

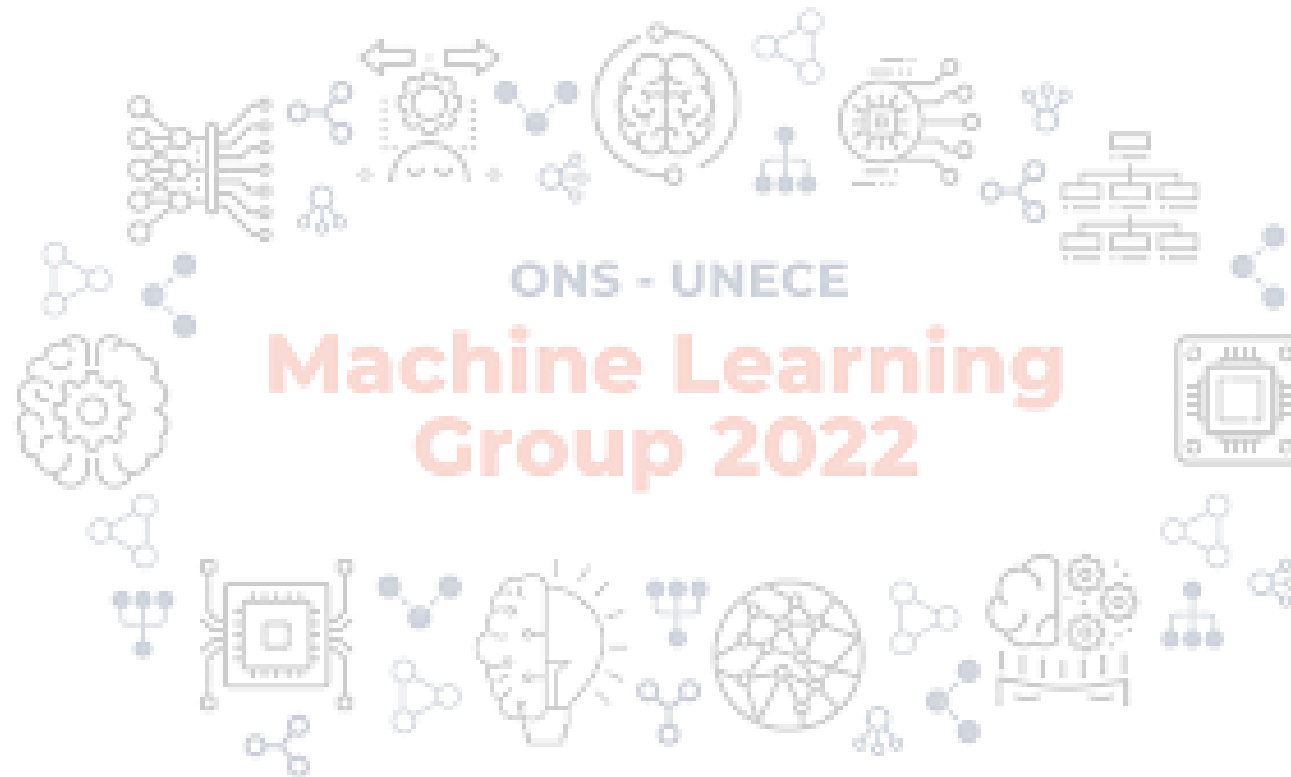
Model Retraining Theme Group

ANDREA DEL MONACO

Bank of Italy

on behalf the Theme Group members

30 November 2022 (virtual)



Model Retraining Theme Group

The views and ideas expressed during the presentation are those of the speaker and do not necessarily reflect the views and the ideas of the Bank of Italy

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In recent years, we have witnessed

- growing demands for trusted information
- rapidly developing and accessible technologies
- numerous competitors



statistical organisations have been actively exploring the potential of the ML in their production processes

automation of manual tasks

substitution of classical statistical methods

production of new statistics

ML in production

The degradation of the ML model affects the quality of the statistical production that is based on the model predictions



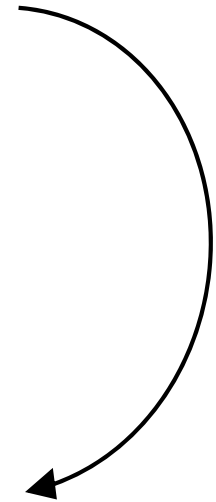
Stakeholders may lose their trust in ML if such models are not properly maintained



Models should be continuously monitored and retrained to maintain their performance

