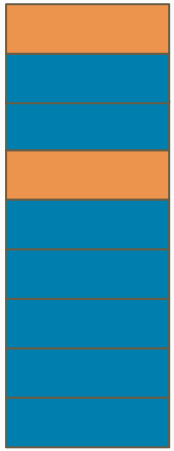
Machine learning with imbalanced clinical data sets

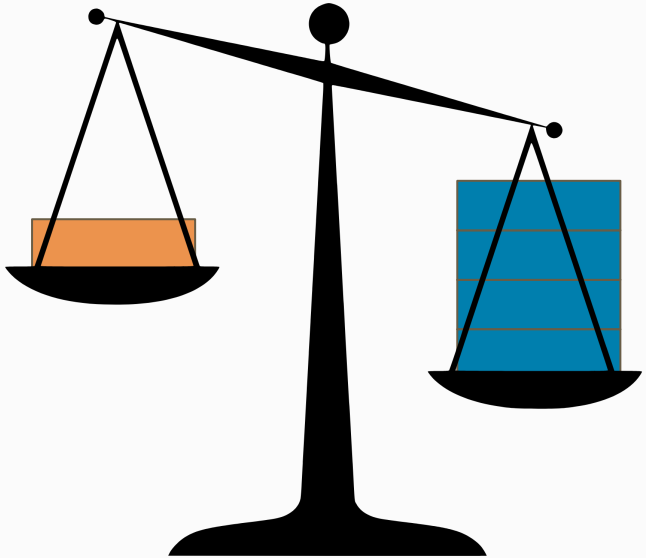
21st January, 2019

Speaker: Víctor Vicente Palacios
Clinical Data Scientist

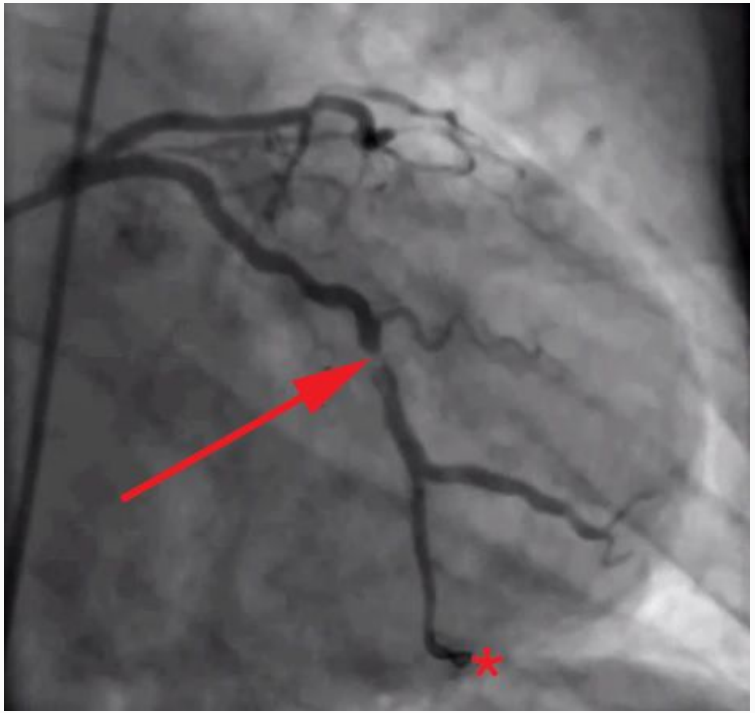
PyData Salamanca meetup

Imbalanced?

