DEEL

DEpendable & Explainable Learning

Conform Prediction in Practice with PUCC

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IRT SAINT EXUPÉRY

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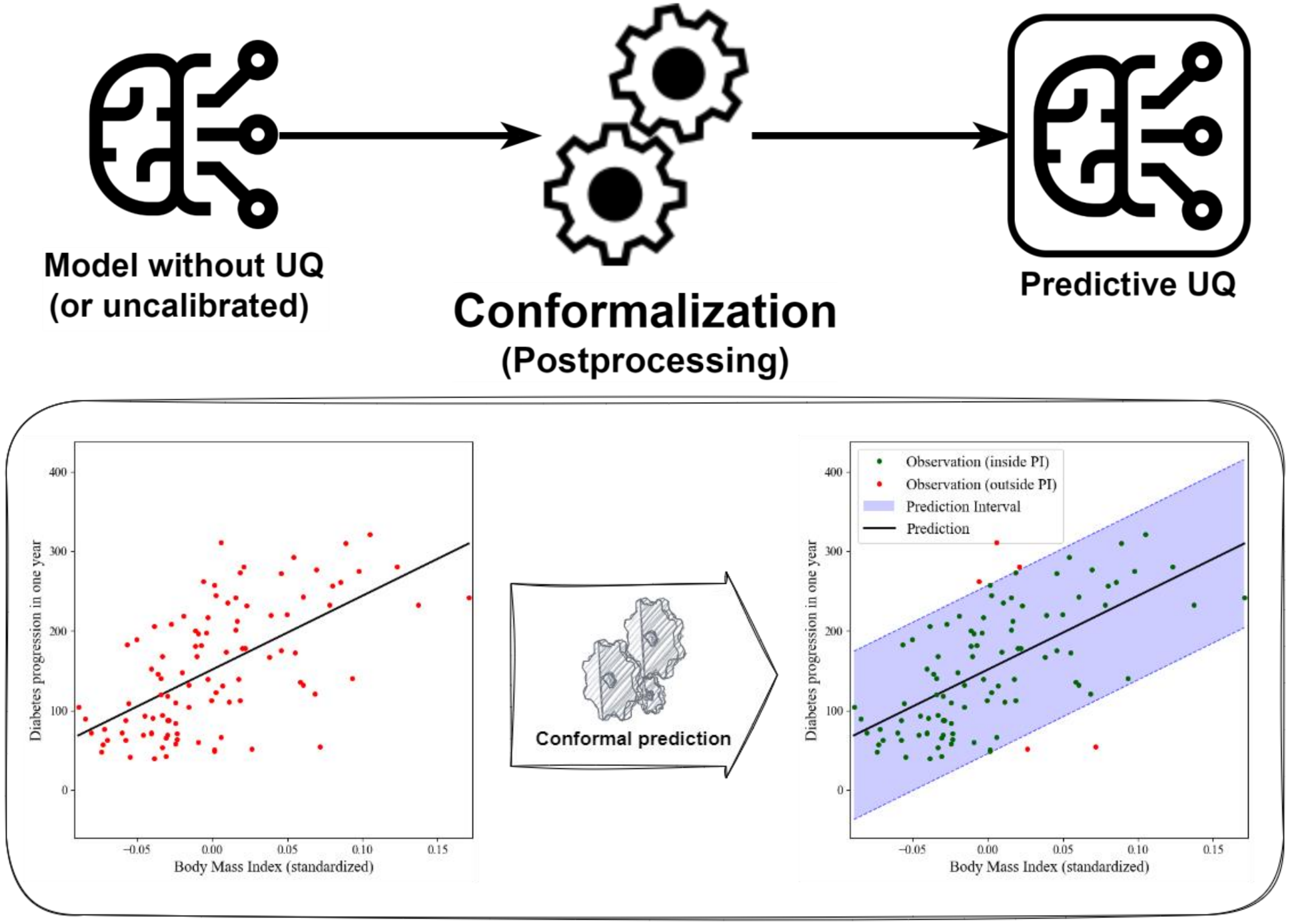
Institut
intelligence
et données