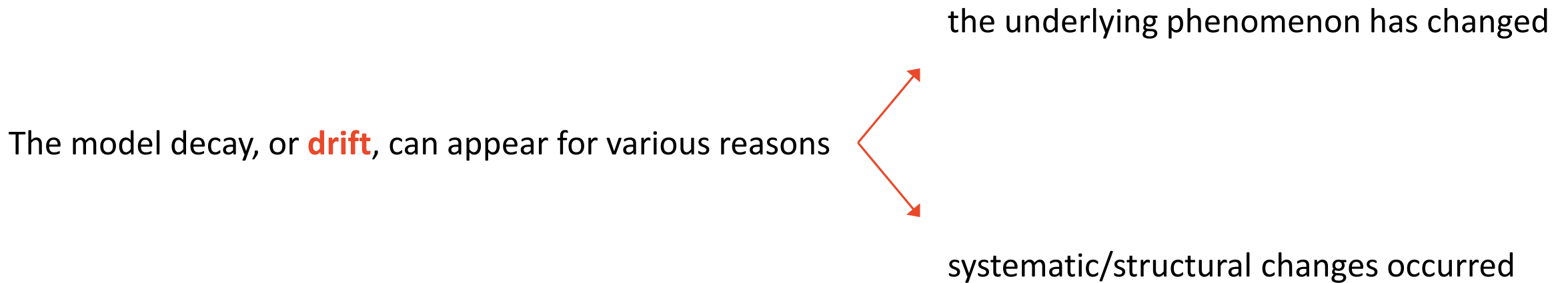
The lack of experience with ML models in production may result in low awareness and understanding of the importance of model maintenance

A proper ML governance is necessary for the model to be accepted by end-users and supported by the IT



why retraining?

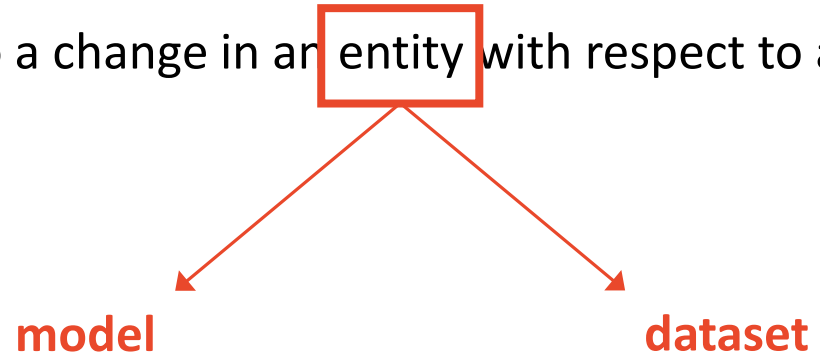
ML models are built over a training dataset under the assumption that patterns therein are valid in making predictions as new data come in.



The model may potentially be exposed to patterns it was not trained on.

what is a "drift"?

Drift refers to a change in an **entity** with respect to a baseline.

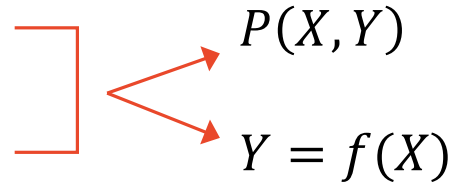


what is a "drift"?

Let

→ X a set of features

→ Y a target variable



→ $S = \{(\mathbf{x}_1, y_1), \dots, (\mathbf{x}_n, y_n)\}$ the dataset

Then

$$\hat{Y} = \hat{f}_S(X)$$

For example, if in a classification problem we have classes c_1, \dots, c_k , then \hat{f}_S is such that

$$\hat{y}_j = \hat{f}_S(\mathbf{x}_j) := \operatorname{argmax}_{h=1, \dots, k} \hat{P}_S(y = c_h | \mathbf{x}_j)$$

what is a "drift"?

However, in production we have new data coming in

$$S^* = \{(\mathbf{x}_1^*, \hat{y}_1^*), \dots, (\mathbf{x}_m^*, \hat{y}_m^*)\} := \{(\mathbf{x}_1^*, \hat{f}_S(\mathbf{x}_1^*)), \dots, (\mathbf{x}_m^*, \hat{f}_S(\mathbf{x}_m^*))\}$$



