AI in Finance: QUO VADIS?

@Swiss Risk Association
16th November 2021

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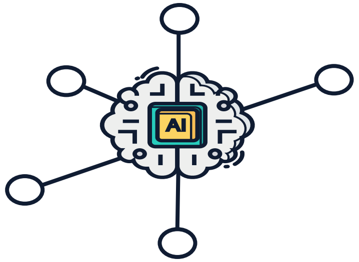
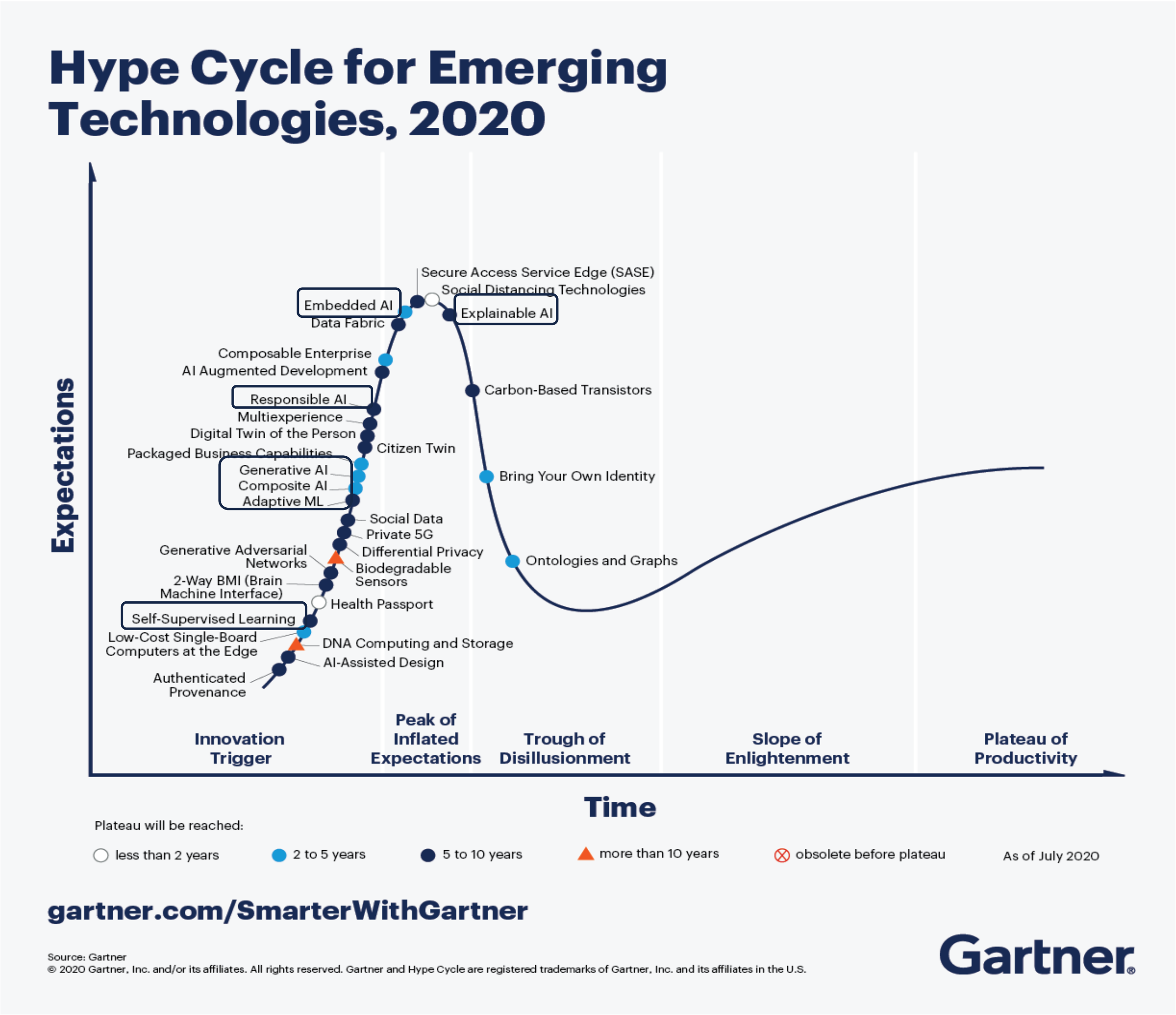
Senior Researcher @ZHAW

Hype vs Real?



AI in finance?