Hands-on Tutorial

https://github.com/M-Mouhcine/puncc-tutorial-pfia2024

Conformal Prediction: Procedure

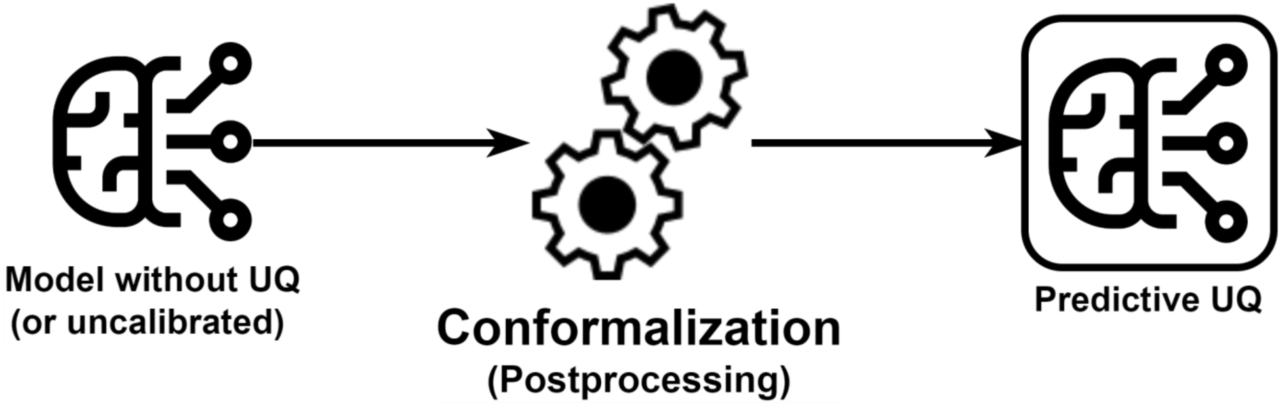


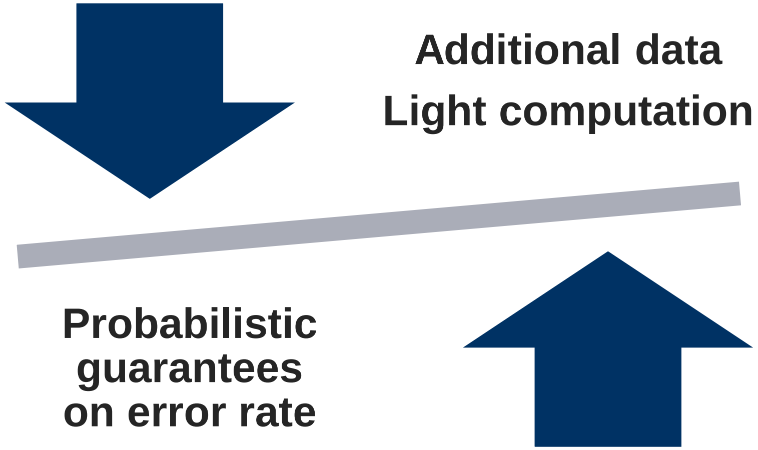
Model without UQ
(or uncalibrated)

Conformalization
(Postprocessing)