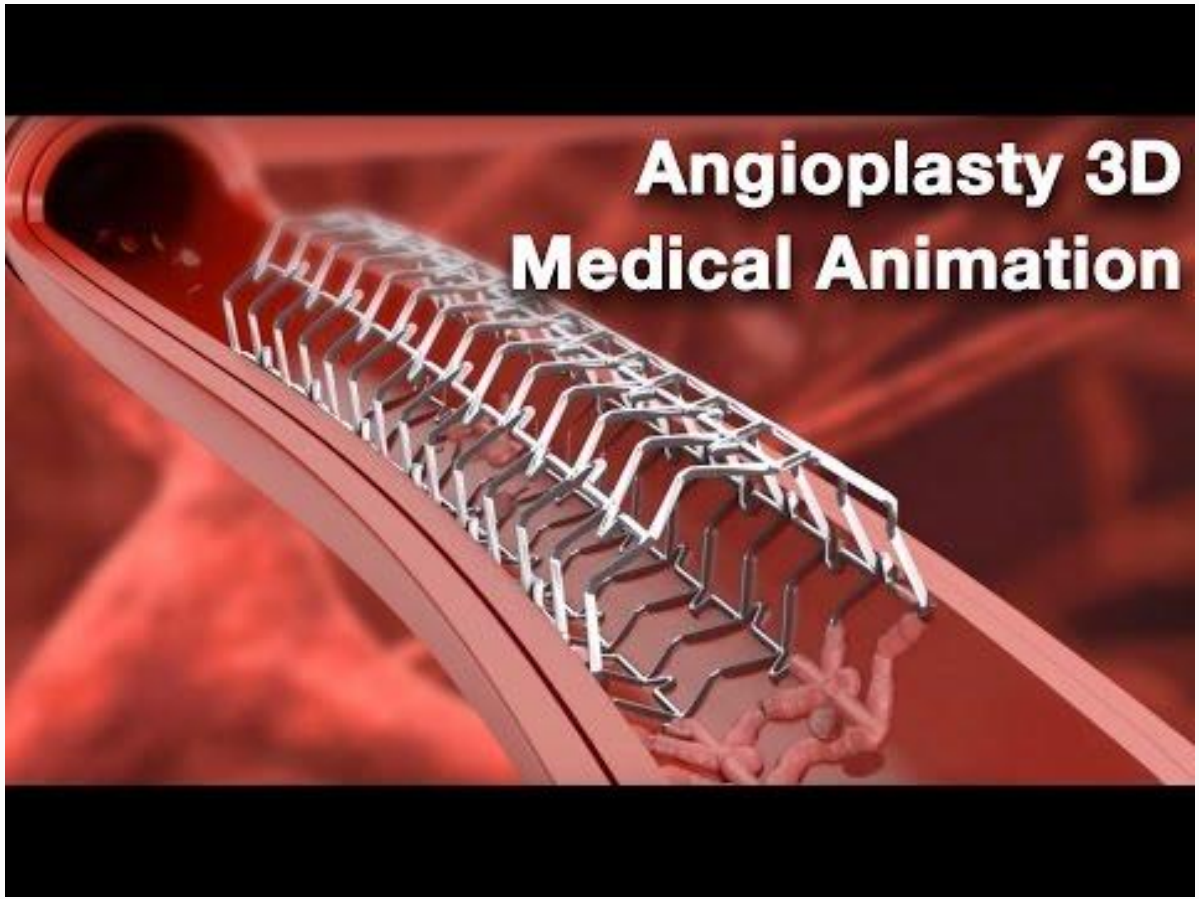




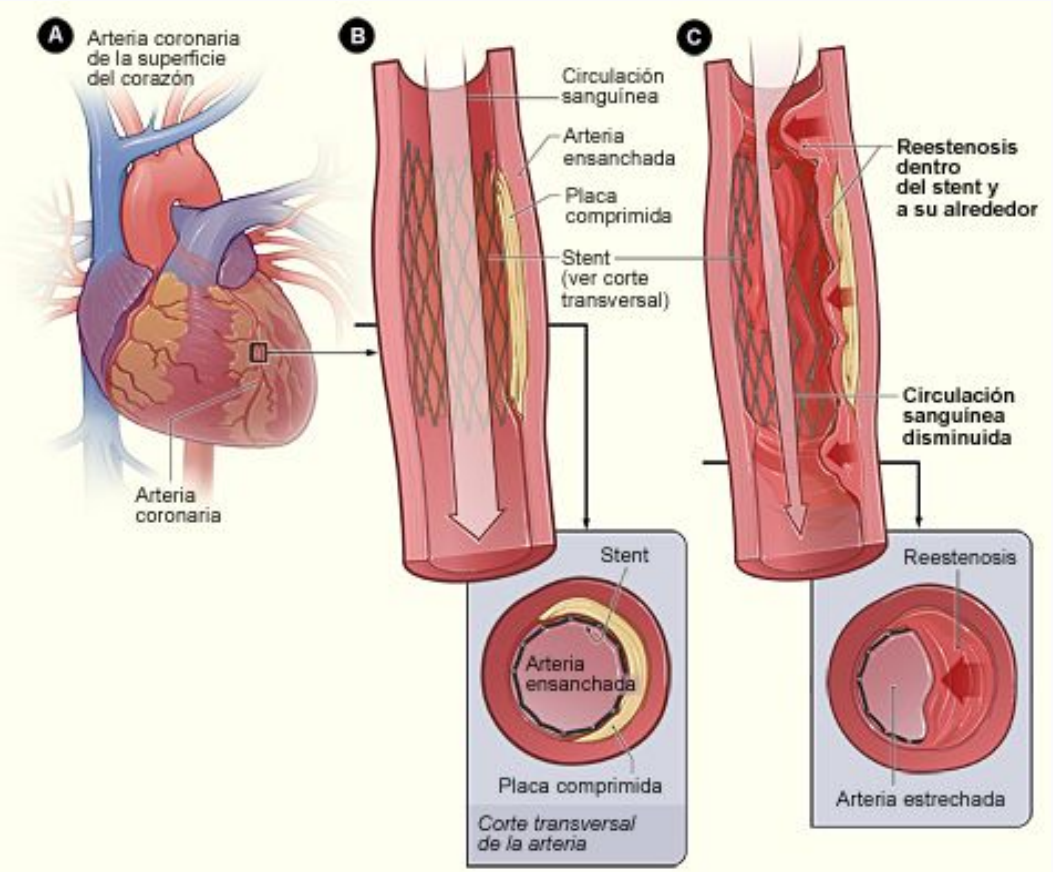
Caso clínico



Implantación stent



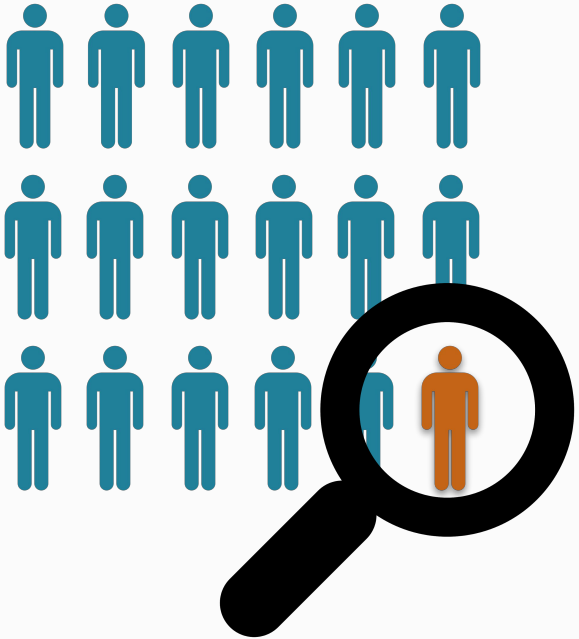
Reestenosis



Casos clínicos

Coronografía

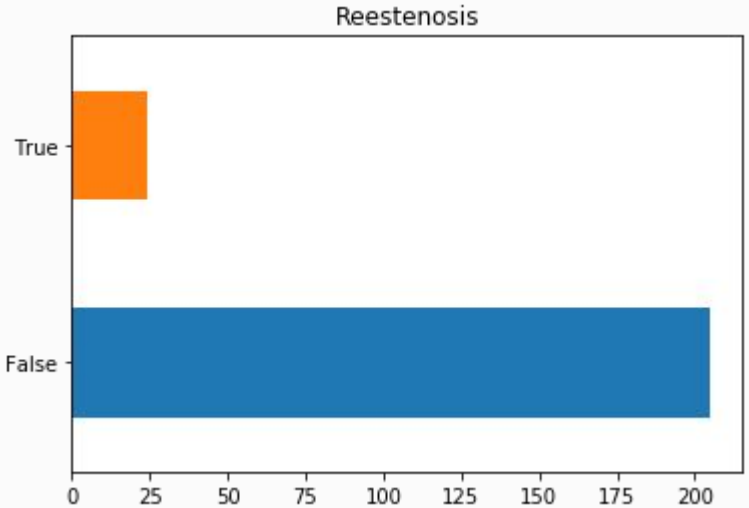
Historia clínica



Ensayo Clínico

	stent	tirofiban	sexo	diabetes	hipertension	his_familiar	edad	tabaquismo	localiz	seg_me_pre	...	tmpg_post	timi_12m
0	1	2	1	1	2.0	2	63	2	RCA	RCADistal	...	3.0	3.0
1	2	2	1	1	1.0	2	78	1	RCA	RCADistal	...	0.0	3.0