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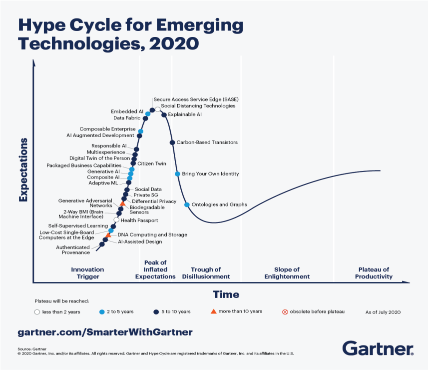

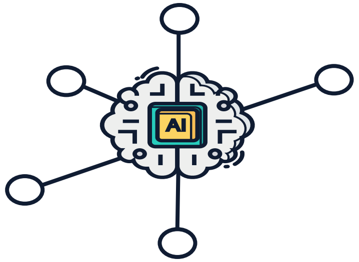

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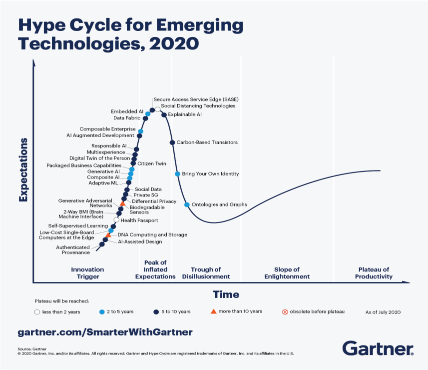

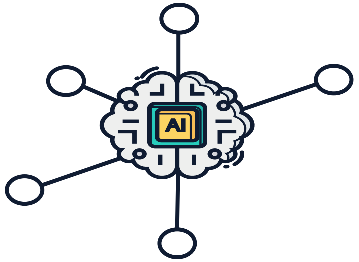

AI in finance?

VOLUMES OF DATA

QUANTITATIVE PROBLEMS

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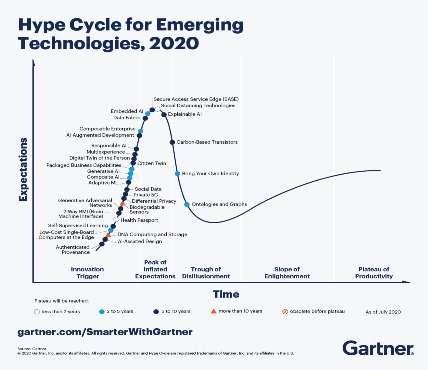

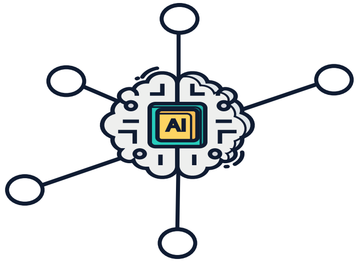

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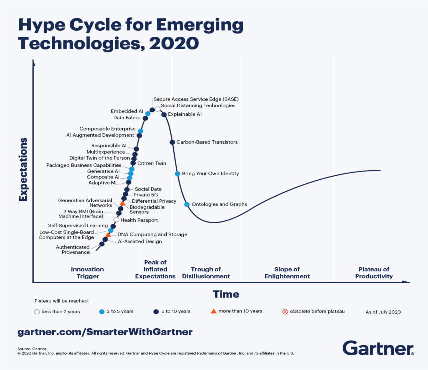
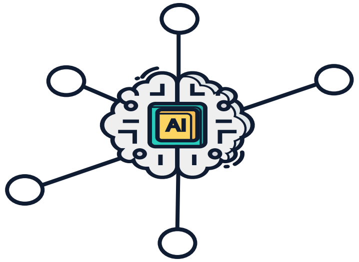
Where is the progress?

Hype vs Real?





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Where is the progress?

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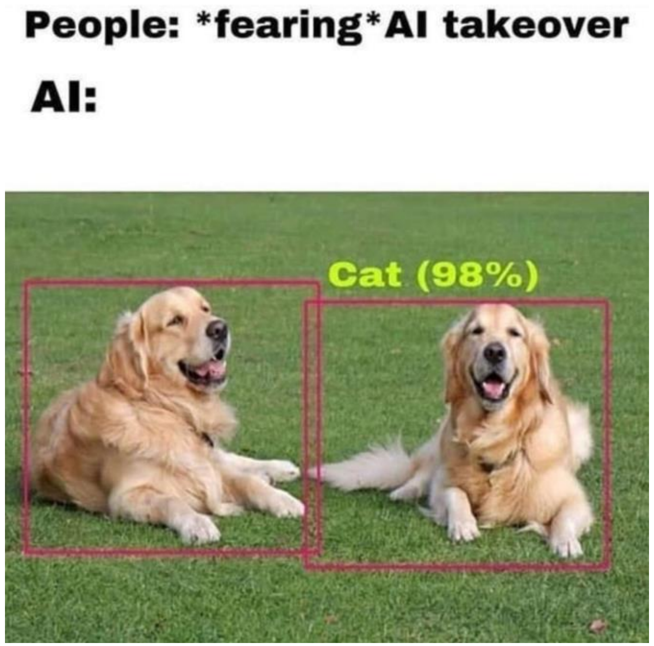
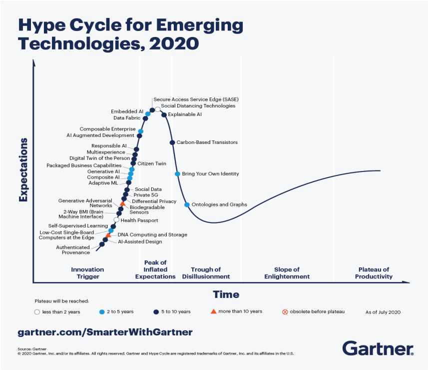
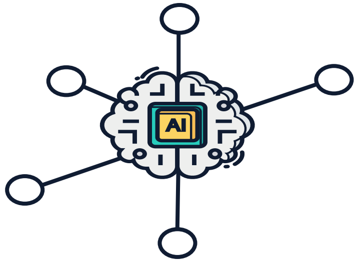