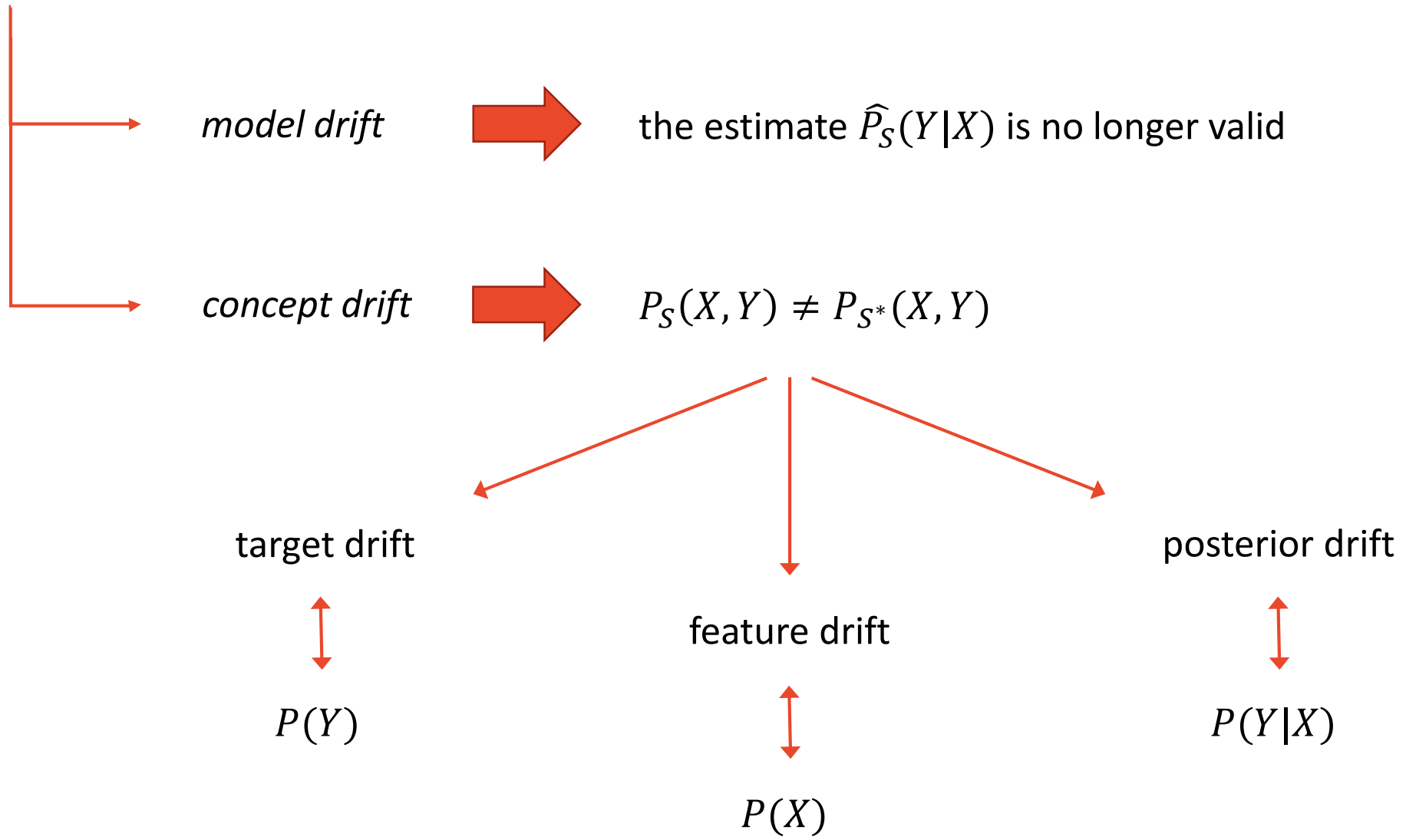
$\hat{P}_S(y = c | \mathbf{x}_j)$ does not hold anymore



degradation of the model!