2	2	1	1	2	2.0	2	51	1	LAD	LADMid	...	3.0	3.0
3	2	1	2	2	1.0	2	70	1	LAD	LADMid	...	0.0	3.0
4	1	2	1	1	2.0	2	64	2	LAD	LADProximal	...	NaN	NaN

- Pacientes con reestenosis **10%**
- Medidas angiográficas
- Historial clínico



imbalanced-learn

imbalanced-learn

stable

Search docs

Install and contribution

Prerequisites

The imbalanced-learn package requires the following dependencies:

- numpy (>=1.8.2)
- scipy (>=0.13.3)
- scikit-learn (>=0.20)
- keras 2 (optional)
- tensorflow (optional)

Our release policy is to follow the scikit-learn releases in order to synchronize the new feature. **imbalanced-learn 0.4 is the last version to support Python 2.7**

Install

imbalanced-learn is currently available on the PyPi's reporitories and you can install it via *pip*:

```
pip install -U imbalanced-learn
```

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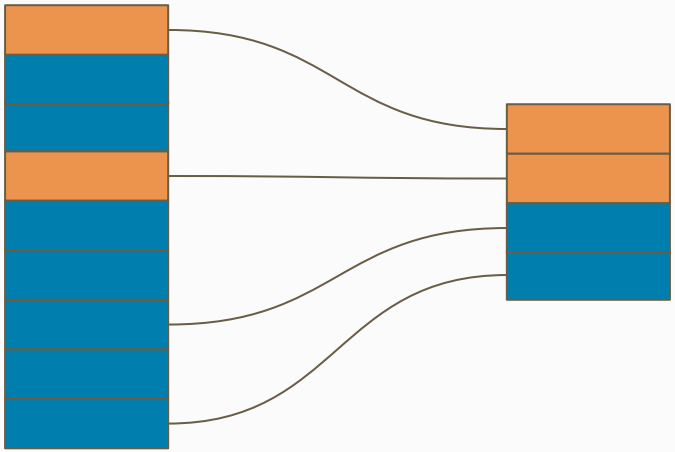
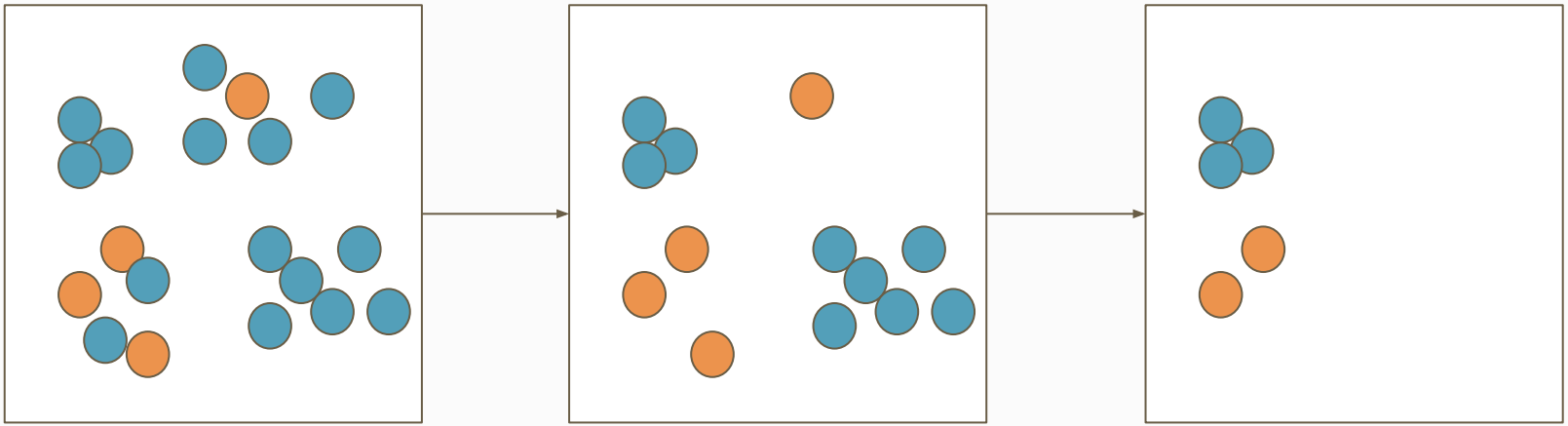
Técnicas de remuestreo