AI in practice is difficult

Hype vs Real?





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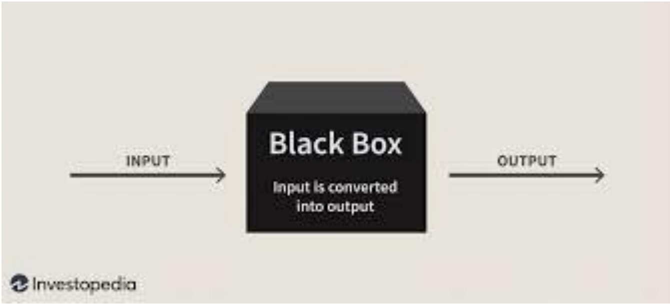

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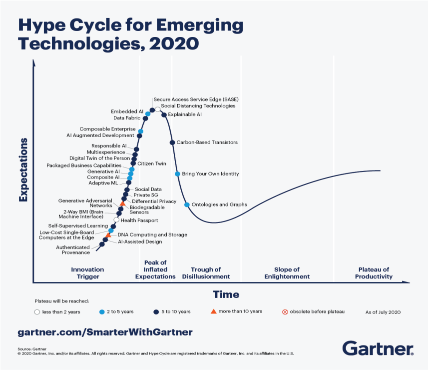

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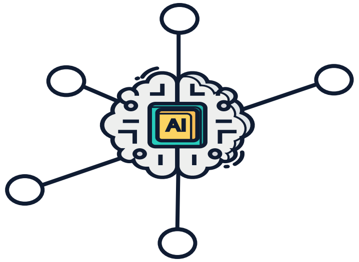

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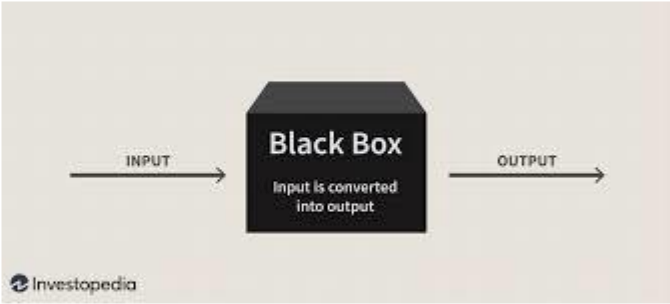

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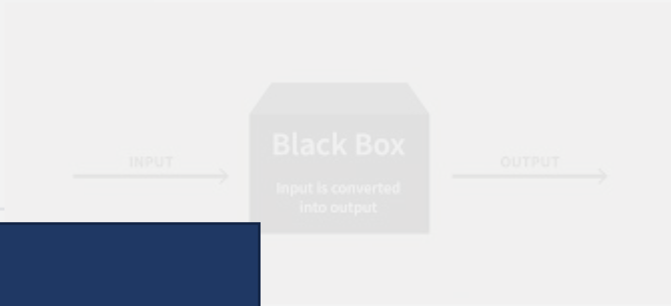


Explainability is the name of the game!

The Need for **eXplainable AI**

INPUT → **BLACK BOX** → **OUTPUT**

It is not clear how variables are being combined to make predictions!

Why do we **NEED** this?

- Trust in models is **key**!

One Mistake!

Image source: medium.com

Why do we **NEED** this?

It has found some snow!

