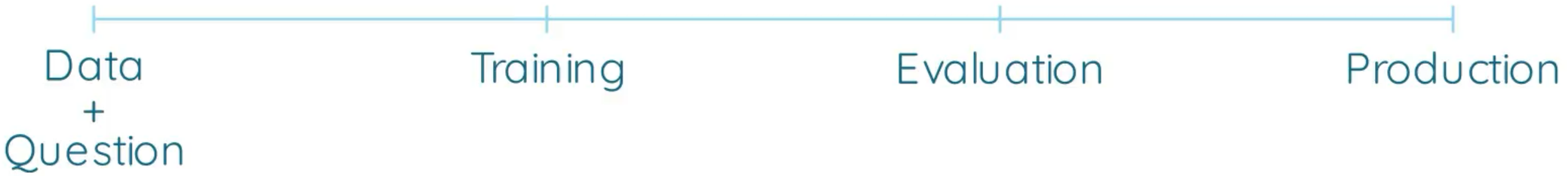
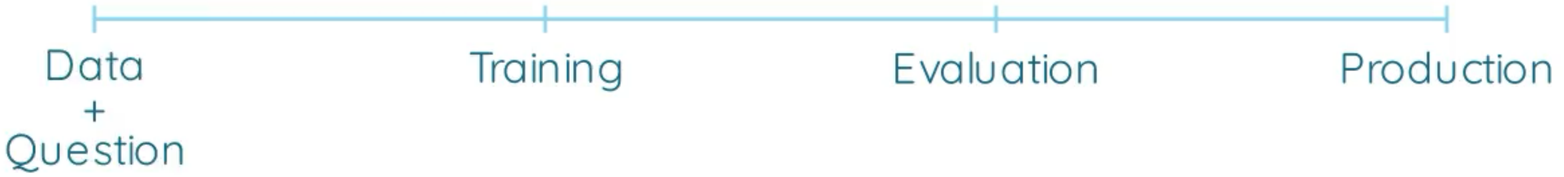
AMPHOS 21
an RSK company

Introduction to ML workflow

03-12-2024


Data
+
Question
Training
Evaluation
Production

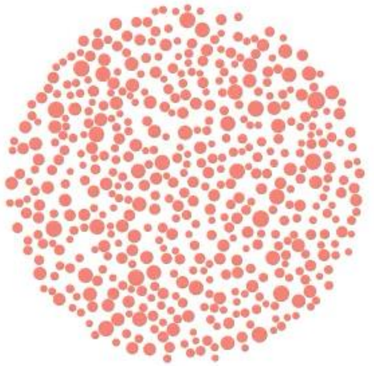

Data
+
Question
Training
Evaluation
Production

Data
+
Question

A21

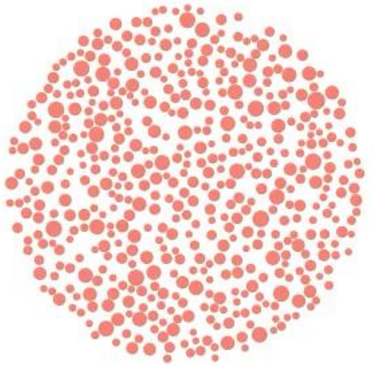
Training — Evaluation — Production

Data
+
Question



Training | Evaluation | Production

Data
+
Question



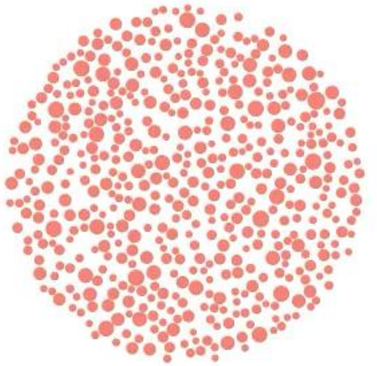
?

Data
+
Question

Evaluation

Production

Training



?

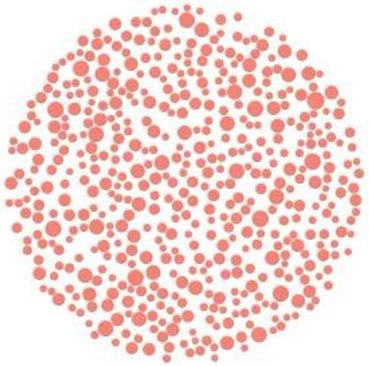
A21

Data
+
Question

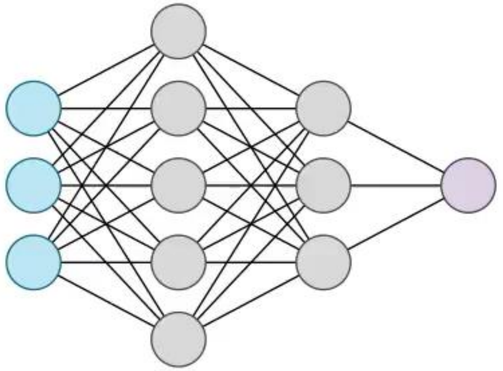
Evaluation

Production

Training

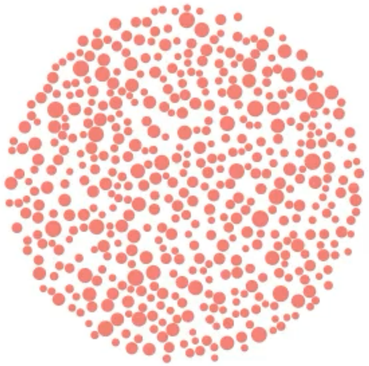


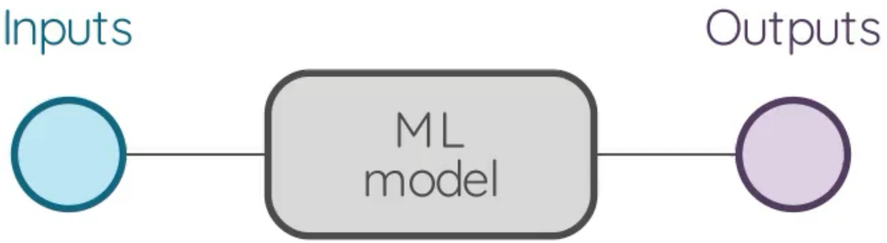
?