- Undersampling
- Oversampling
- Combinada
- Ensemble

Undersampling



Undersampling (Edited Nearest Neighbours)



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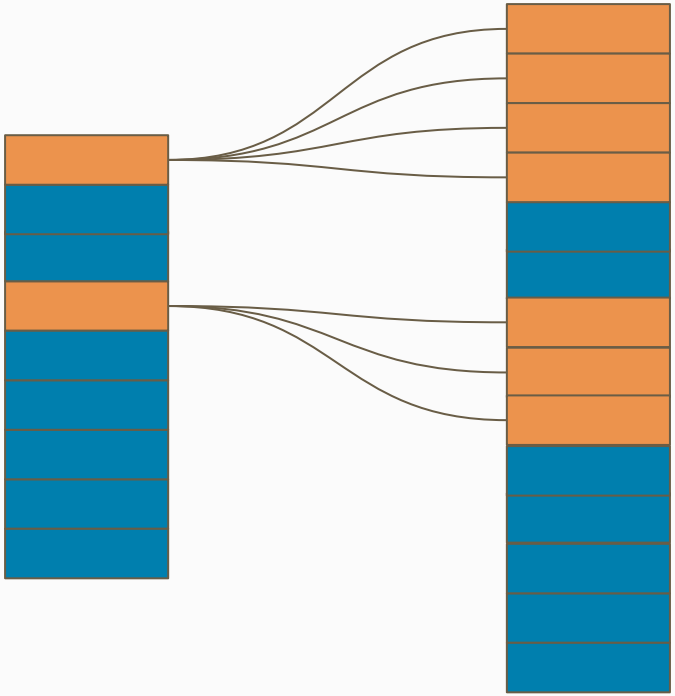
Undersampling (Edited Nearest Neighbours)

```
from sklearn.ensemble import RandomForestClassifier
from imblearn.under_sampling import EditedNearestNeighbours
from imblearn.pipeline import make_pipeline

rf = RandomForestClassifier(random_state=42)

enn = EditedNearestNeighbours(random_state=42)
pipe_enn = make_pipeline(enn, rf)

pipe_enn.fit(X_train, y_train)
y_pred = pipe_enn.predict(X_test)
```

Resultados

	ACCURACY	SPECIFICITY	SENSITIVITY
RF	0.9	0.99	0.07
RF + ENN	0.9	0.98	0.14

Oversampling



Oversampling (Synthetic Minority Oversampling Technique)

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Oversampling (Synthetic Minority Oversampling Technique)

```
from sklearn.ensemble import RandomForestClassifier
from imblearn.over_sampling import SMOTE
from imblearn.pipeline import make_pipeline

rf = RandomForestClassifier(random_state=42)

smt = SMOTE(random_state=42)
pipe_smt = make_pipeline(smt, rf)
pipe_smt.fit(X_train, y_train)
y_pred = pipe_smt.predict(X_test)
```

