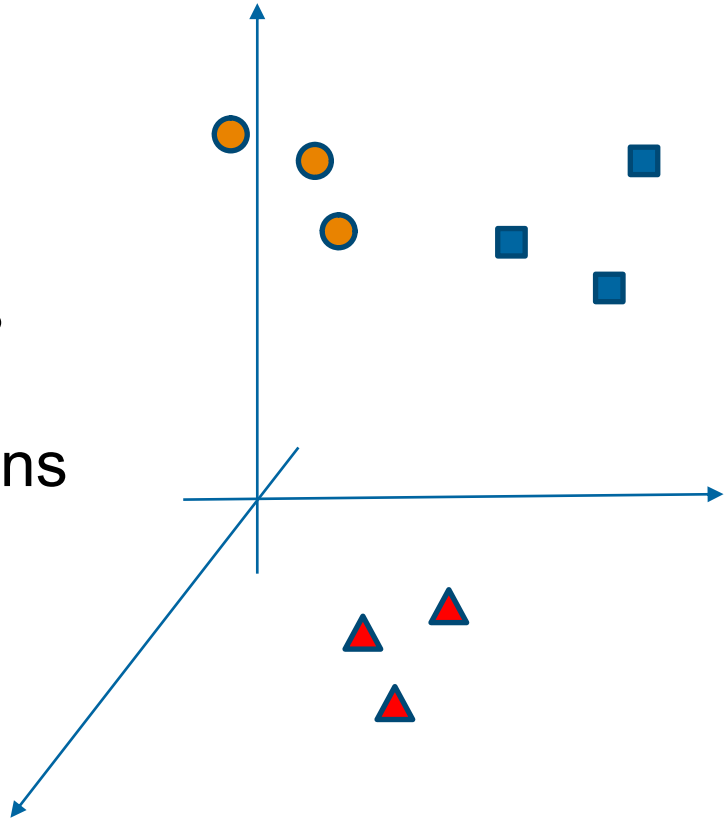
Selección de variables



Selección de variables

X_{nm}

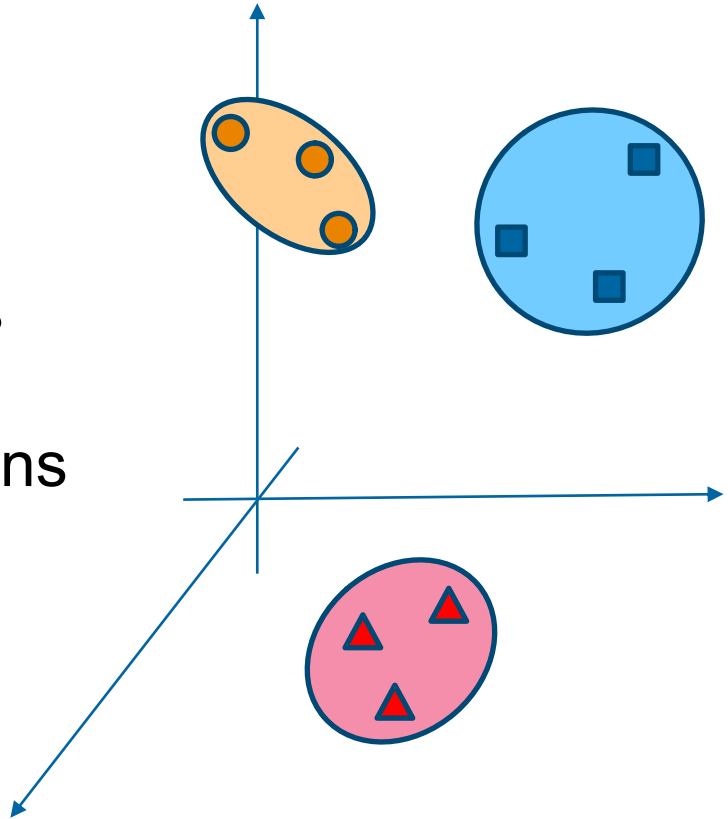
n elements
m features
d dimensions
j groups