Data
+
Question
Evaluation
Production

Training

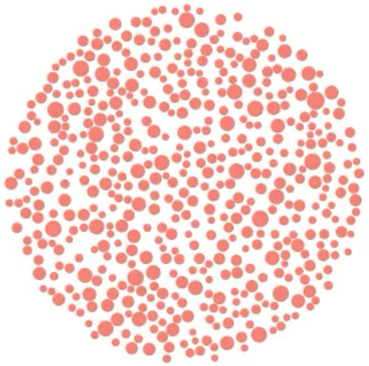


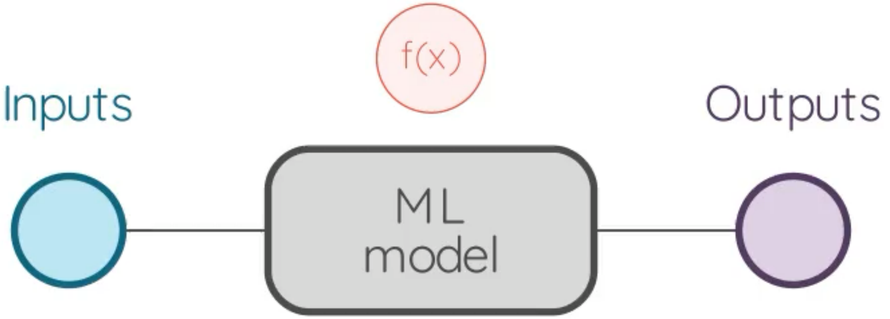

Inputs
Outputs
ML
model

?