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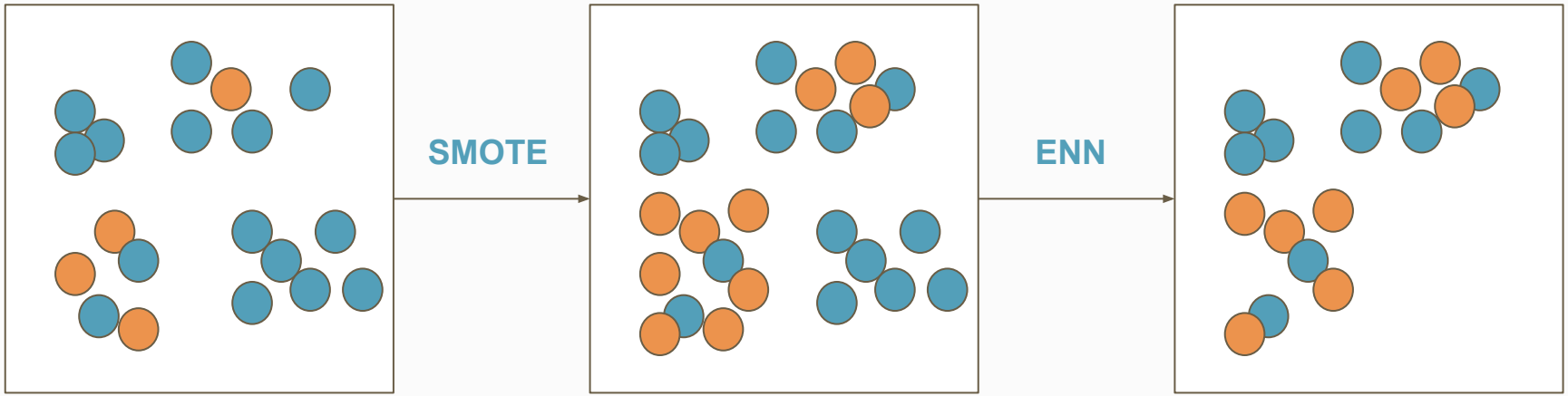
Resultados

	ACCURACY	SPECIFICITY	SENSITIVITY
RF	0.9	0.99	0.07
RF + ENN	0.9	0.98	0.14
RF + SMOTE	0.9	0.97	0.2

Over+Undersampling (SMOTE + ENN)



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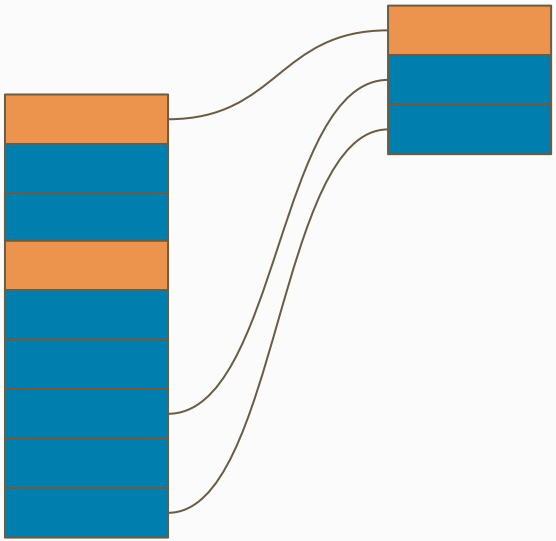
Over+Undersampling (SMOTE + ENN)

```
from sklearn.ensemble import RandomForestClassifier
from imblearn.combine import SMOTEENN
from imblearn.pipeline import make_pipeline

rf = RandomForestClassifier(random_state=42)

smtenn = SMOTEENN(random_state=42)
pipe_smtenn = make_pipeline(smtenn, rf)
pipe_smtenn.fit(X_train, y_train)
y_pred = pipe_smtenn.predict(X_test)
```

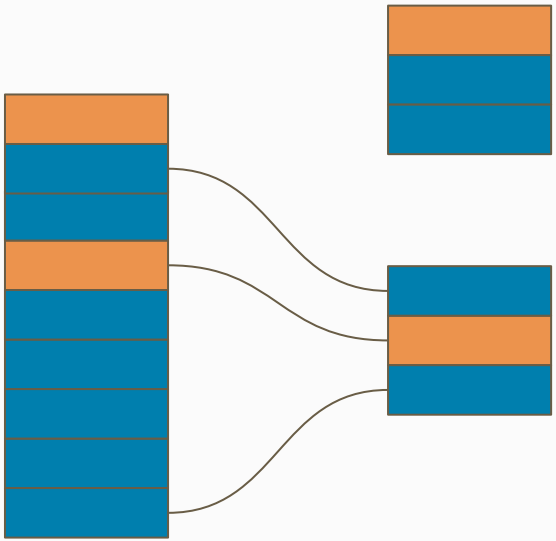
Resultados

	ACCURACY	SPECIFICITY	SENSITIVITY
RF	0.9	0.99	0.07
RF + ENN	0.9	0.98	0.14
RF + SMOTE	0.9	0.97	0.2
RF + SMOTEENN	0.87	0.94	0.3