Selección de variables

X_{nm}

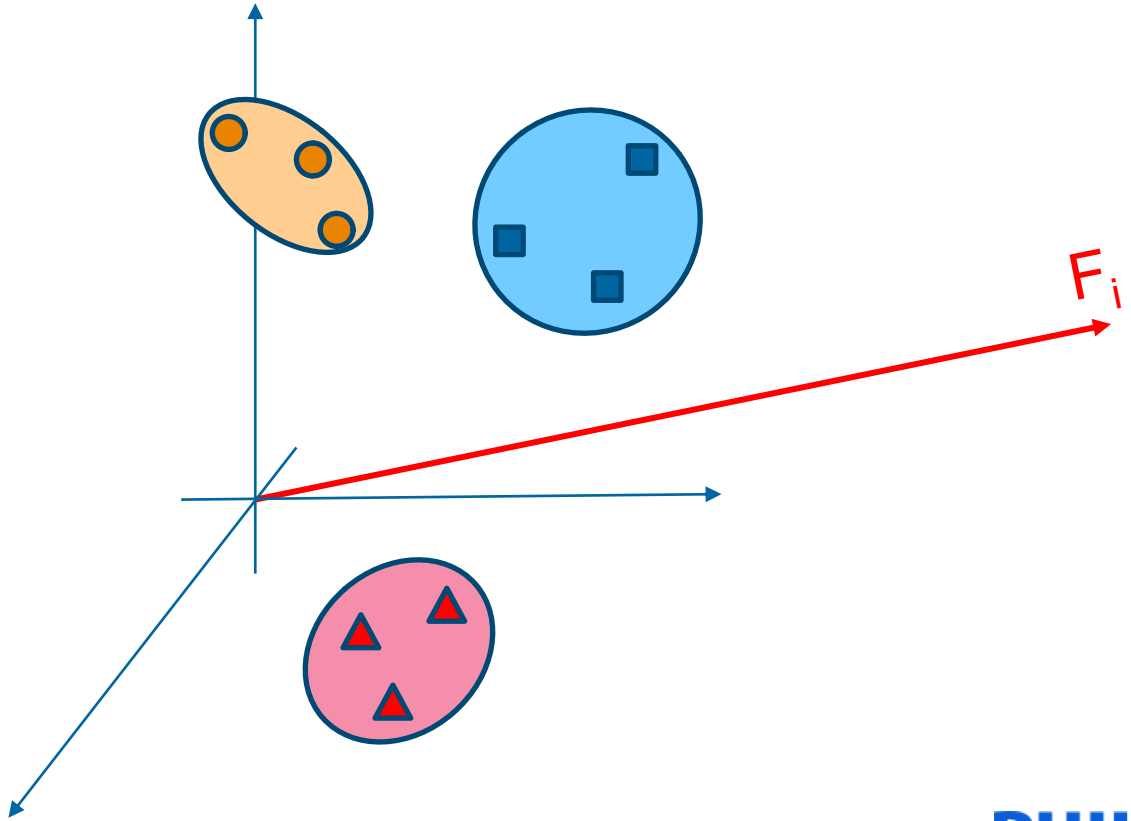
n elements
m features
d dimensions
j groups