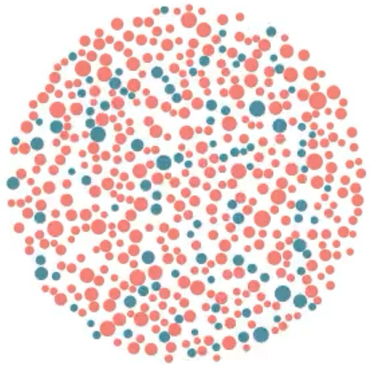

Data
+
Question
Evaluation
Production

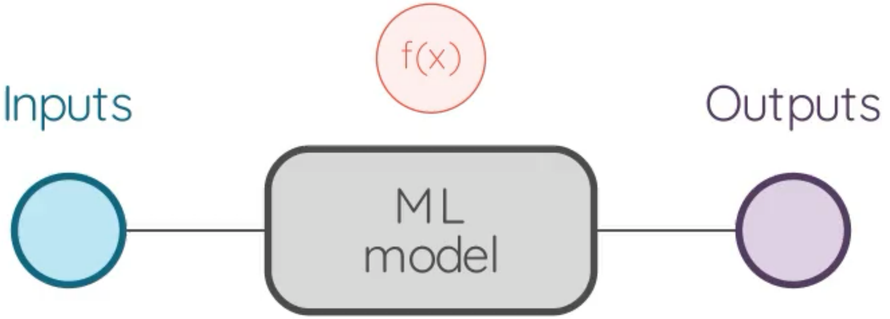
Training



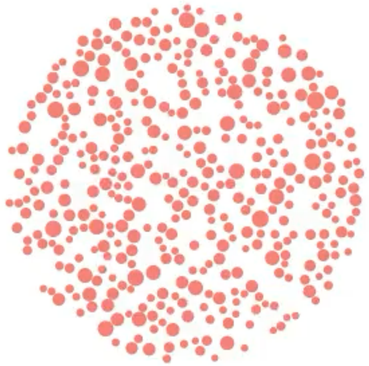

f(x)
Inputs
Outputs
ML
model

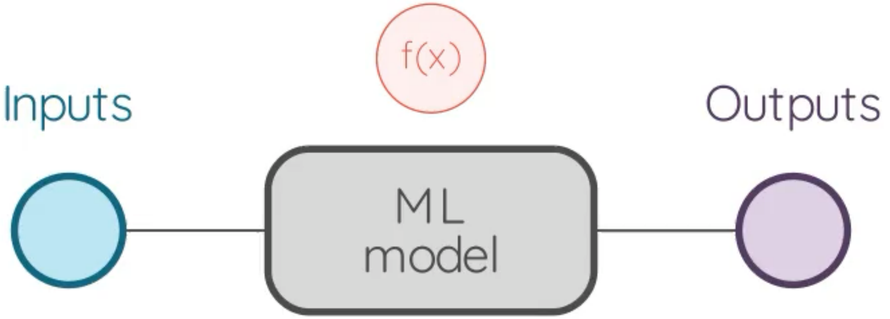
Training

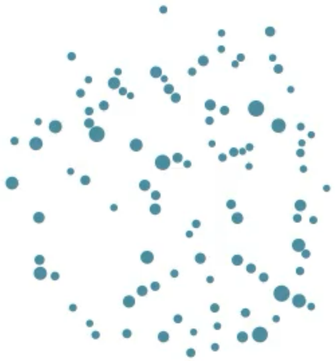


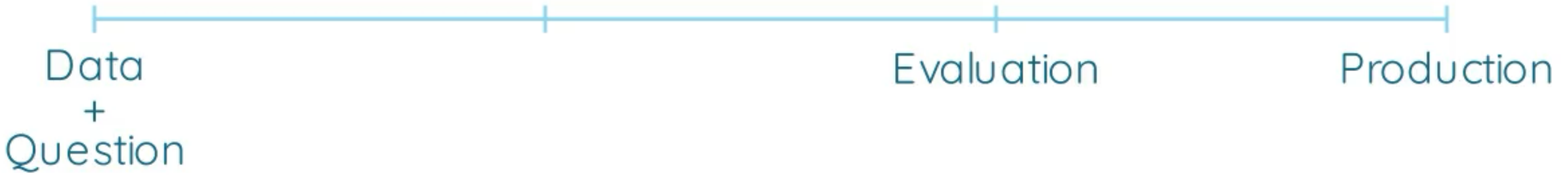


Training

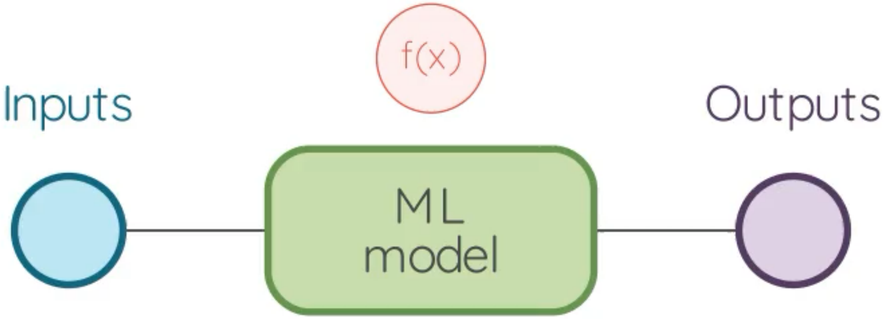


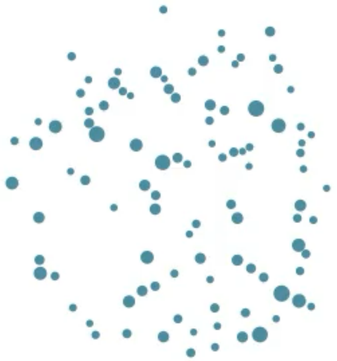


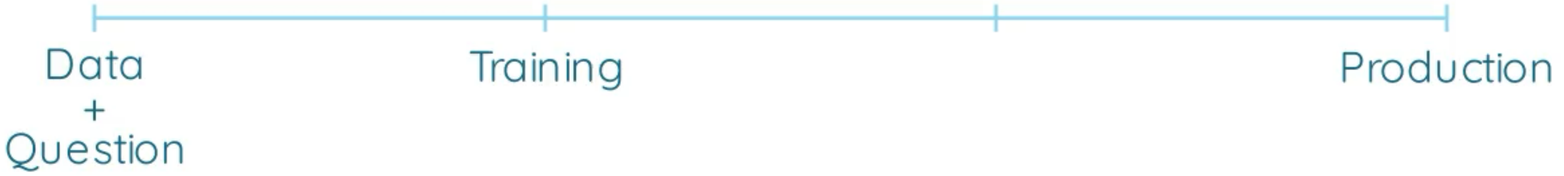



Data
+
Question
Evaluation
Production

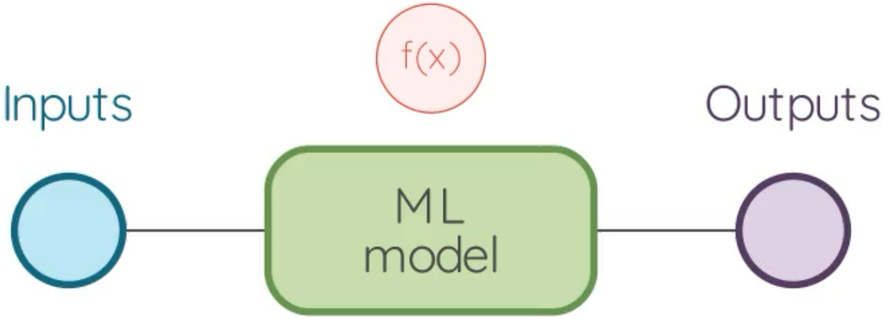
Training

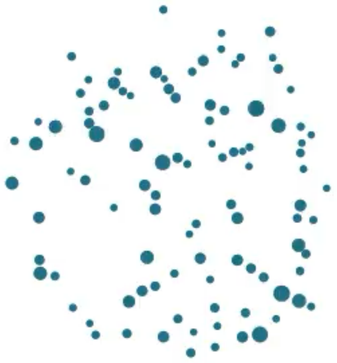

f(x)
Inputs
Outputs
ML
model

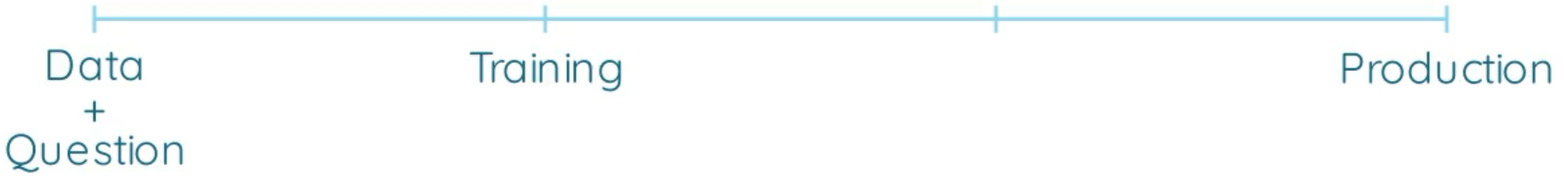



Data
+
Question
Training
Production

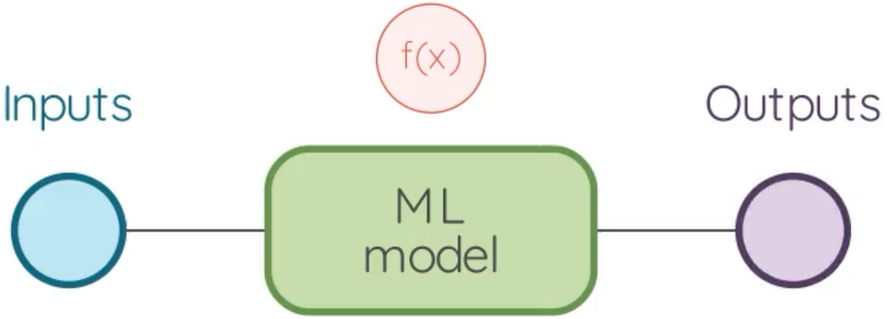
Evaluation

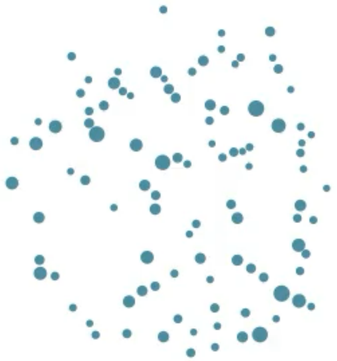

f(x)
Inputs
Outputs
ML
model

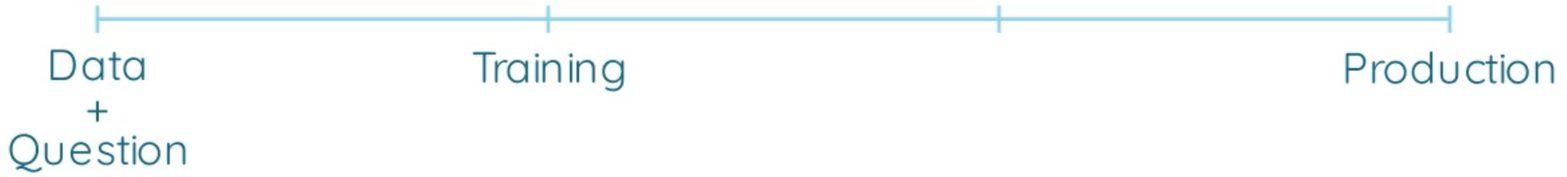



Data
+
Question
Training
Production

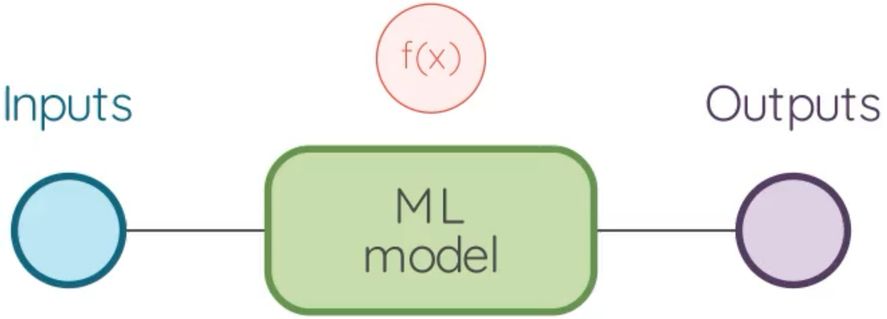