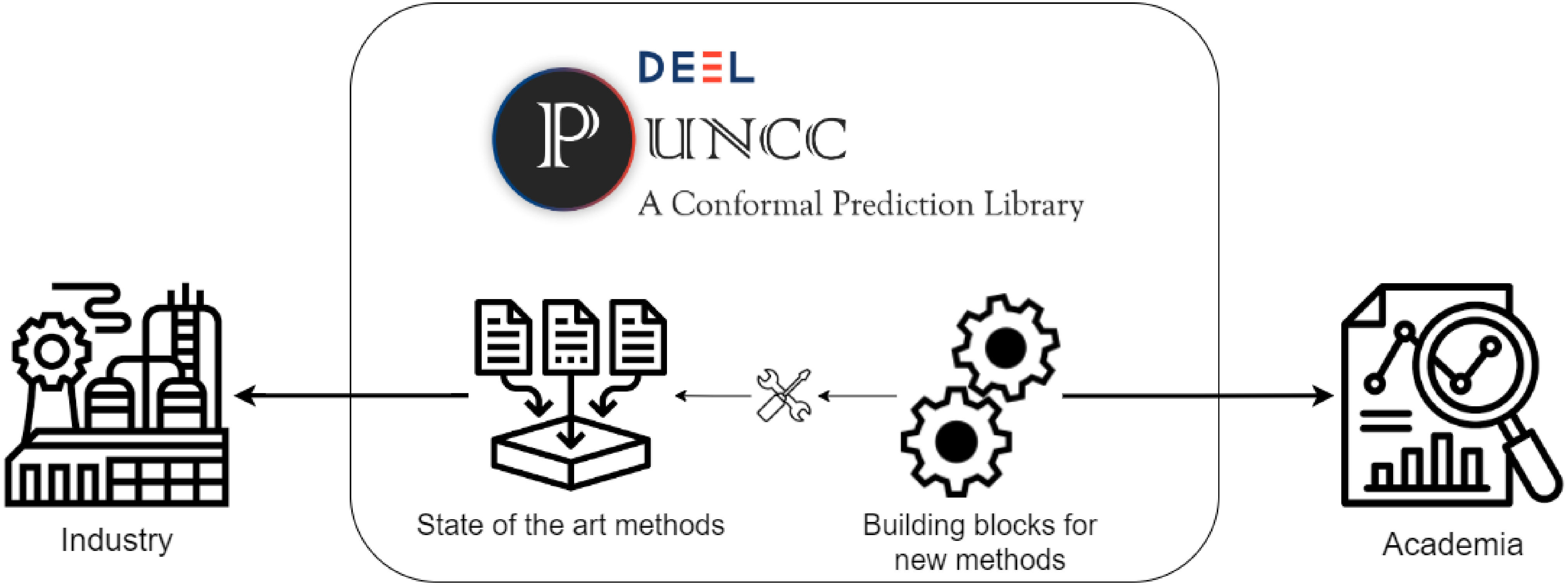
Predictive UQ

Conformal Prediction: Procedure



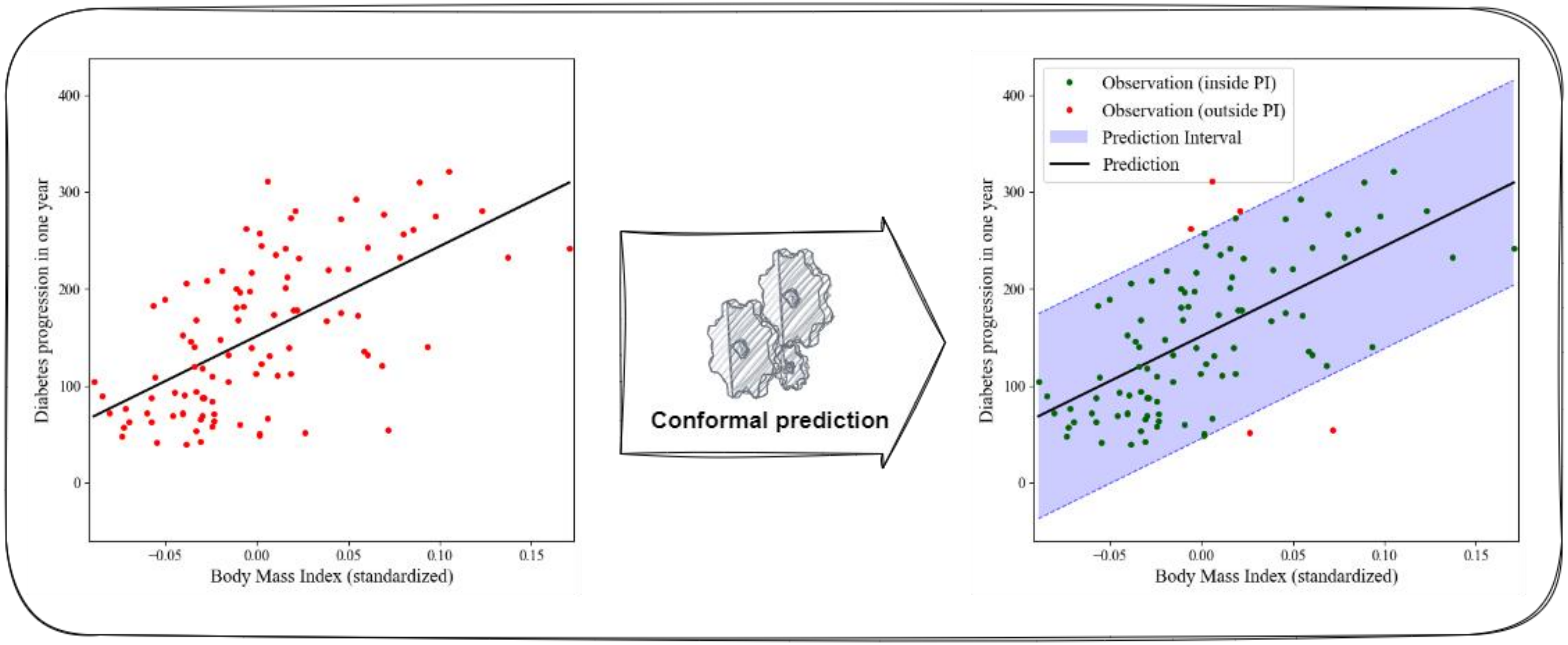


PUNCC Library (Predictive UNcertainty Calibration and Conformalization)