Selección de variables

X_{nm}

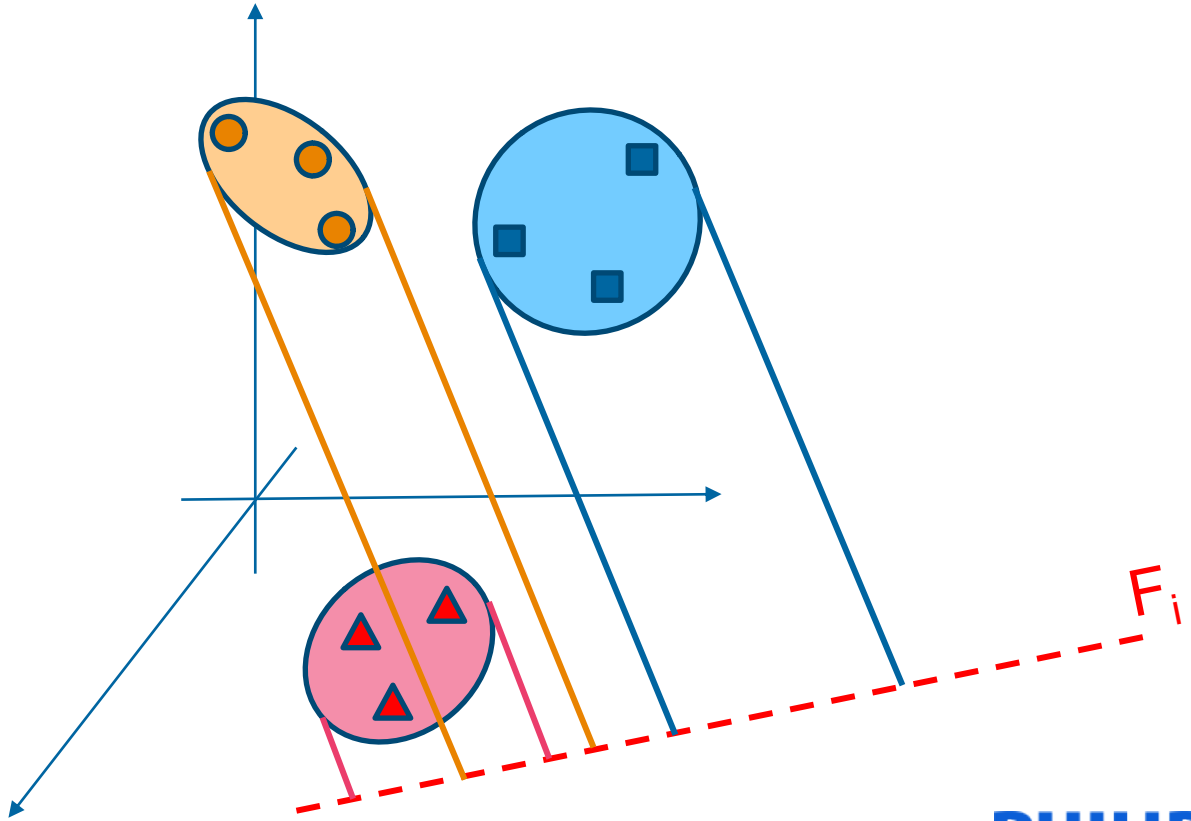
R_{nd} C_{md}



Selección de variables

X_{nm}

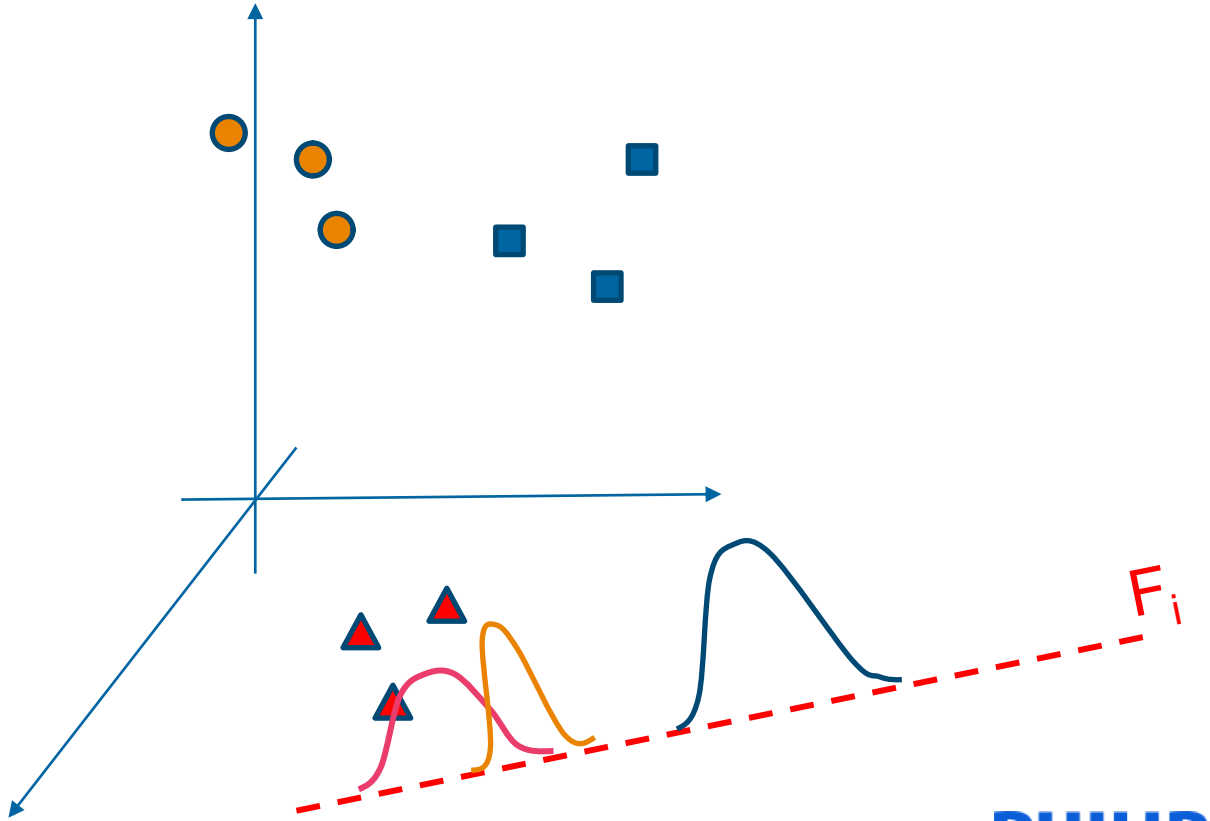