Evaluation

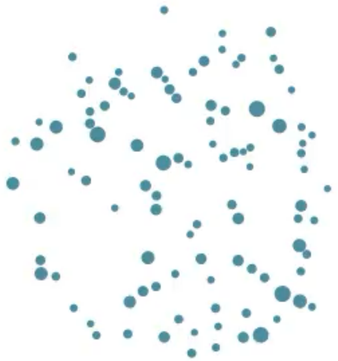

f(x)
Inputs
Outputs
ML
model

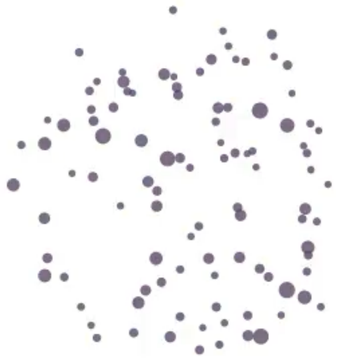


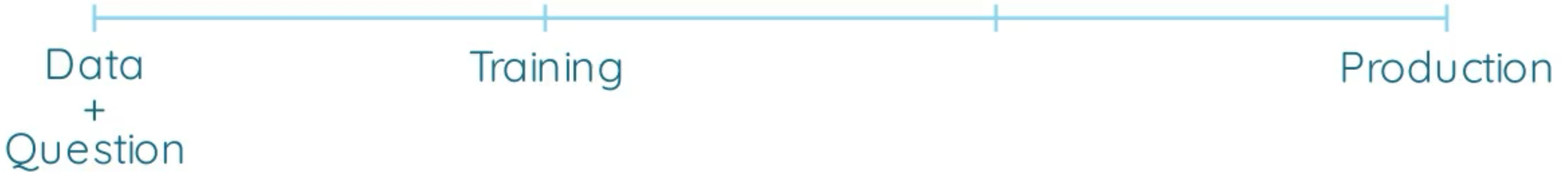

Data
+
Question
Training
Production

Evaluation

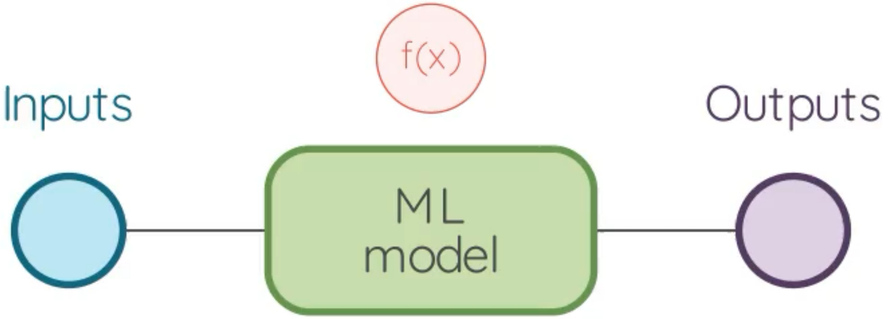

f(x)
Inputs
Outputs
ML
model

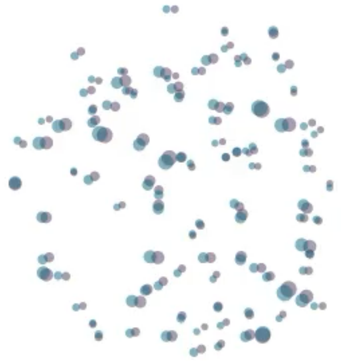


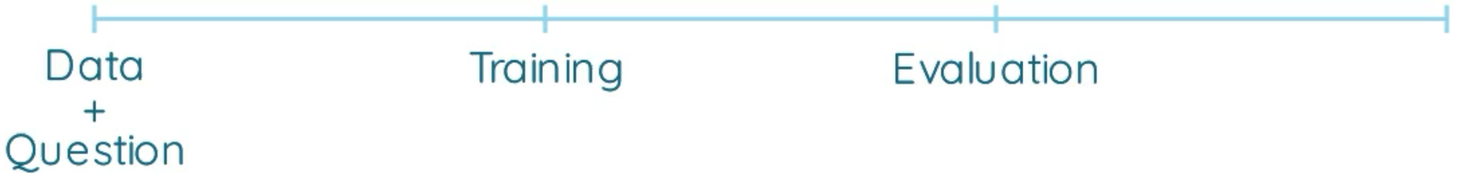



Data
+
Question
Training
Production

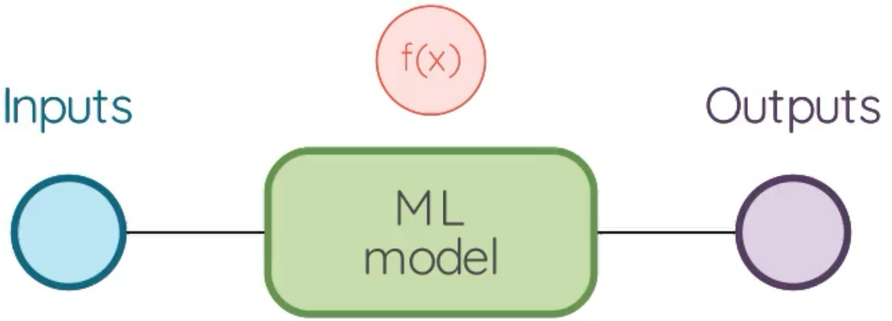
Evaluation

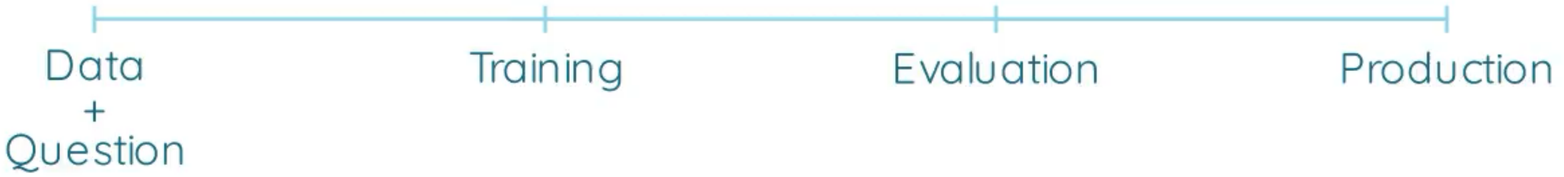

f(x)
Inputs
Outputs
ML
model

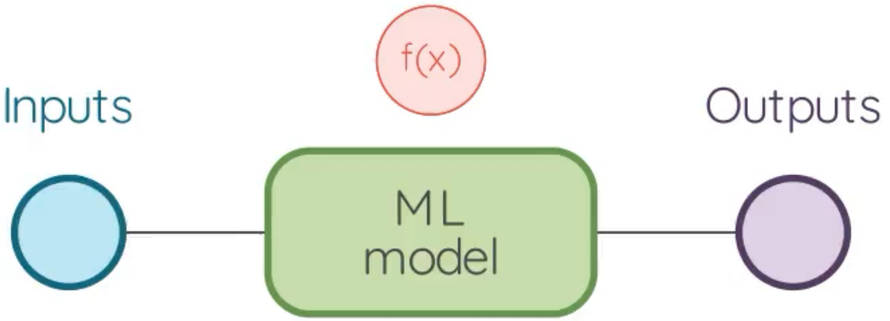



Data
+
Question
Training
Evaluation

Production


f(x)
Inputs
Outputs
ML
model


Data
+
Question
Training
Evaluation
Production


f(x)
Inputs
Outputs
ML
model

A21

interface for Machine Learning

A21

TensorFlow (TF) and SciPy

interface for Machine Learning

iML

A21

TensorFlow (TF) and SciPy

interface for Machine Learning

iML

Tree based algorithms and Artificial Neural Networks (ANN)