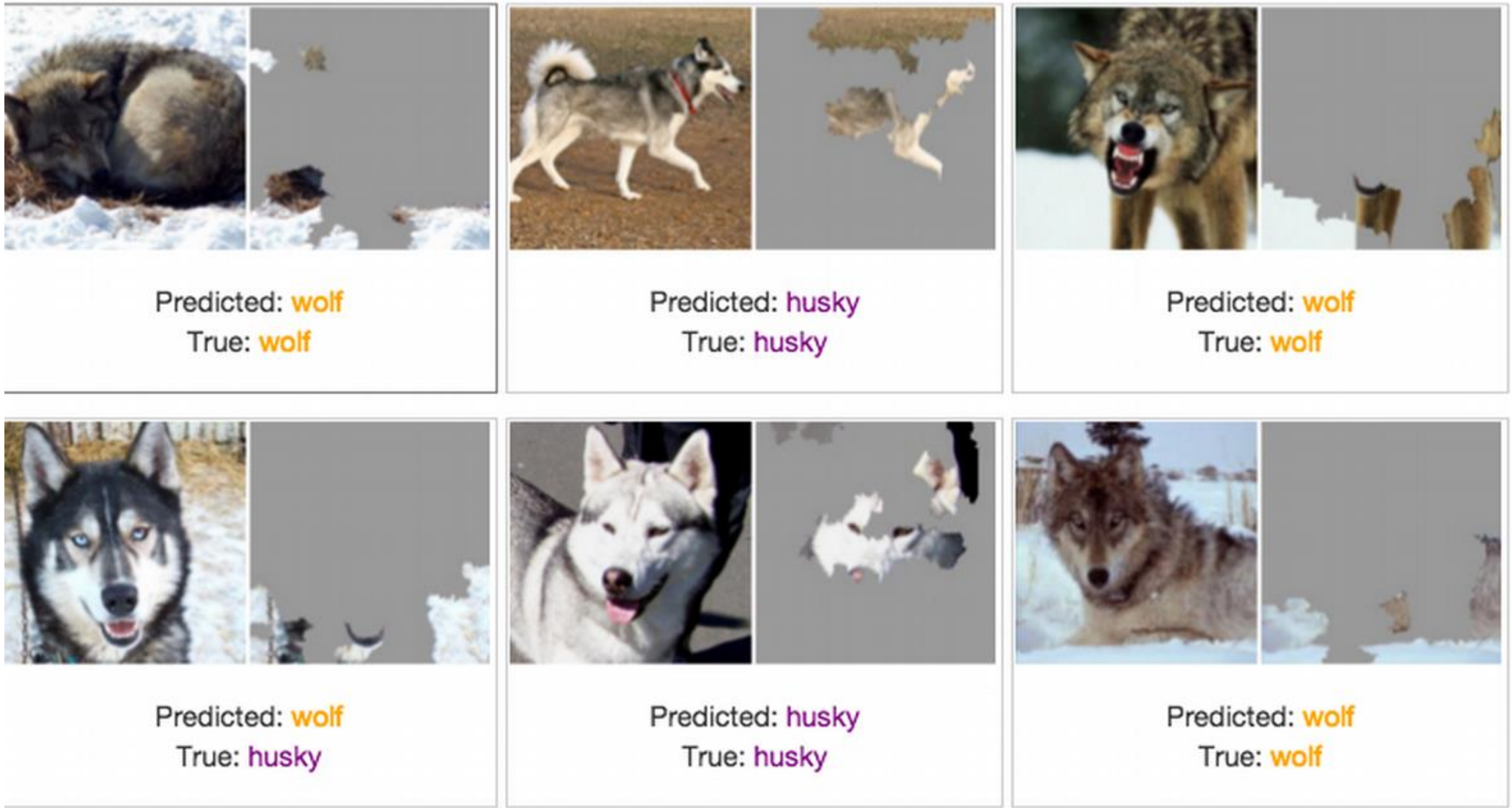
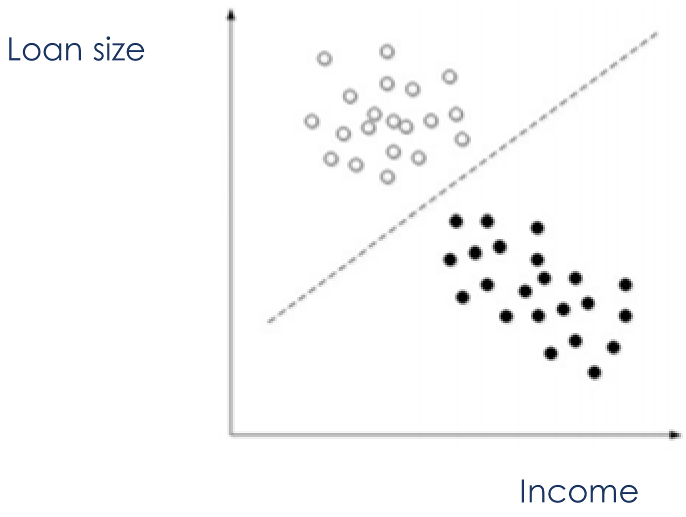