R_{nd} C_{md}



Selección de variables

X_{nm}

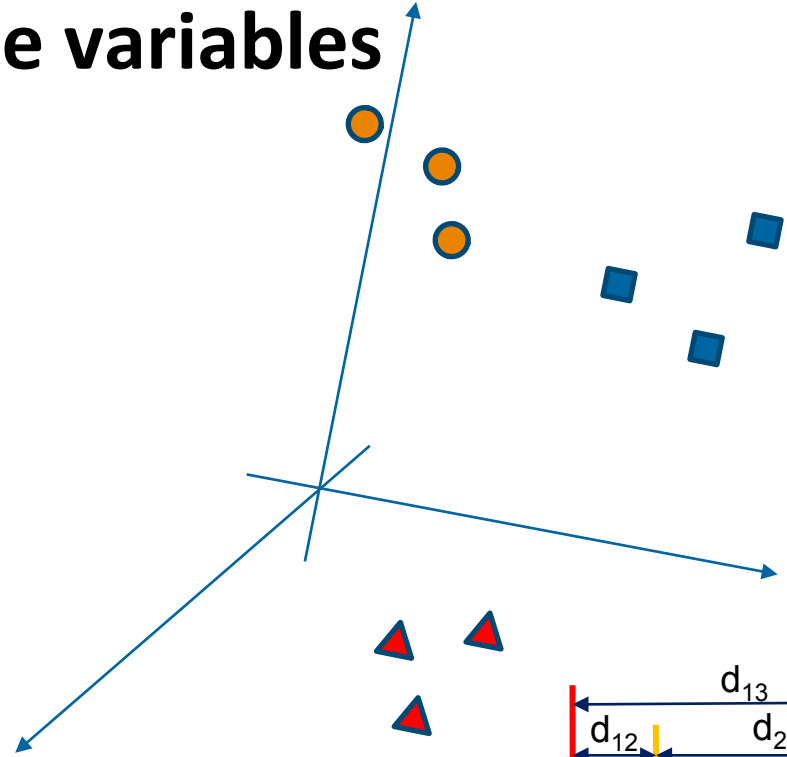
R_{nd} C_{md}



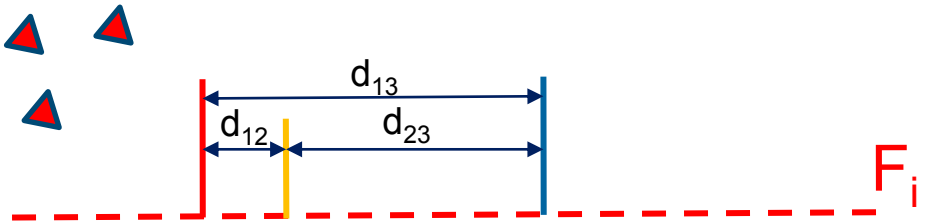