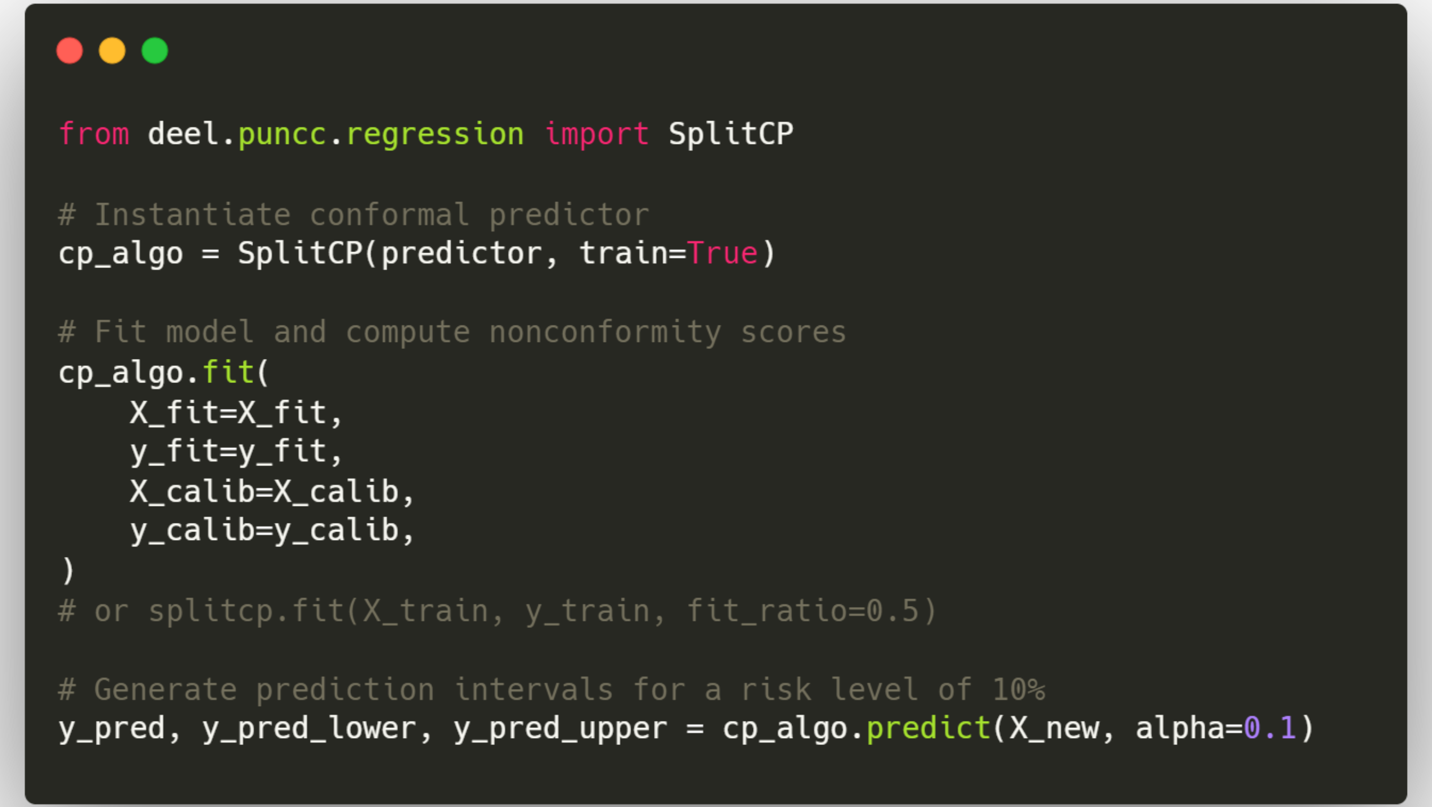

DEEL
PUNCC
A Conformal Prediction Library
Industry
State of the art methods
Building blocks for new methods
Academia

https://github.com/deel-ai/puncc

PUNCC: Regression



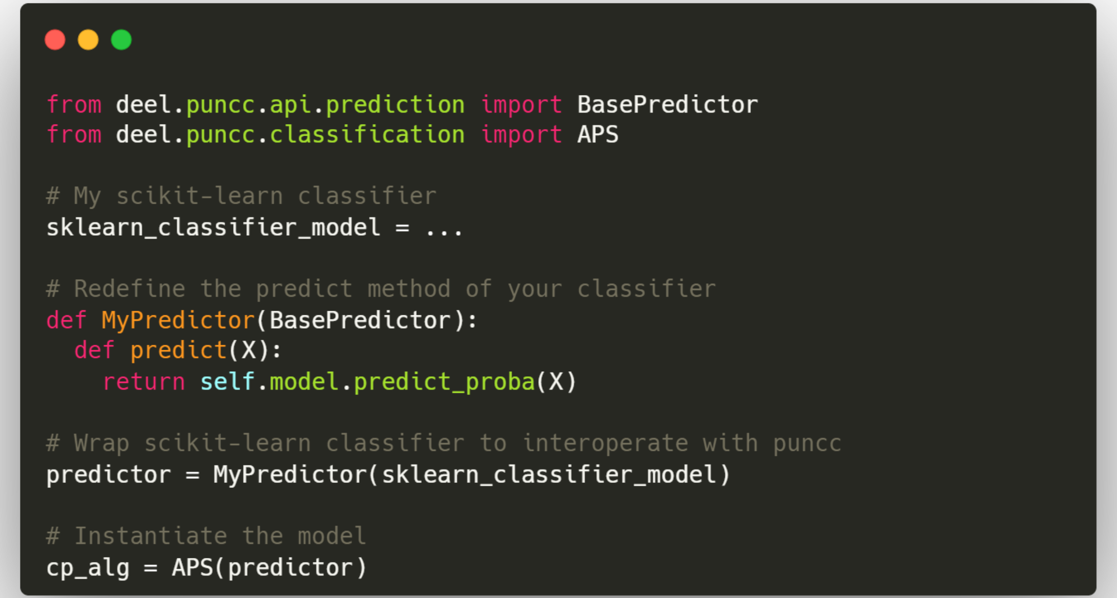
Conformal Regression in few lines of code



```python
from deel.puncc.regression import SplitCP

# Instantiate conformal predictor
cp_algo = SplitCP(predictor, train=True)

# Fit model and compute nonconformity scores
cp_algo.fit(
    X_fit=X_fit,
    y_fit=y_fit,
    X_calib=X_calib,
    y_calib=y_calib,
)
# or splitcp.fit(X_train, y_train, fit_ratio=0.5)

# Generate prediction intervals for a risk level of 10%
y_pred, y_pred_lower, y_pred_upper = cp_algo.predict(X_new, alpha=0.1)
```