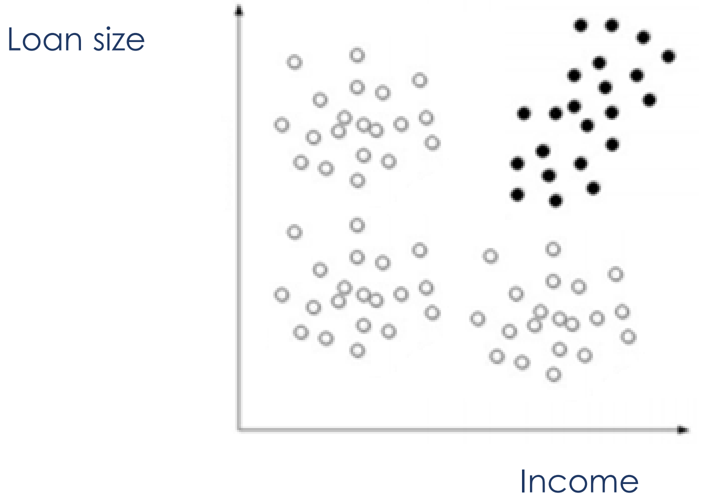
Image source: medium.com

CREDIT RISK Management



CREDIT RISK Management

What about **non-linear relationships**?

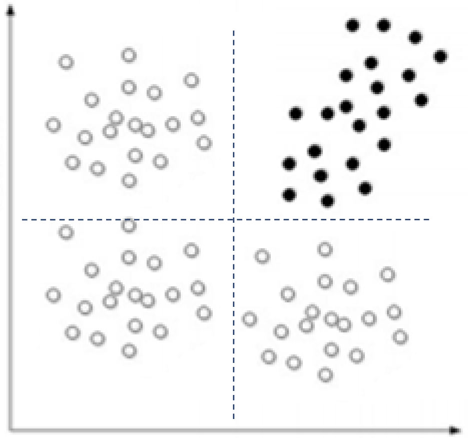


CREDIT RISK Management

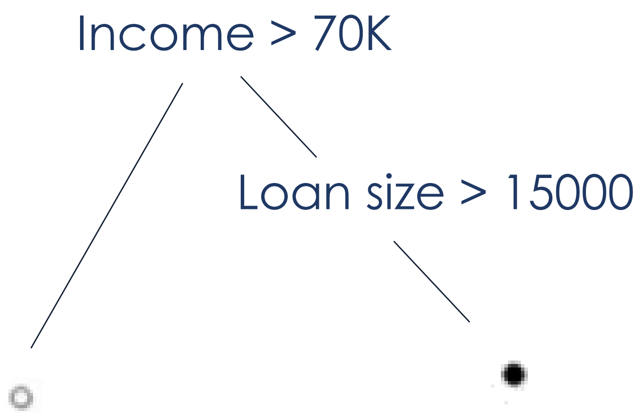
What about **non-linear relationships**?

Still interpretable!