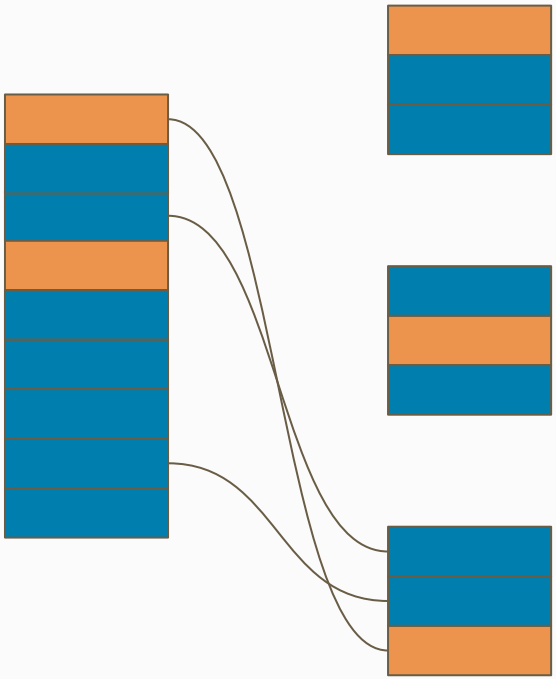
Balanced Bagging Classifier



Balanced Bagging Classifier



Balanced Bagging Classifier



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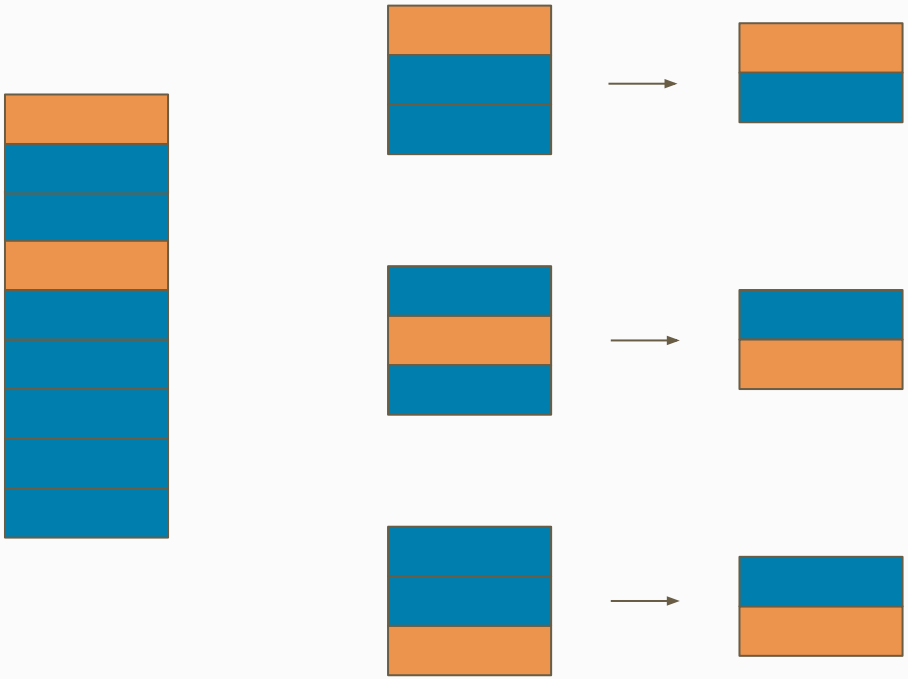
Balanced Bagging Classifier