- Basic ML algorithms
- Allows for basic prediction output architectures (single values)

A21

TensorFlow (TF) and SciPy

inter face for **M**achine **L**ear ning

iML

Recurrent Neural Networks (RNN)

- They have "memory"
- Suitable for time-series
- They capture temporal (recurrent) patterns
- **Prophet** and **NeuralProphet** engines have been added

Tree based algorithms and Artificial Neural Networks (ANN)

- Basic ML algorithms
- Allows for basic prediction output architectures (single values)

A21

TensorFlow (TF) and SciPy

interface for **M**achine **L**earning

iML

Recurrent Neural Networks (RNN)

- They have "memory"
- Suitable for time-series
- They capture temporal (recurrent) patterns
- **Prophet** and **NeuralProphet** engines have been added

Tree based algorithms and Artificial Neural Networks (ANN)

- Basic ML algorithms
- Allows for basic prediction output architectures (single values)

Convolutional Neural Networks (CNN)

- They capture spatial patterns
- Images, maps, heterogeneous fields, etc

A21

iML

interface for Machine Learning

TensorFlow (TF) and SciPy

Recurrent Neural Networks (RNN)

- They have "memory"
- Suitable for time-series
- They capture temporal (recurrent) patterns
- **Prophet** and **NeuralProphet** engines have been added

Tree based algorithms and Artificial Neural Networks (ANN)

- Basic ML algorithms
- Allows for basic prediction output architectures (single values)

Webapps and optimization

- Interactive webapps fully integrated on iML
- Interactive plots, web reports, etc
- Hyperparameter and general optimization methods

Convolutional Neural Networks (CNN)

- They capture spatial patterns
- Images, maps, heterogeneous fields, etc

A21

iML

interface for Machine Learning

TensorFlow (TF) and SciPy

Recurrent Neural Networks (RNN)

- They have "memory"
- Suitable for time-series
- They capture temporal (recurrent) patterns
- **Prophet** and **NeuralProphet** engines have been added

Tree based algorithms and Artificial Neural Networks (ANN)

- Basic ML algorithms
- Allows for basic prediction output architectures (single values)

Webapps and optimization

- Interactive webapps fully integrated on iML
- Interactive plots, web reports, etc
- Hyperparameter and general optimization methods

Convolutional Neural Networks (CNN)

- They capture spatial patterns
- Images, maps, heterogeneous fields, etc

Submodules (RT module)

- iML can accomodate plugins that add extra features
- The RT module integrates PhreeqC to automatically generate RT datasets
- Extra modules and capabilities can be added