Selección de variables

X_{nm}

R_{nd} C_{md}



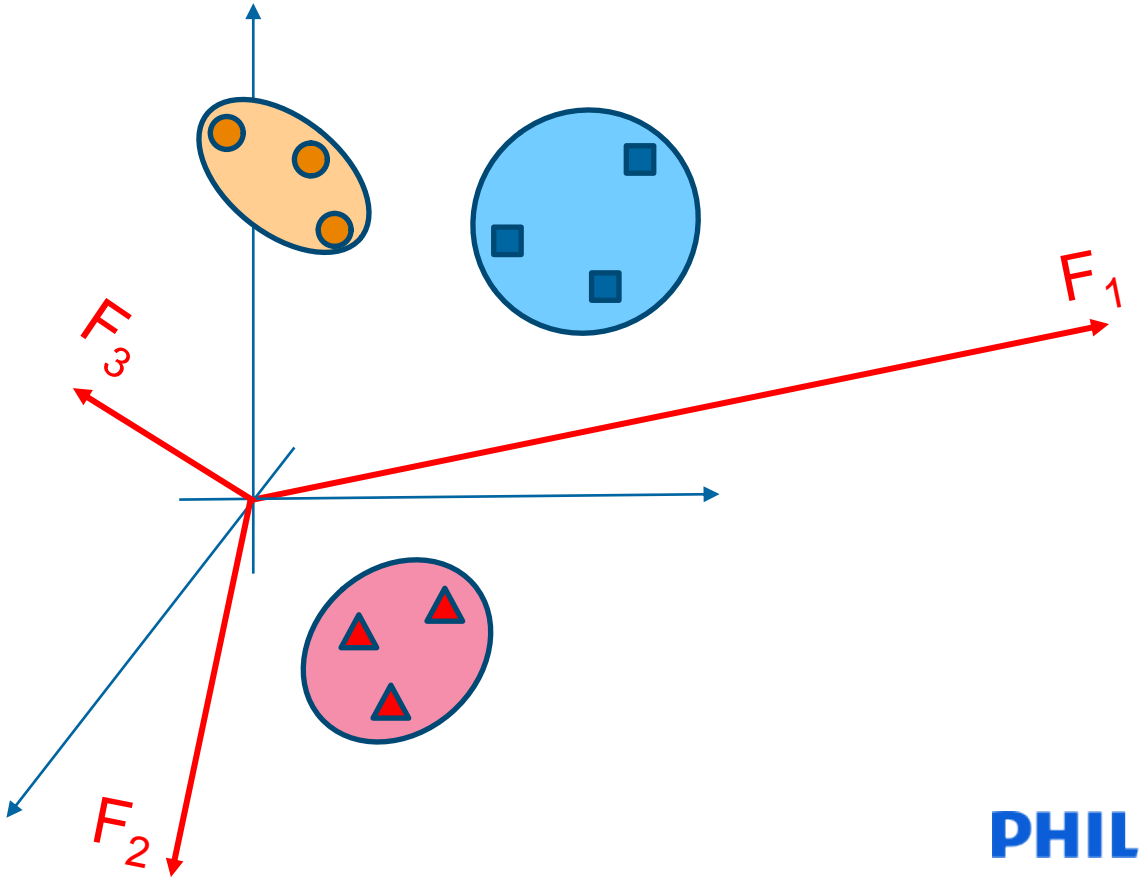
	1 - 2	1 - 3	2 - 3
F_i	d_{12}	d_{13}	d_{23}