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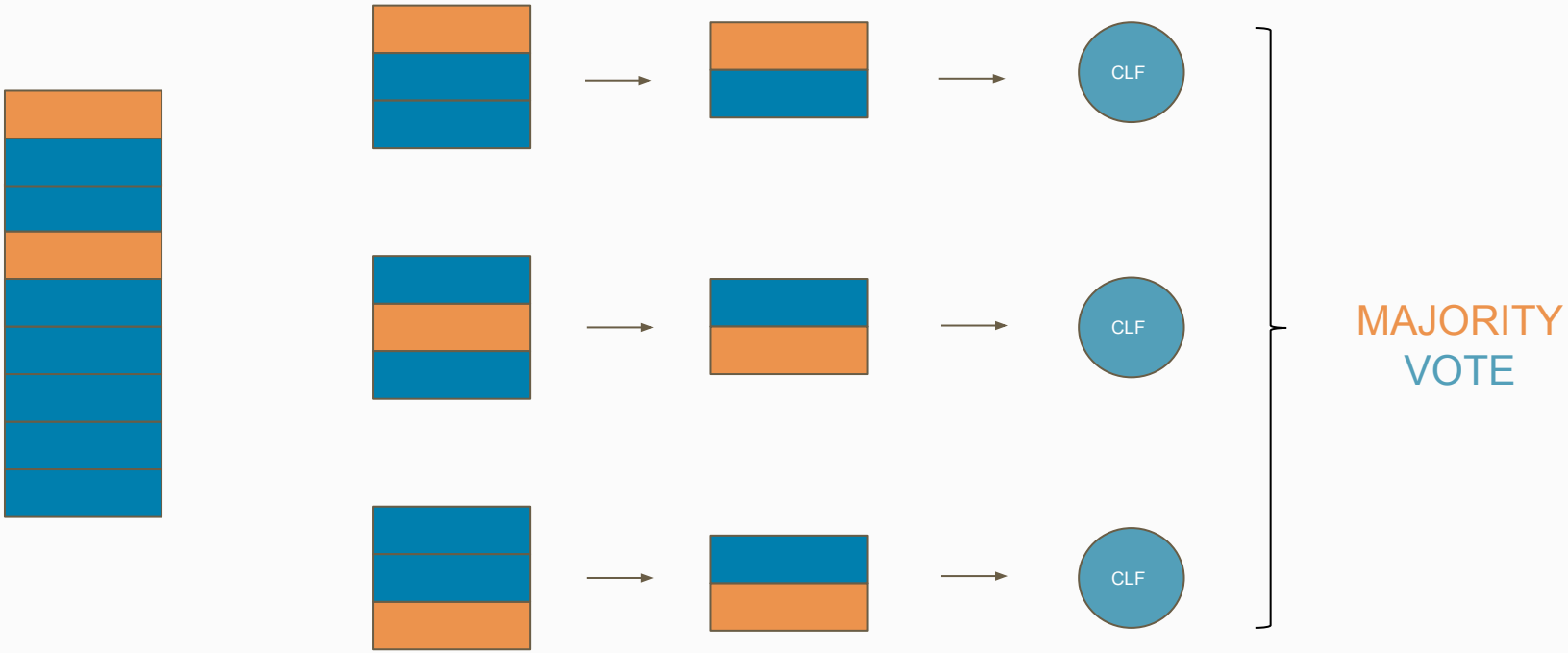
Balanced Bagging Classifier



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Balanced Bagging Classifier

```
from sklearn.ensemble import RandomForestClassifier
from imblearn.ensemble import BalancedBaggingClassifier
from imblearn.pipeline import make_pipeline

rf = RandomForestClassifier(random_state=42)

bbc = BalancedBaggingClassifier(rf)
bbc.fit(X_train, y_train)
y_pred = bbc.predict(X_test)
```

Resultados

	ACCURACY	SPECIFICITY	SENSITIVITY
RF	0.9	0.99	0.07
RF + ENN	0.9	0.98	0.14
RF + SMOTE	0.9	0.97	0.2
RF + SMOTEENN	0.87	0.94	0.3
RF + BBC	0.7	0.7	**0.7**

Thanks to all attendees! and sponsors!

PyData Salamanca meetup will come back on 21st March 2019

Natural Language Processing

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Ana Valdivia
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