A21

interface for Machine Learning

A21

interface for Machine Learning

A21

Interface for Machine Learning

iML

Aqualearning - ACA

Aqualearning - ACA

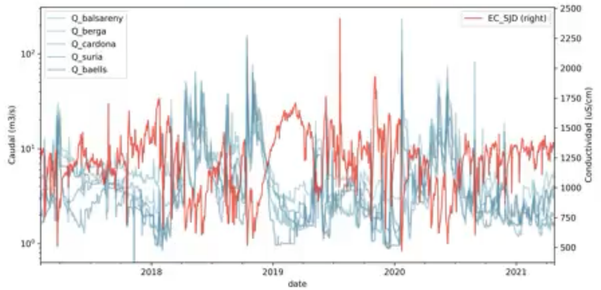
A21

interface for Machine Learning

iML

Aqualearning - ACA

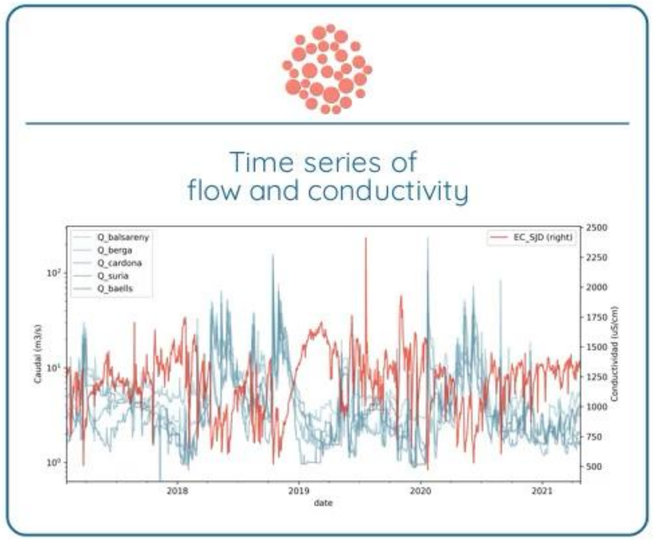
Time series of flow and conductivity

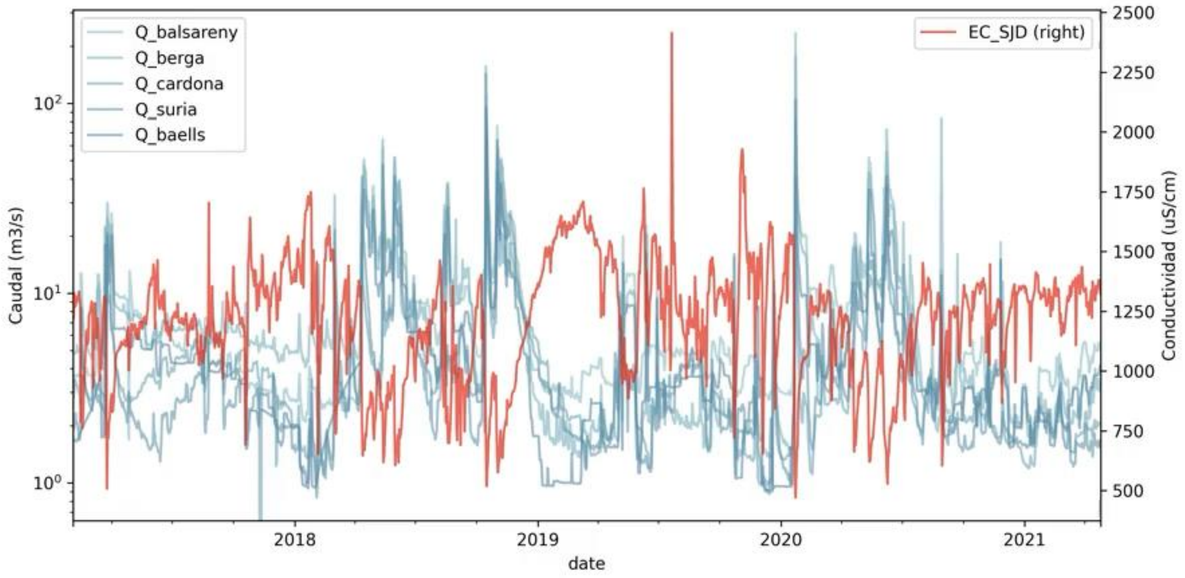


Interface for Machine Learning

iML

Aqualearning - ACA



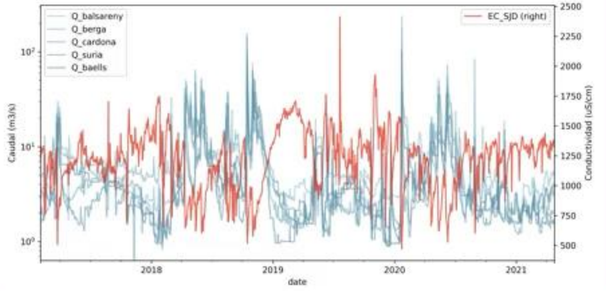


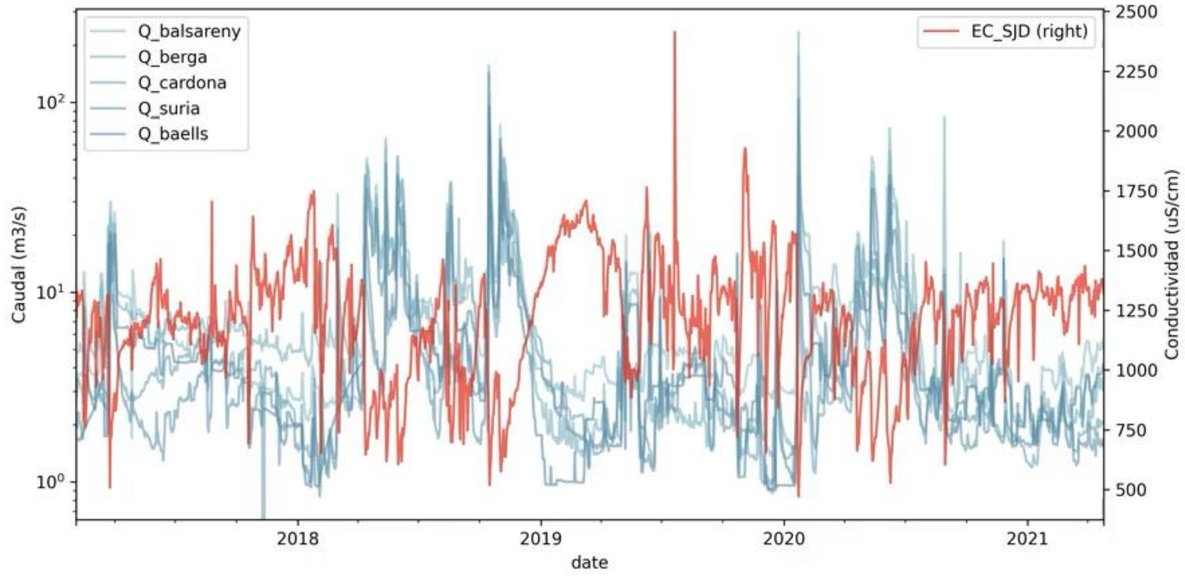
Interface for Machine Learning

iML

Aqualearning - ACA

Time series of flow and conductivity



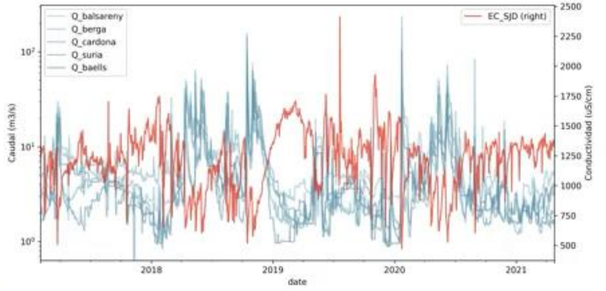


Interface for Machine Learning

iML

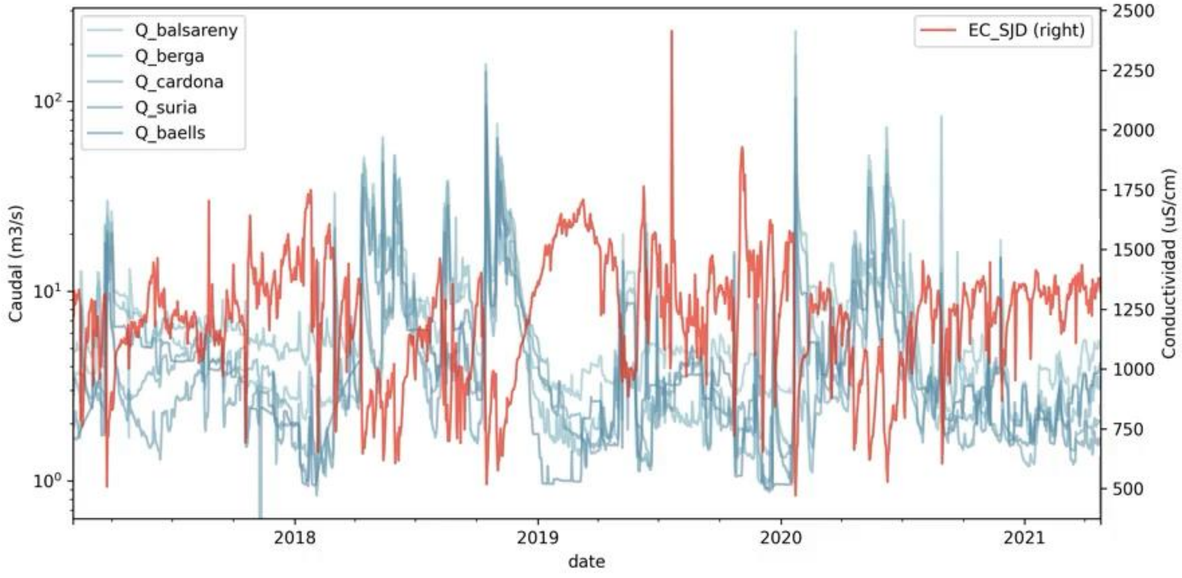
Aqualearning - ACA

Time series of
flow and conductivity



?