Interoperability

- ❑ PUNCC supports popular data types and ML libraries and more …

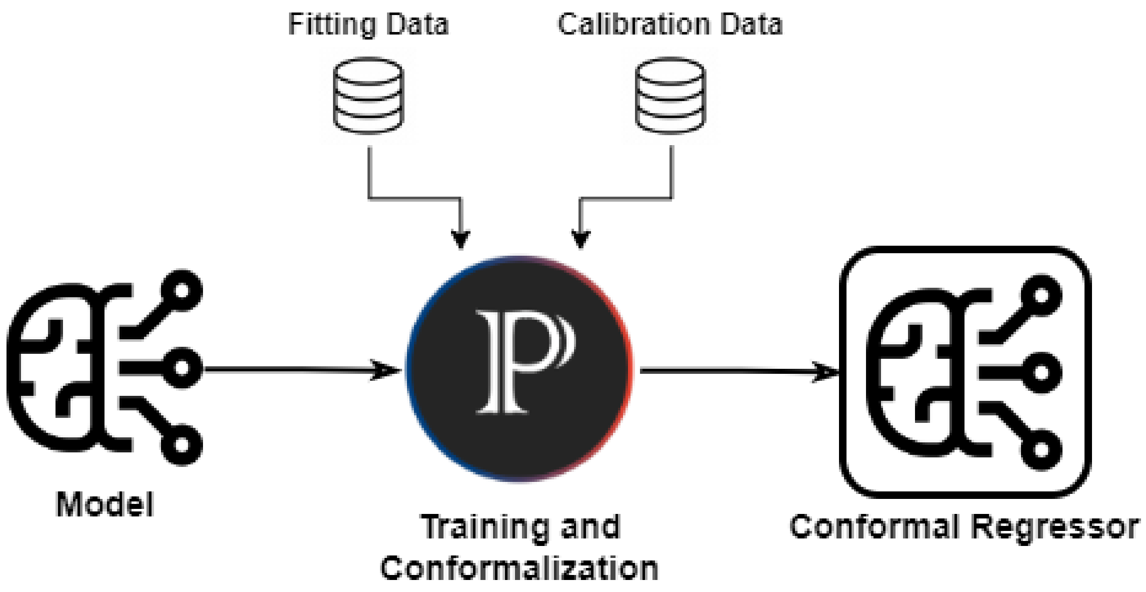


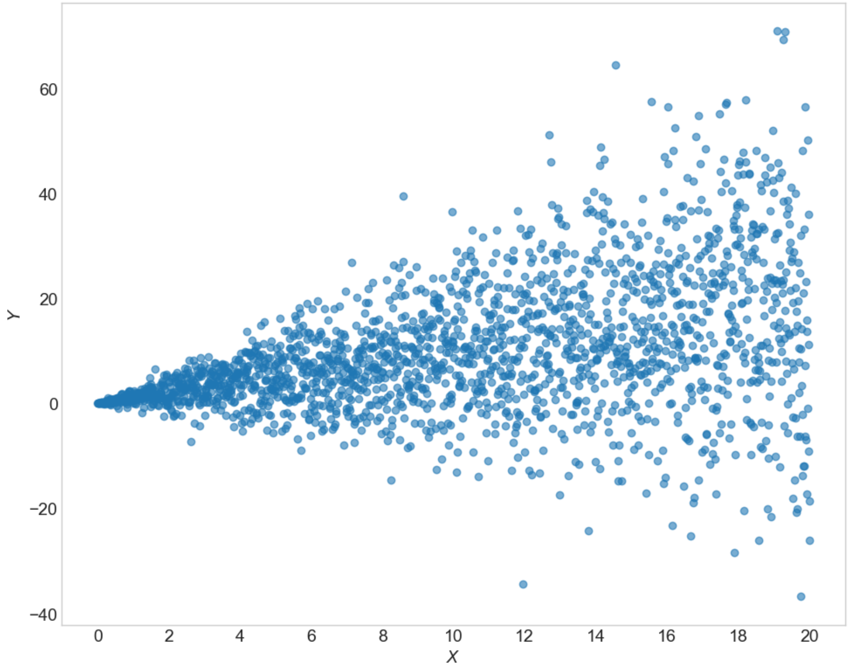
```
from deel.puncc.api.prediction import BasePredictor
from deel.puncc.classification import APS

# My scikit-learn classifier
sklearn_classifier_model = ...

# Redefine the predict method of your classifier
def MyPredictor(BasePredictor):