Loan size



Income



N-dimensions and **HIGH COMPLEXITY**

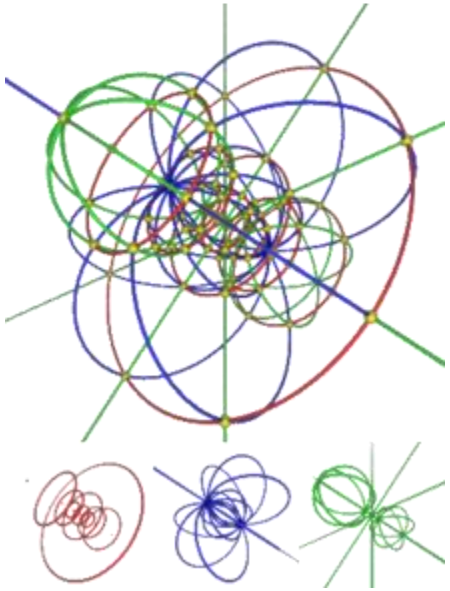


Image source: wikipedia

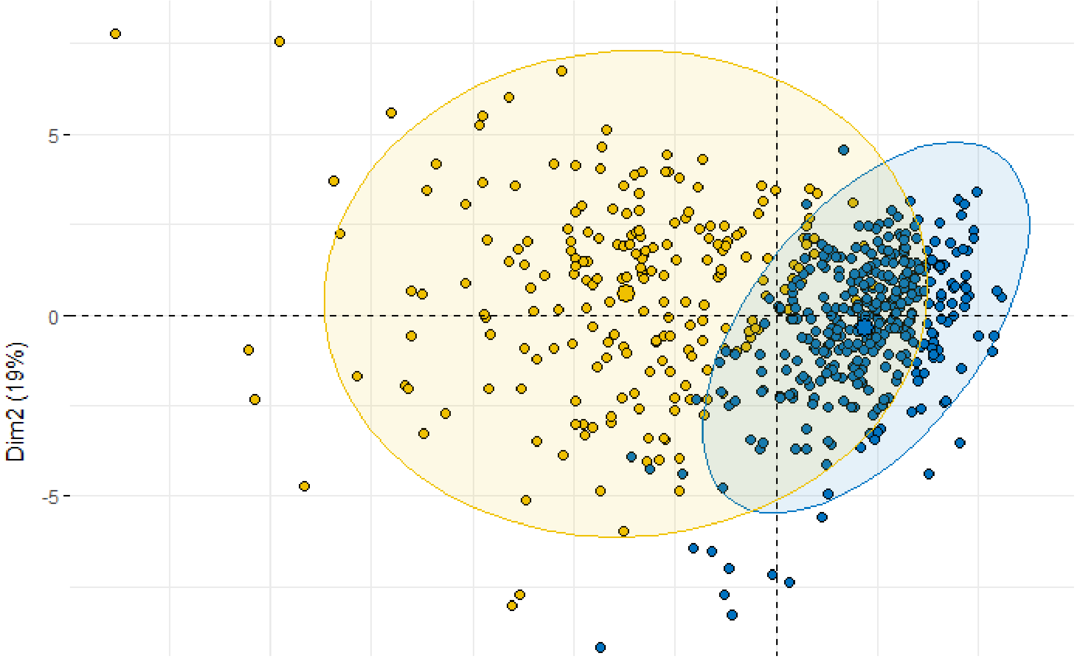


Image source: towardsdatascience.com

FEATURE IMPORTANCE

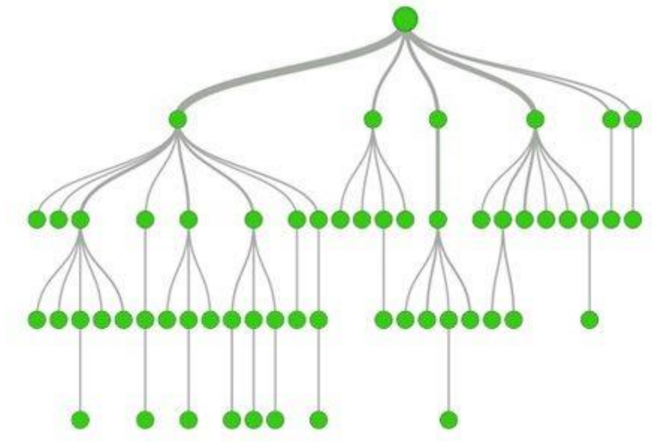
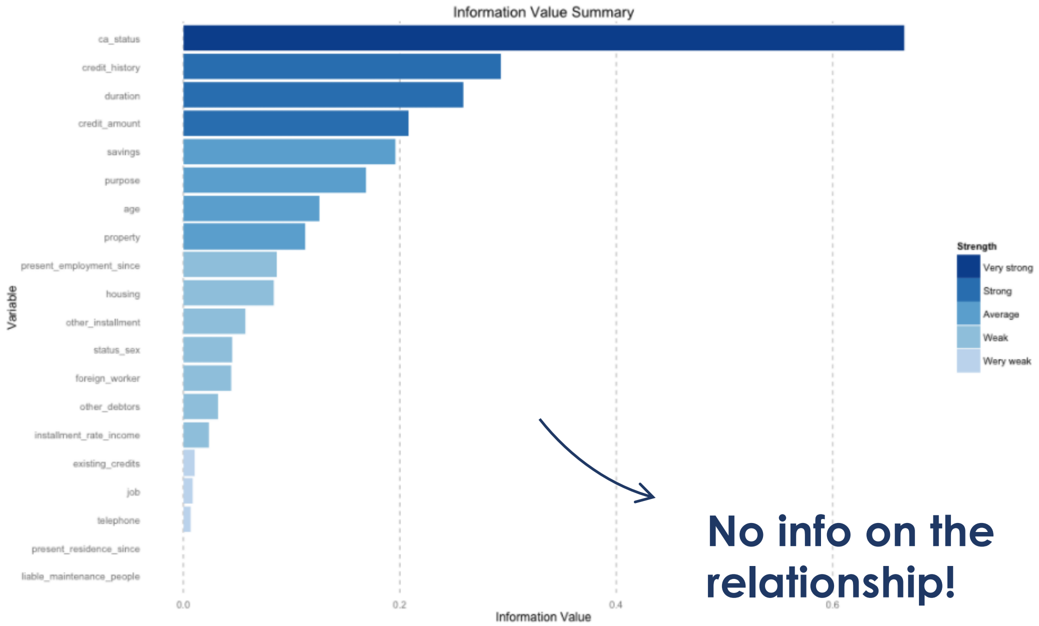


Image source: opendatascience.com



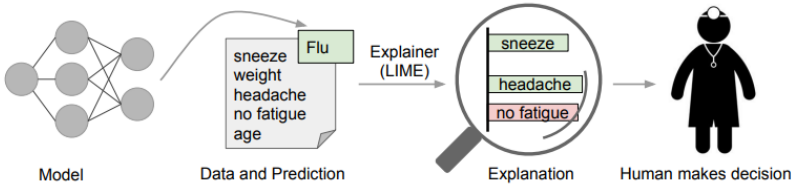
No info on the relationship!