Can we predict the
conductivity in Sant Joan d'Espí
using the flows upstream?

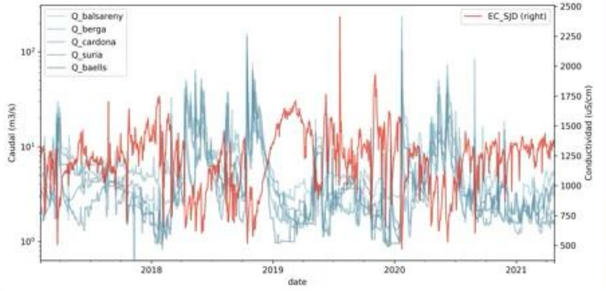


Interface for Machine Learning

iML

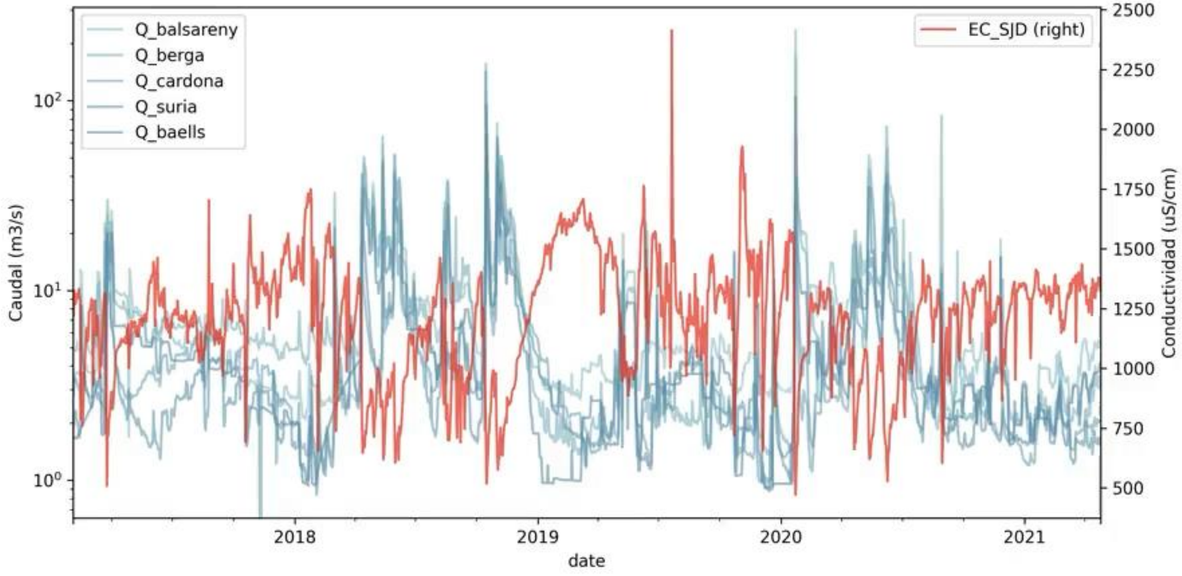
Aqualearning - ACA

Time series of
flow and conductivity



?

Can we predict the
conductivity in Sant Joan d'Espí
using the flows upstream?



Time-series

RNN

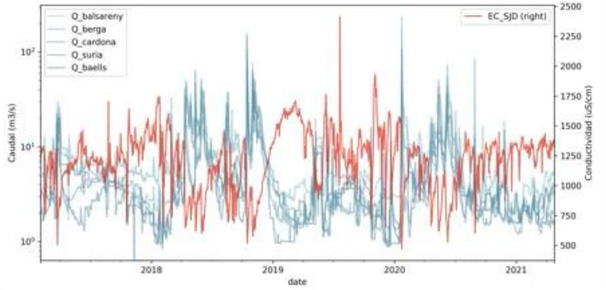
Puntual value

Interface for Machine Learning

iML

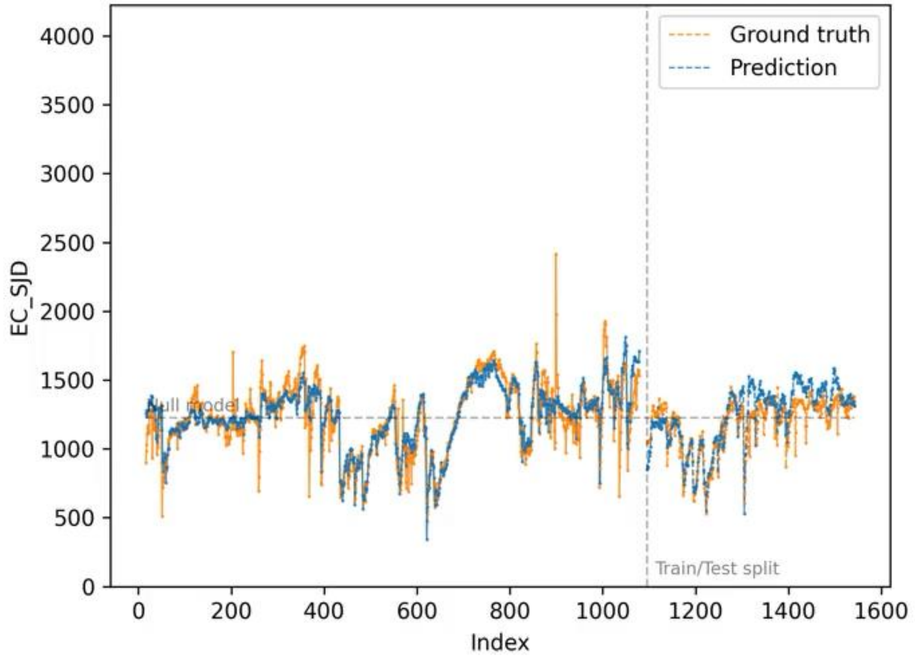
Aqualearning - ACA

Time series of
flow and conductivity



?

Can we predict the
conductivity in Sant Joan d'Espí
using the flows upstream?