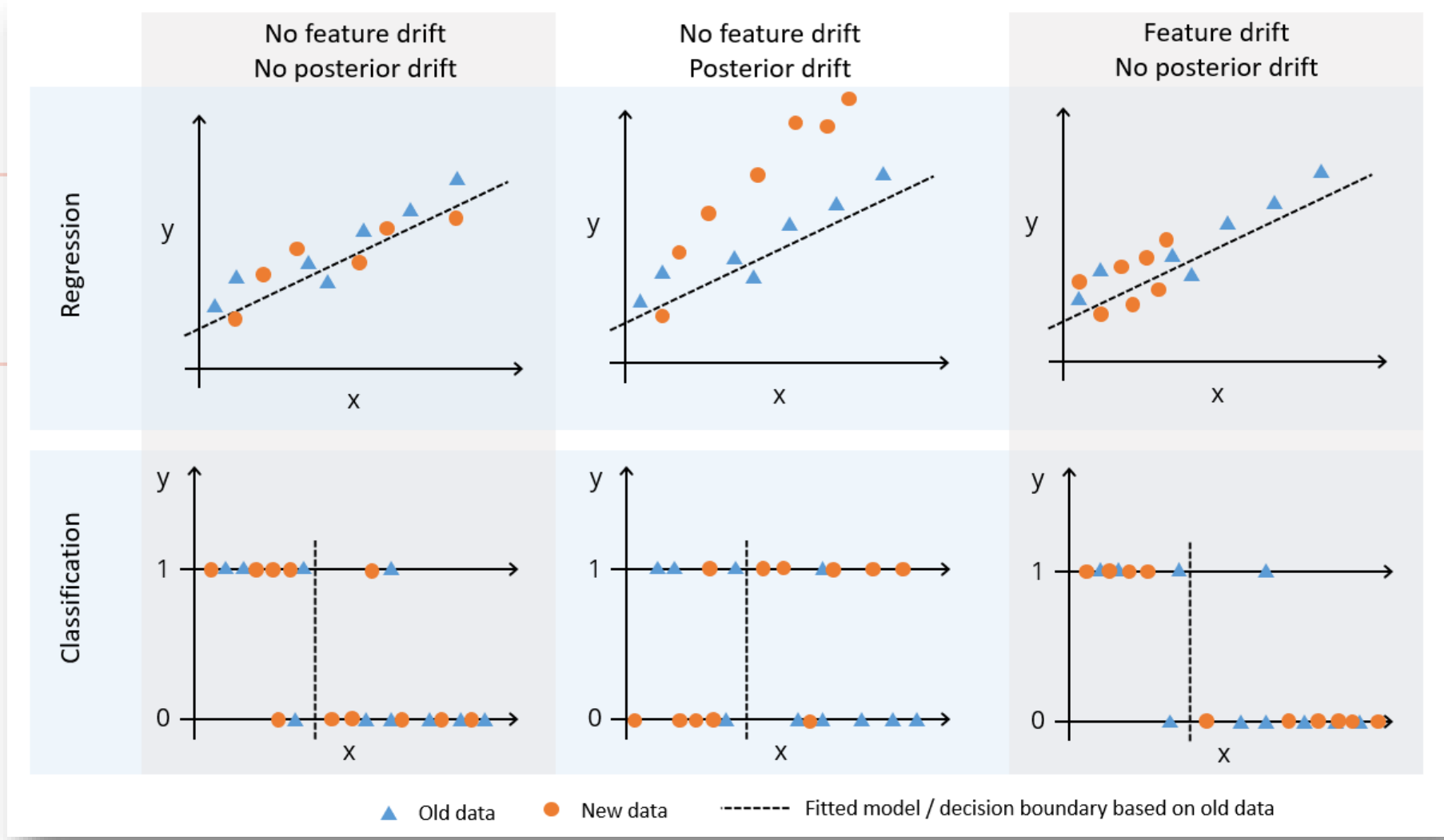
what is a "drift"?

There are two types of **drift**



what is a "drift"?

There are two types of drift



$$P(X)$$

how to detect a drift?

To detect a drift, two approaches can be considered

→ *performance-based approach*



performance metrics + collection of true values of targets

→ *data distribution-based approach*



distribution of new data **vs** distribution of training data

how to detect a drift?