  def predict(X):
    return self.model.predict_proba(X)

# Wrap scikit-learn classifier to interoperate with puncc
predictor = MyPredictor(sklearn_classifier_model)

# Instantiate the model
cp_alg = APS(predictor)
```

- ❑ Can work on top of UQ models and libraries

Demo: Conformal Regression

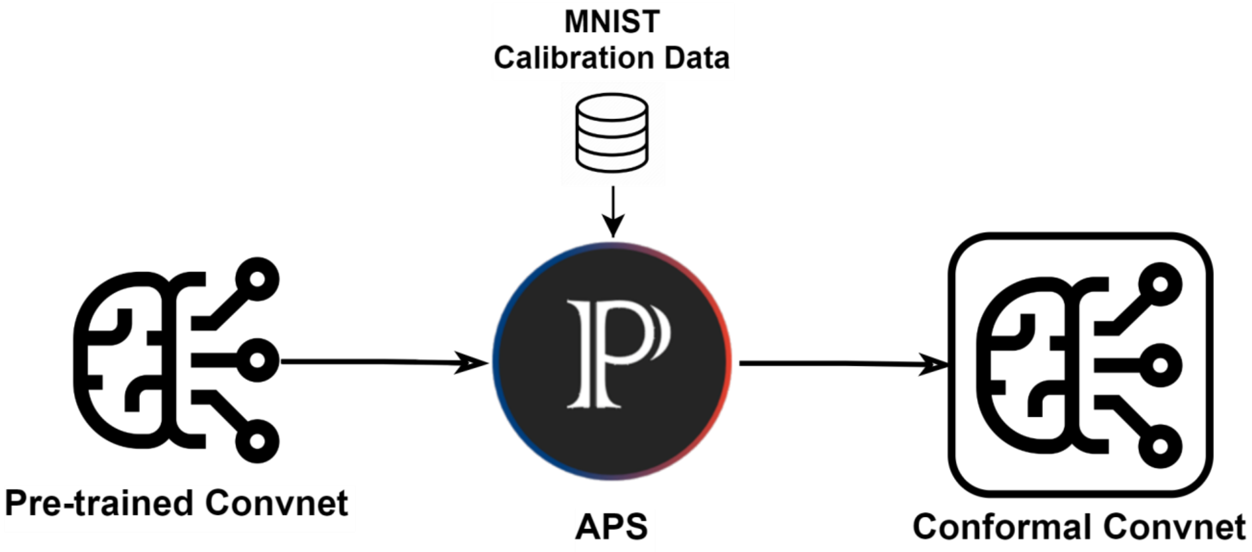
❑ Experimentation with different CP methods