Image source: stackoverflow.com

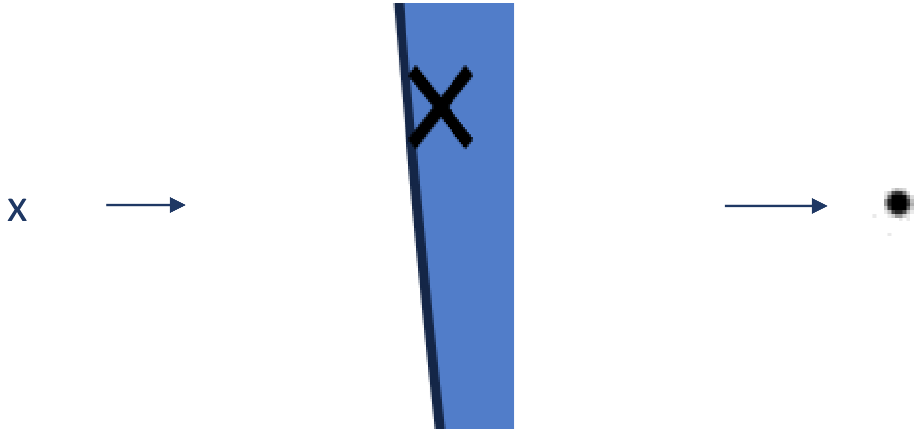
State-of-Art **XAI METHODS: LIME**

LIME - Local Interpretable Model-agnostic Explanations

- explains the prediction of **any machine learning classifier** by learning an interpretable model **locally** around the prediction.



Highly accurate at local level!

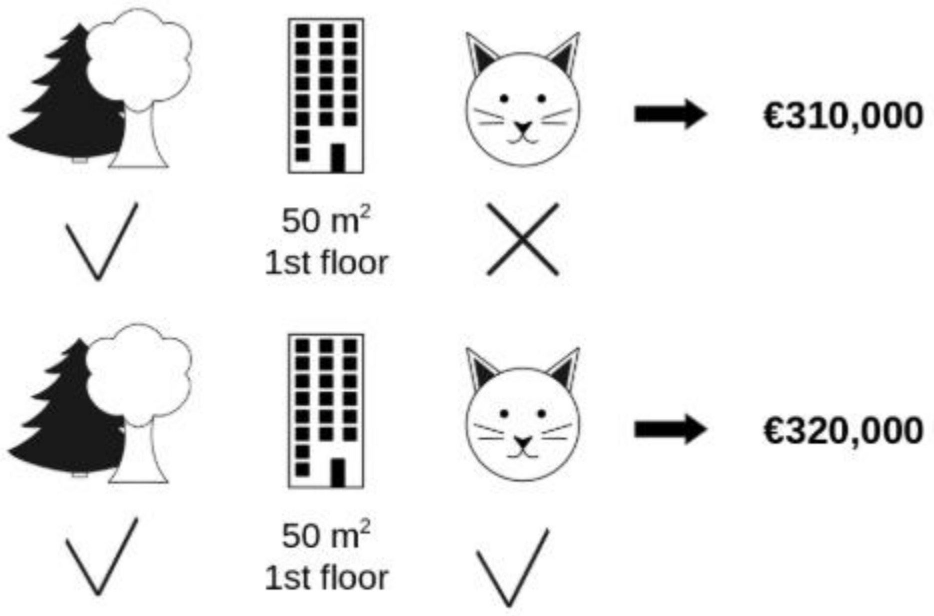


So local that one can apply a linear model to understand the relationship!

State-of-Art **XAI METHODS: SHAPLEY** Values

- The Shapley value is the average marginal contribution of a feature value across all possible coalitions.

The contribution of the cat-banned is -10K!



This greatly depends on our random pick!

We repeat the sampling step and average the contribution!

Image source: christophm.github.io

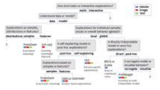


Figure. Arya et al. (2019) proposed taxonomy based on questions about what is explained, how it is explained and at what level

Figure. Linardatos et al. (2021) taxonomy mind-map of Machine Learning Interpretability Techniques.