To detect a drift, two approaches can be considered

→ *performance-based approach*



performance metrics + collection of true values of targets



it addresses directly the degradation of the model

→ *data distribution-based approach*



distribution of new data **vs** distribution of training data

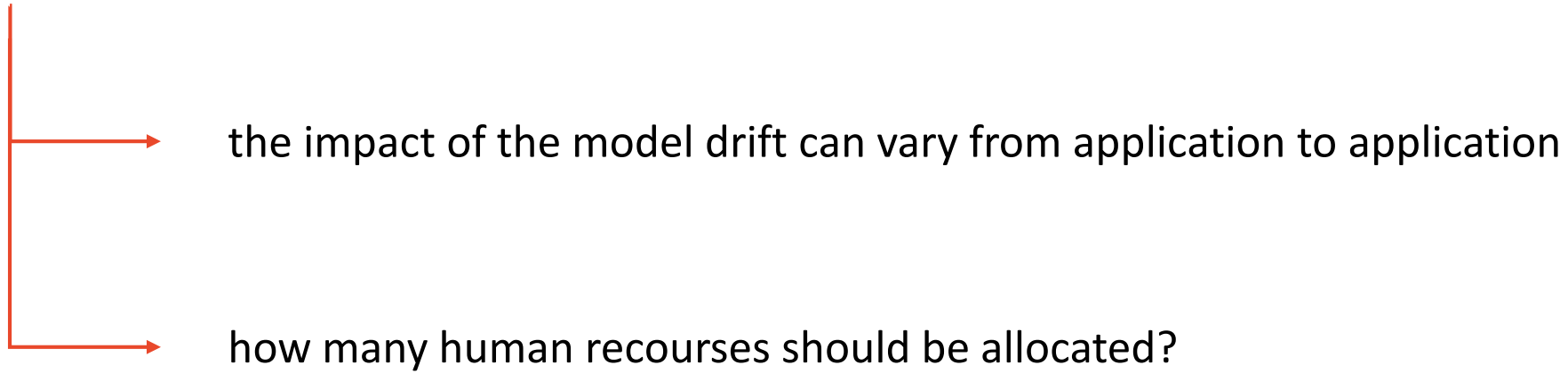


complicated to set a corporate-wide monitoring system

"to retrain, or not to retrain"?

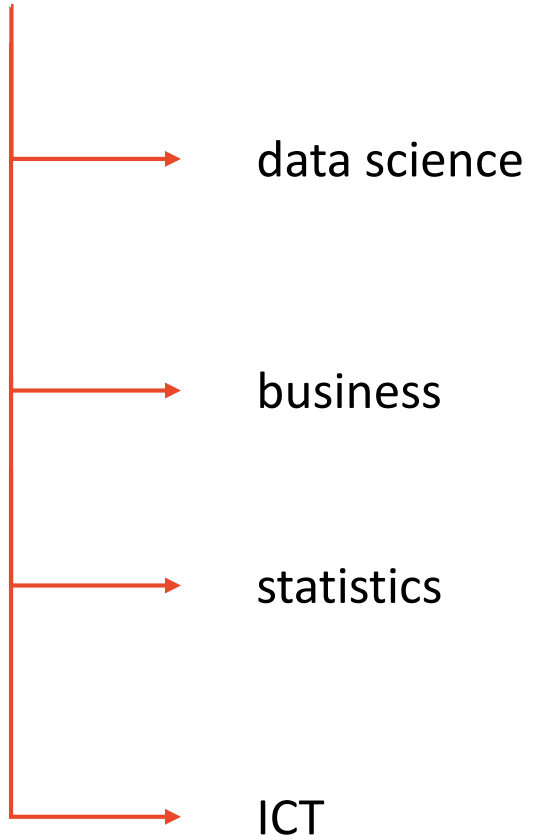
Ideally, we should always retrain our model when a drift has been detected.

In practice, a costs-benefits analysis should be carry out.



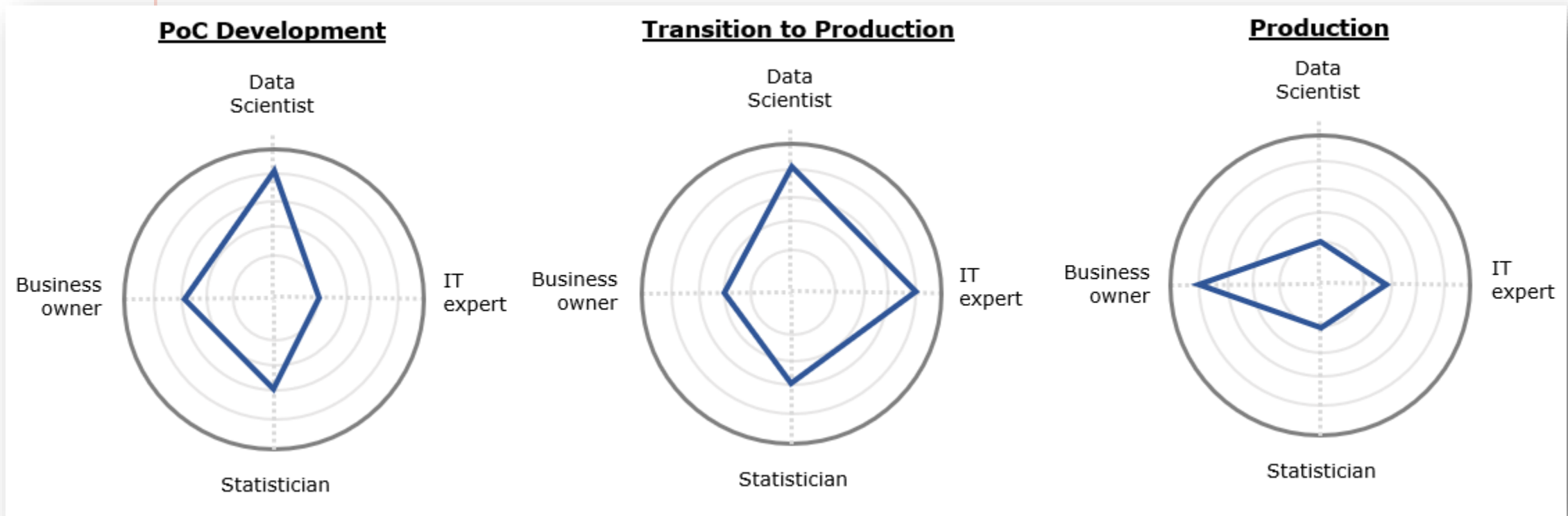
collaboration!