Demo: Conformal Classification

❑ Pretrained classifier within existing ML pipeline

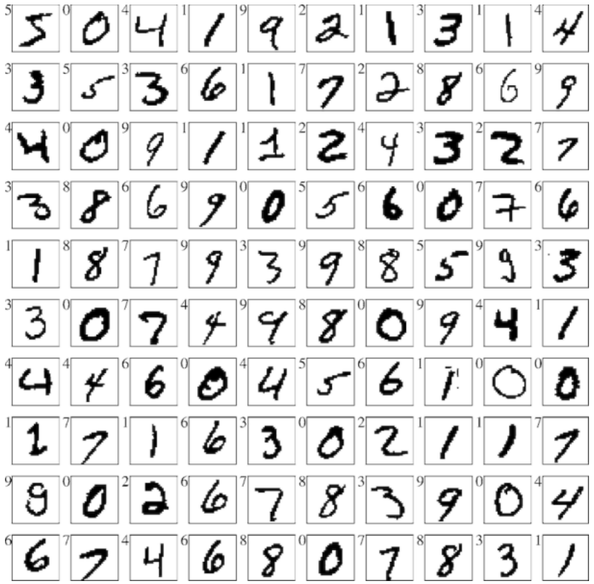


MNIST Calibration Data

Pre-trained Convnet

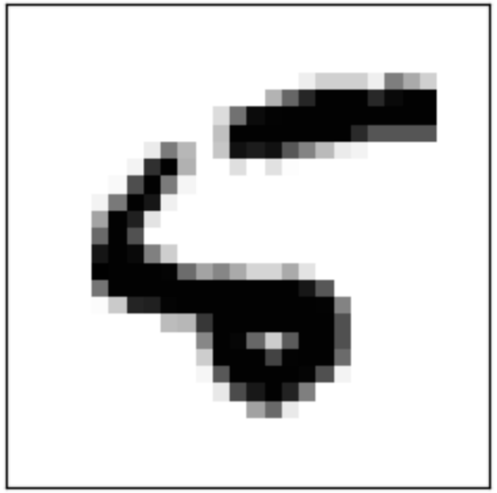
APS

Conformal Convnet



Source: D. Decoste

PUNCC: Classification



Most likely class predicted by model

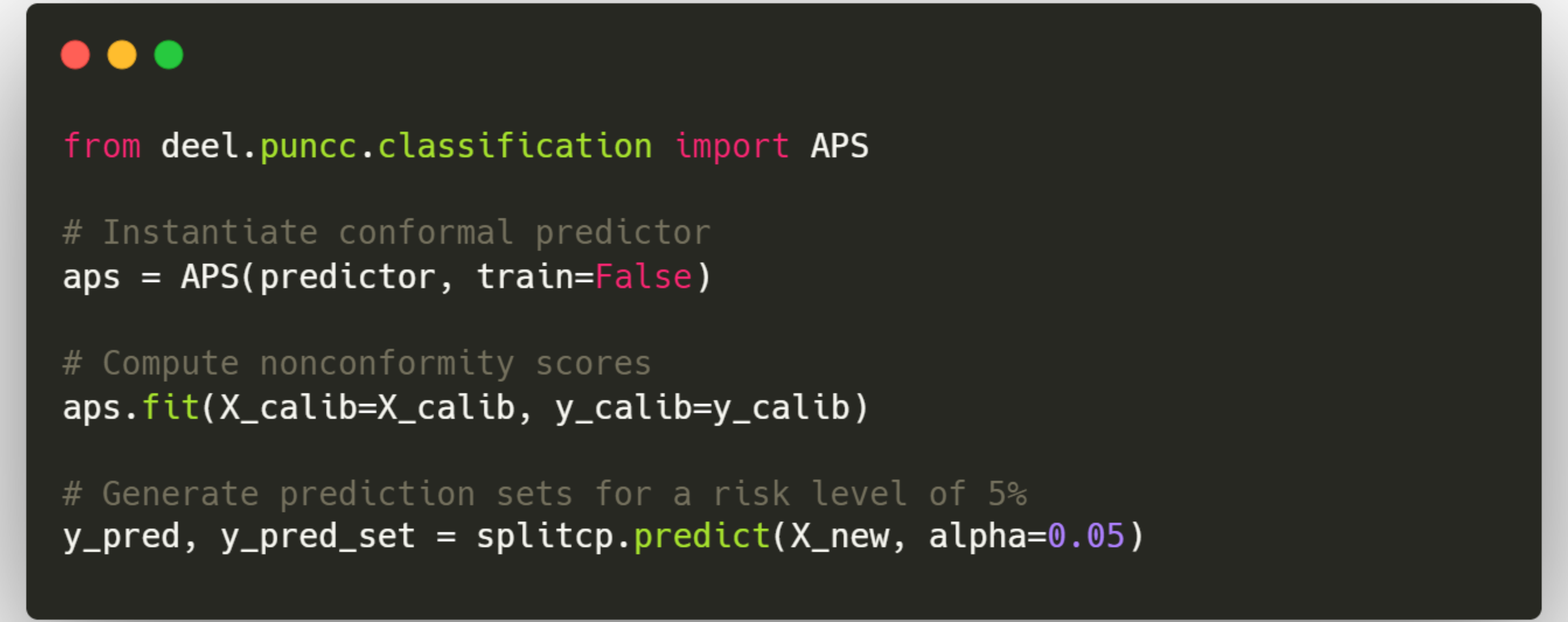
{5} 99.7%

Conformalization

Prediction set with probabilistic guarantees

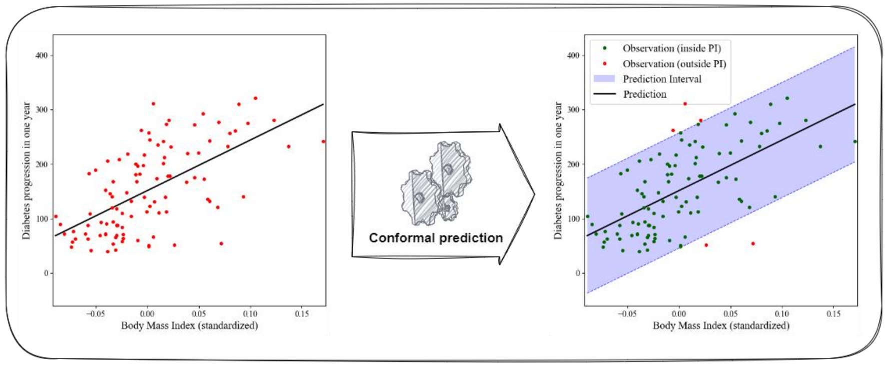
{5 , 6} 99.7% 0.03%

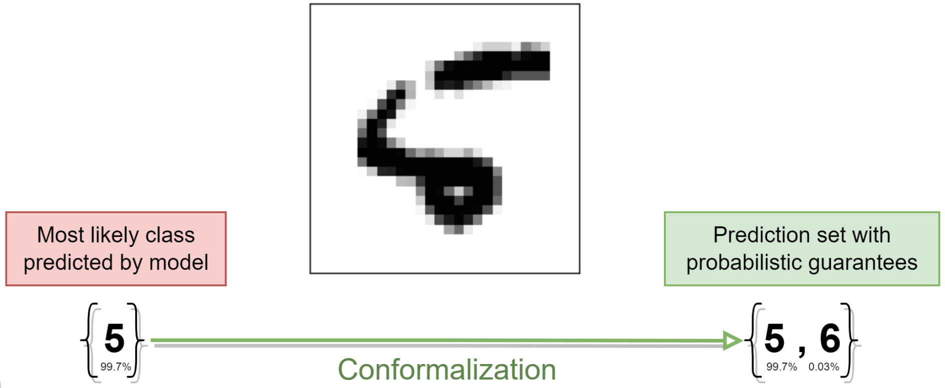
Conformal Classification in few lines of code



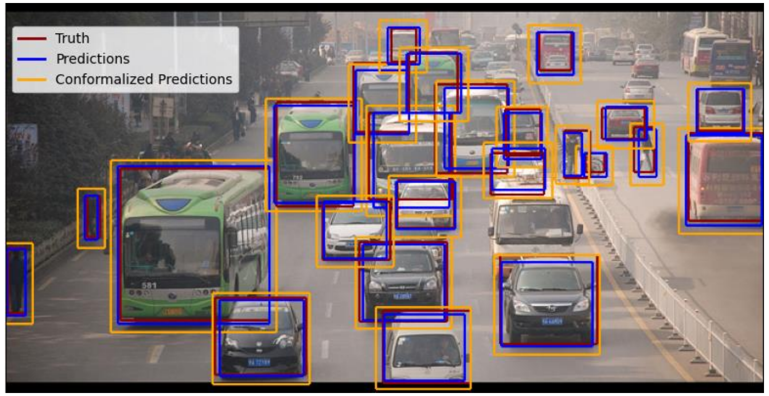
```python