Selección de variables

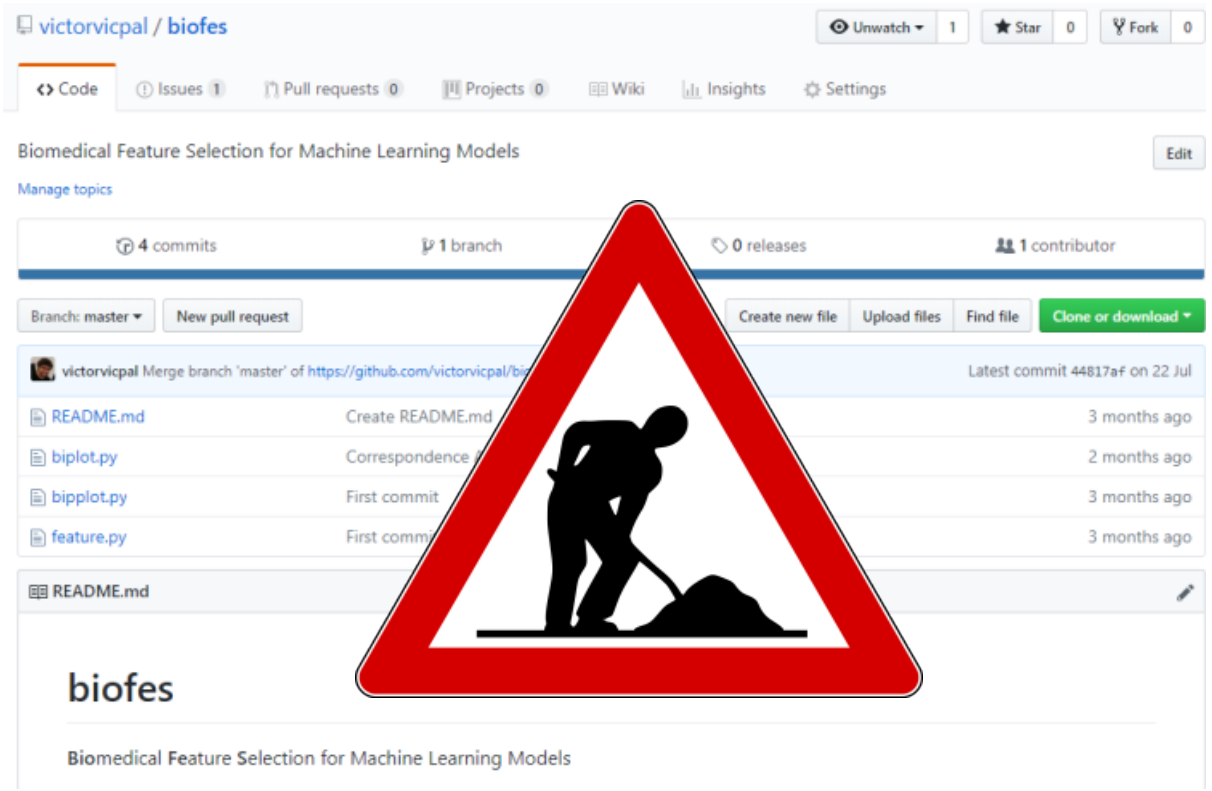
X_{nm}

R_{nd} C_{md}



Selección de variables

victorvicpal/biofes

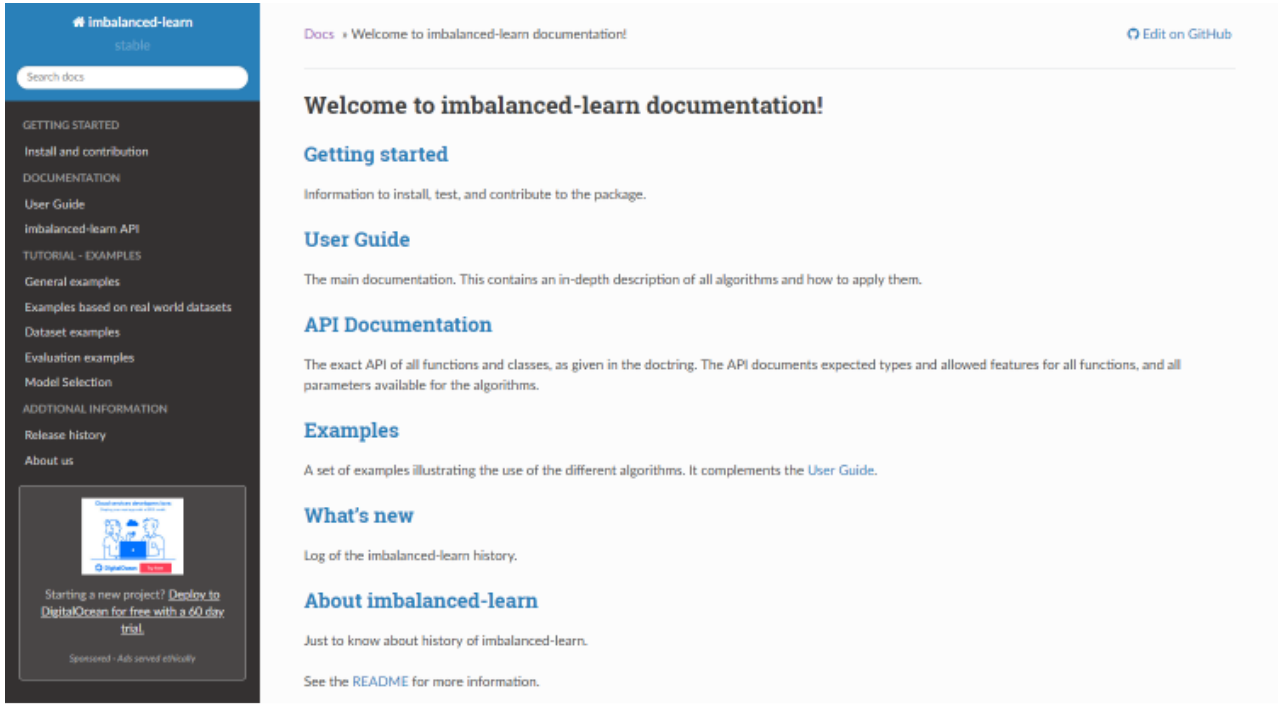


innovation you

PHILIPS

Datos Desbalanceados

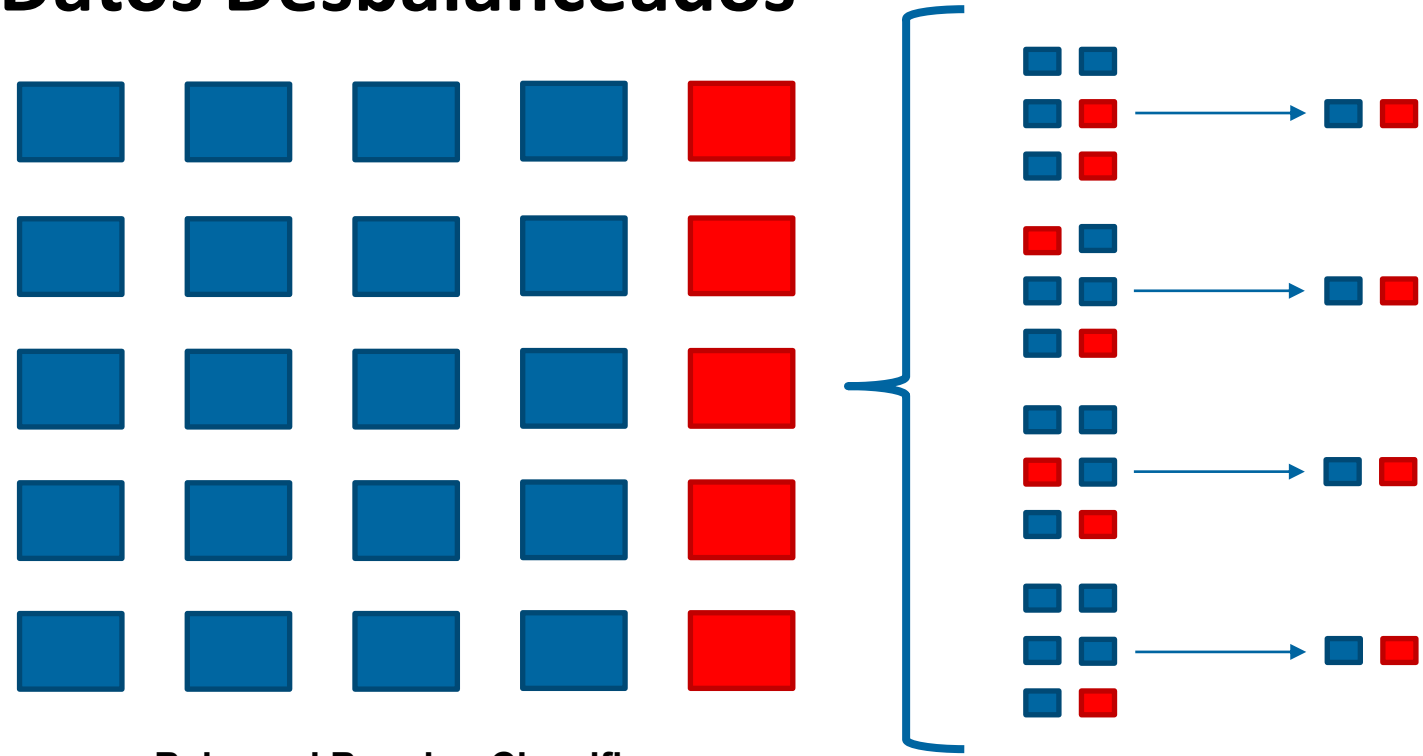
imbalanced-learn



innovation you

PHILIPS

Datos Desbalanceados



Balanced Bagging Classifier

Datos Desbalanceados

```
>>> from imblearn.ensemble import BalancedBaggingClassifier
>>> bbc = BalancedBaggingClassifier(base_estimator=DecisionTreeClassifier(),
...                                 ratio='auto',
...                                 replacement=False,
...                                 random_state=0)
>>> bbc.fit(X_train, y_train)
BalancedBaggingClassifier(...)
>>> y_pred = bbc.predict(X_test)
>>> confusion_matrix(y_test, y_pred)
array([[   9,    1,    2],
       [   0,   55,    4],
       [  42,   46, 1091]])
```

¿Falsos Positivos o Falsos Negativos?

	NO	SÍ
NO	**VN** 9760	**FP** 140
SÍ	**FN** 3	**VP** 97

9900 casos

100 casos

ACCURACY = (9760 + 97) / 10000 = 0.99

PRECISION = 97 / (97+140) = 0.55

RECALL = 97 / (97 + 3) = 0.97

¿Falsos Positivos o Falsos Negativos?