Time-series

RNN

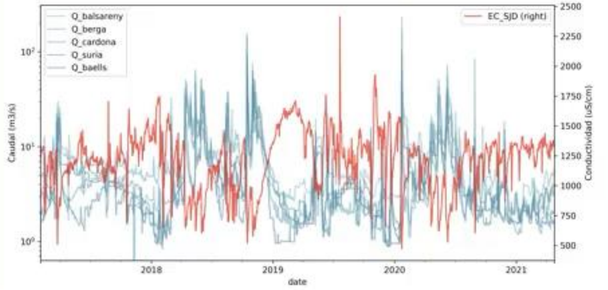
Puntual value

Interface for Machine Learning

iML

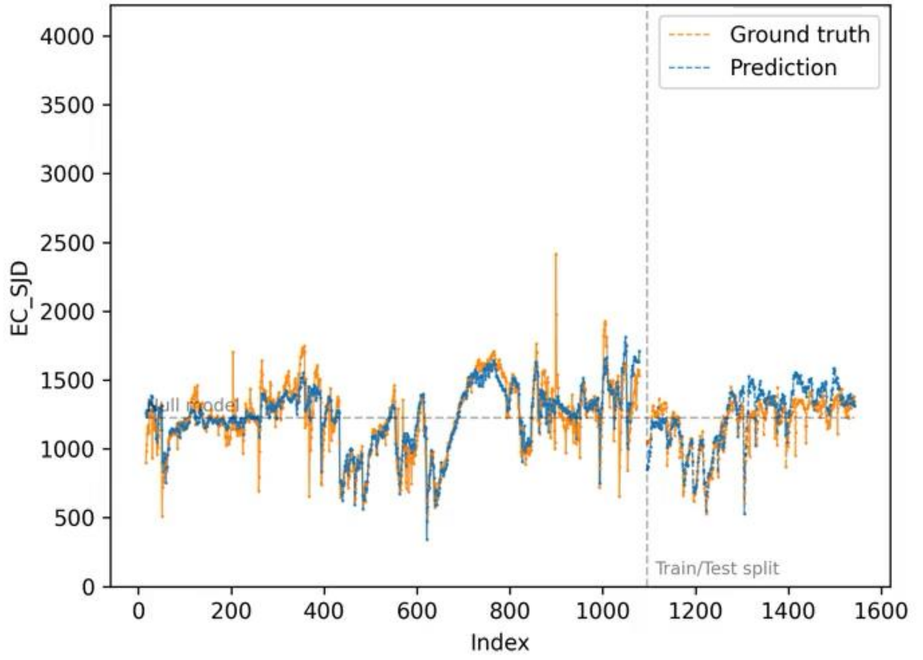
Aqualearning - ACA

Time series of
flow and conductivity



Can we predict the
conductivity in Sant Joan d'Espí
using the flows upstream?

$R^2_{train} = 0.75$ | $R^2_{test} = 0.62$ | $MAE_{train} = 85.76\mu S/cm$ | $MAE_{test} = 94.34\mu S/cm$



A21

Aqualearning - ACA

interface for Machine Learning

iML

A21

Aqualearning - ACA

interface for Machine Learning

iML

Aqualearning - Floods

A21

Aqualearning - ACA

interface for Machine Learning

iML

Aqualearning - Floods

Aqualearning - ACA

iML

Aqualearning - Floods

?

Flood extension simulations take too long (6-8 hours) to have a viable early warning system.
Can we speed up this process using artificial intelligence?

A21

Aqualearning - ACA

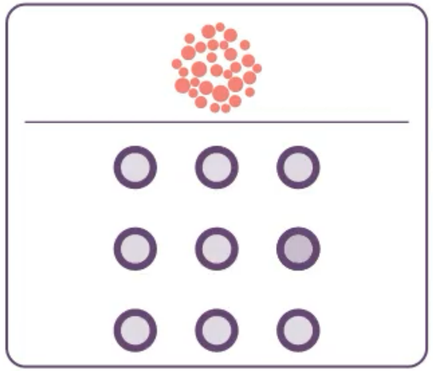
interface for Machine Learning

iML

Aqualearning - Floods

?

Flood extension simulations take too long (6-8 hours) to have a viable early warning system.
Can we speed up this process using artificial intelligence?



Interface for Machine Learning

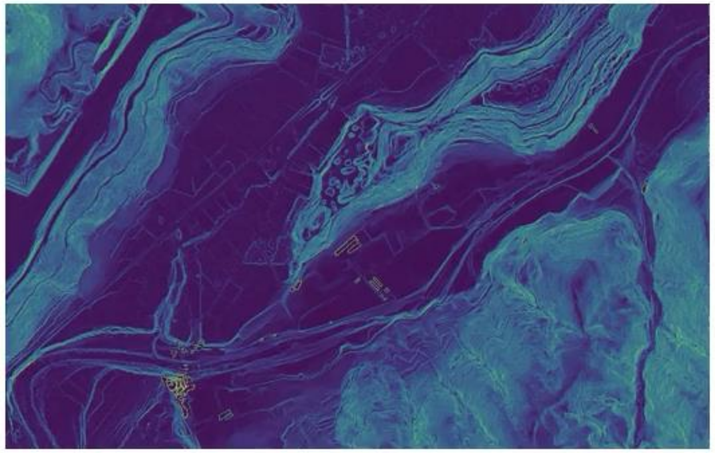
Aqualearning - ACA

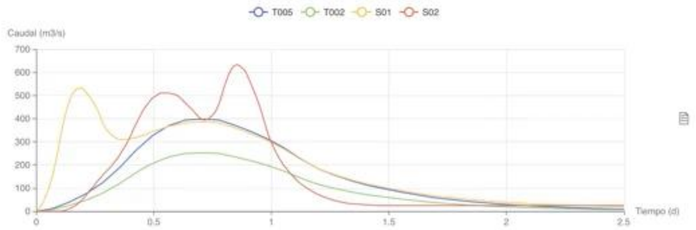
iML

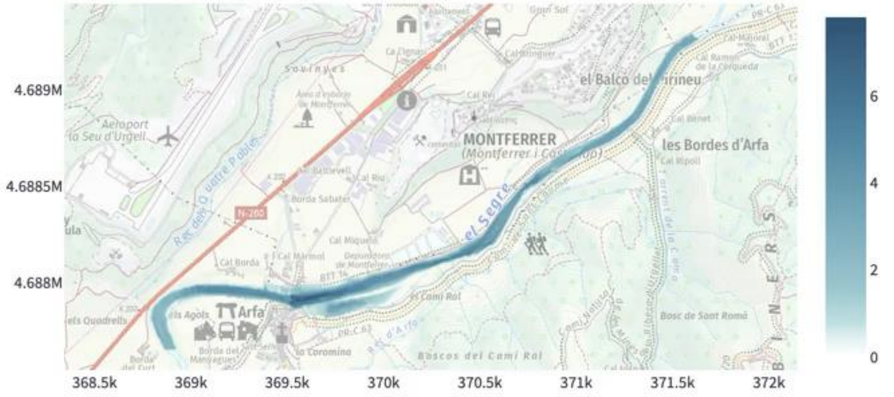
Aqualearning - Floods

?

Flood extension simulations take too long (6-8 hours) to have a viable early warning system.
Can we speed up this process using artificial intelligence?







A21

Aqualearning - ACA

interface for Machine Learning

iML

Aqualearning - Floods

A21

Aqualearning - ACA

interface for Machine Learning

iML

Aqualearning - Floods