from deel.puncc.classification import APS

# Instantiate conformal predictor
aps = APS(predictor, train=False)

# Compute nonconformity scores
aps.fit(X_calib=X_calib, y_calib=y_calib)

# Generate prediction sets for a risk level of 5%
y_pred, y_pred_set = splitcp.predict(X_new, alpha=0.05)
```

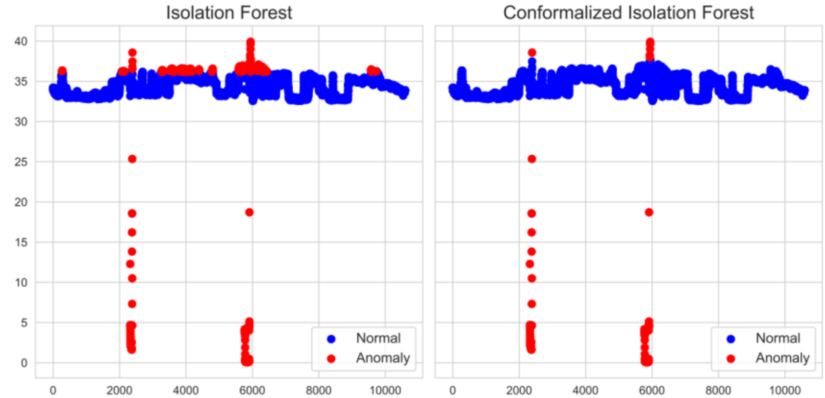
PUNCC for different ML Tasks




Most likely class predicted by model

Prediction set with probabilistic guarantees





PUNCC Project

❑Documentation

❑Tutorials

❑Tests

❑Updates

❑Open to contributions: issues, PR, …

https://github.com/deel-ai/puncc

DEEL
France-Quebec

Thanks for your attention !