	NO	SÍ
NO	**VN** 9760	**FP** 140
SÍ	**FN** 3	**VP** 97

9900 casos

100 casos

PRUEBA NO INVASIVA

ACCURACY = (9760 + 97) / 10000 = 0.99

PRECISION = 97 / (97+140) = 0.55

RECALL = 97 / (97 + 3) = **0.97**

¿Falsos Positivos o Falsos Negativos?

	NO	SÍ
NO	**VN** 9760	**FP** 140
SÍ	**FN** 3	**VP** 97

9900 casos

100 casos

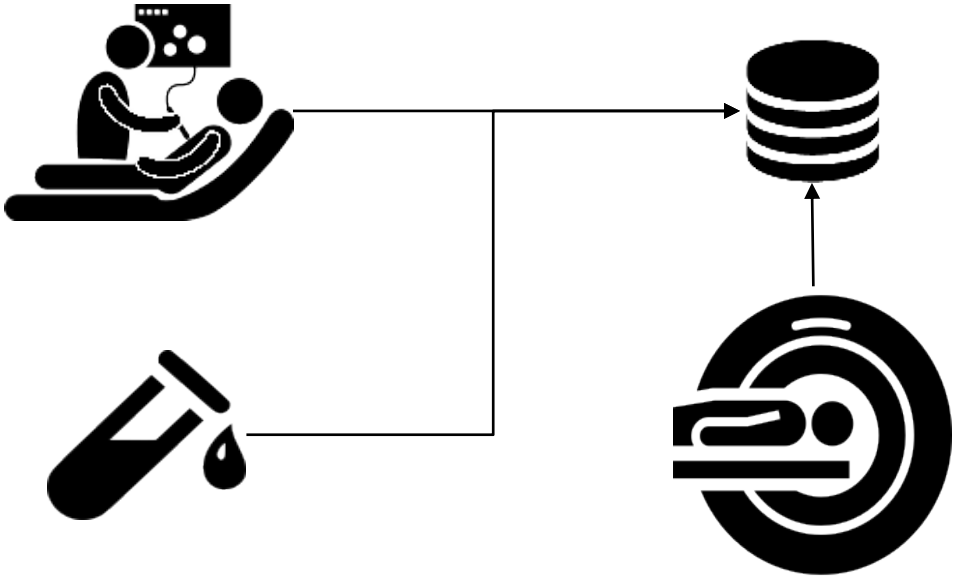
PRUEBA INVASIVA

ACCURACY = (9760 + 97) / 10000 = 0.99

PRECISION = 97 / (97+140) = **0.55**

RECALL = 97 / (97 + 3) = 0.97

Cardiotoxicidad



CARTIER

Cardiotoxicidad

2 MESES
ECO
SANGRE

6 MESES
ECO
RESO
SANGRE

12 MESES
ECO
RESO
SANGRE

QUIMIOTERAPIA

BASAL
ECO
RESO
SANGRE

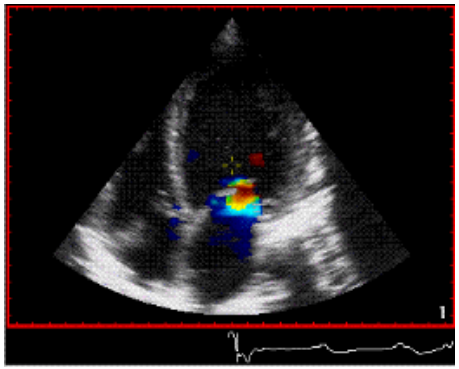
4 MESES
ECO
RESO
SANGRE

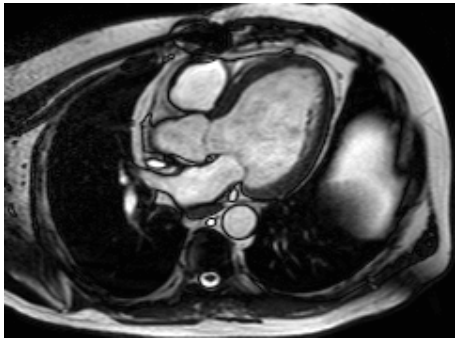
9 MONTHS
ECHO
BLOOD
TEST

innovation you

PHILIPS

¿Riesgo de cardiotoxicidad?





PROXIMAMENTE…

Muchas gracias por su atención

Víctor Vicente Palacios

victor.vicente.palacios@Philips.com