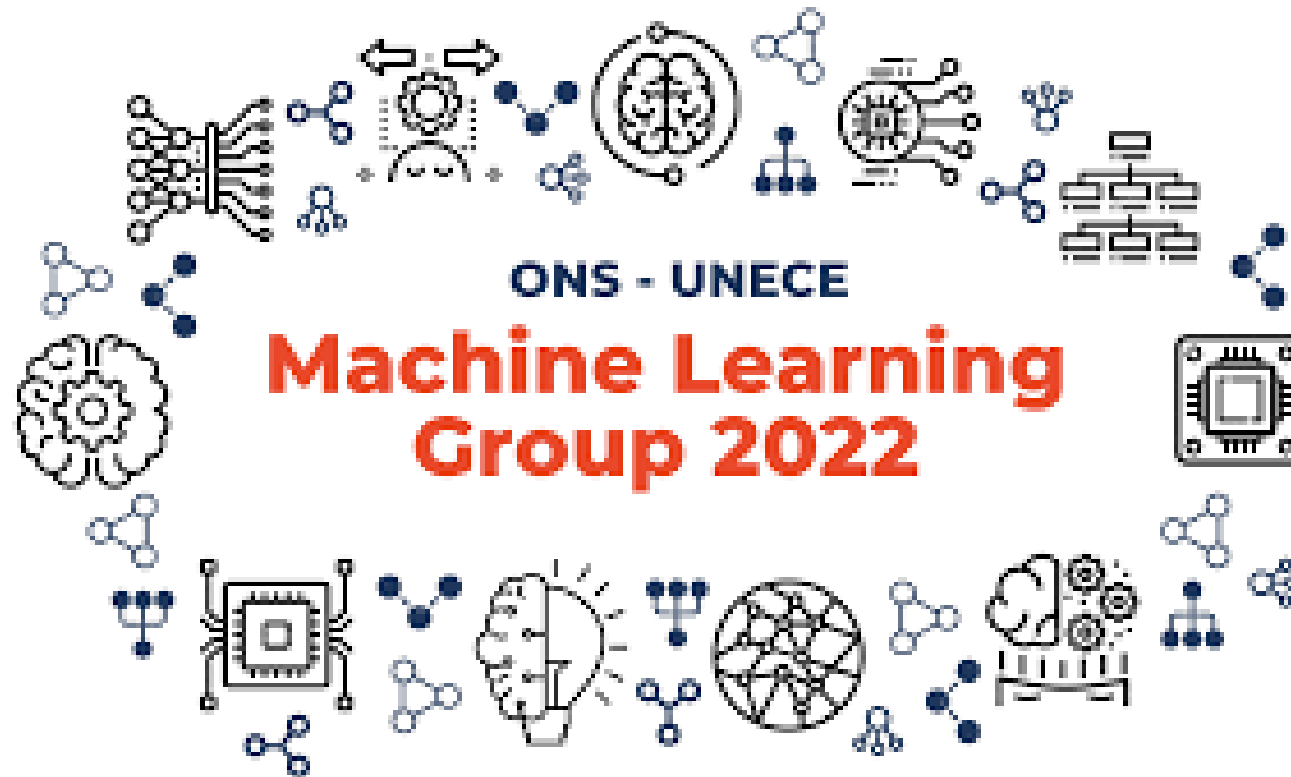
The expertise required can be grouped into four categories



collaboration!

The expertise required can be grouped into four categories





thank you!

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