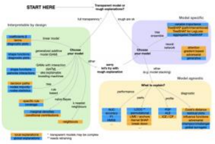
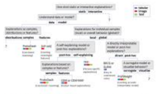


Figure. Maksymiuk et al. (2021) model-oriented taxonomy for XAI method

XAI Research



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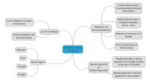

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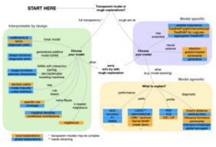

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Match explainability needs of stakeholders with the XAI methods

XAI Research

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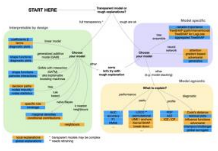

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Match explainability needs of stakeholders with the XAI methods

Performance of XAI methods in view of the unique features of financial data

XAI Research

XAI research in **FINANCE**

What is the best way to bring those explanations to different stakeholders in the financial world?

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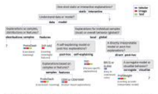
Match explainability needs of stakeholders with the XAI methods



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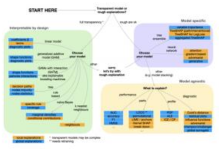

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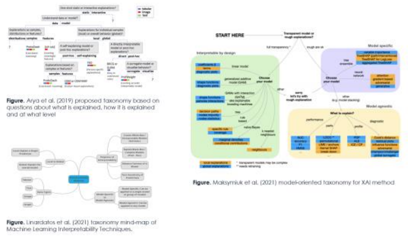
XAI Research

XAI research in **FINANCE**

Deployment



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XAI Research

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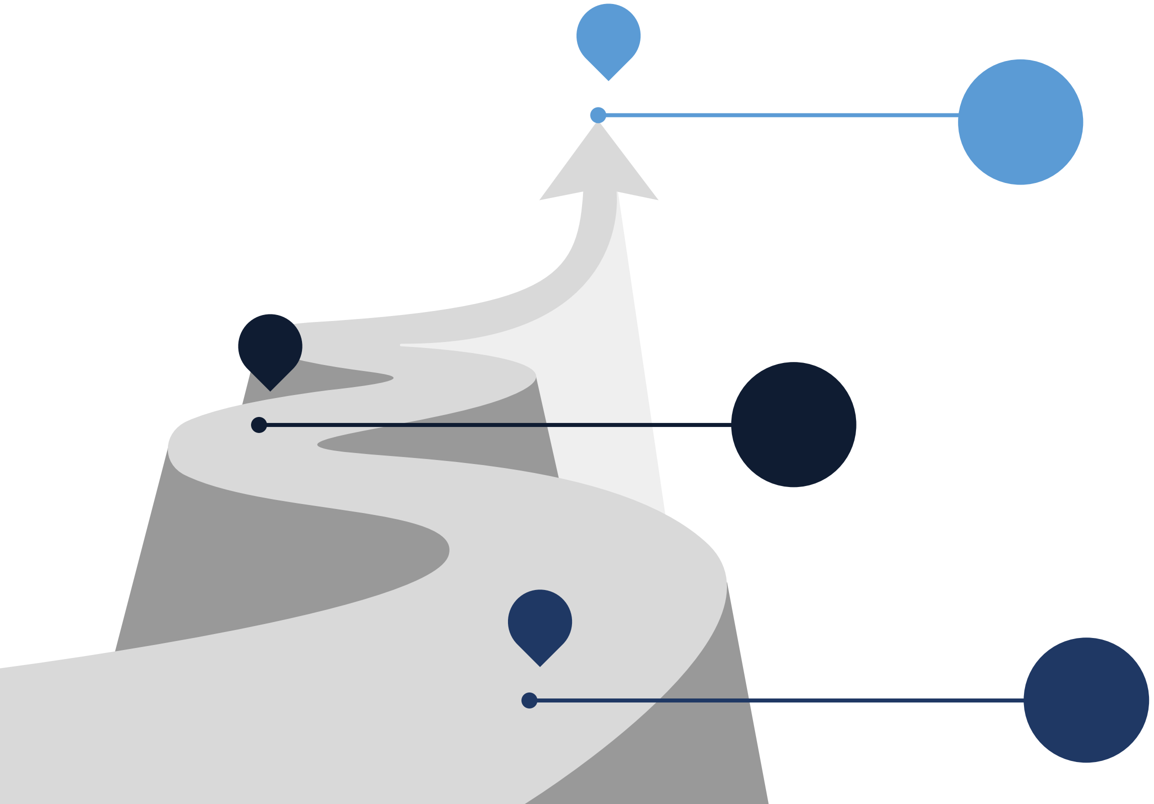
Deployment

Productivity

RESEARCH Projects

Context: Credit Risk Management

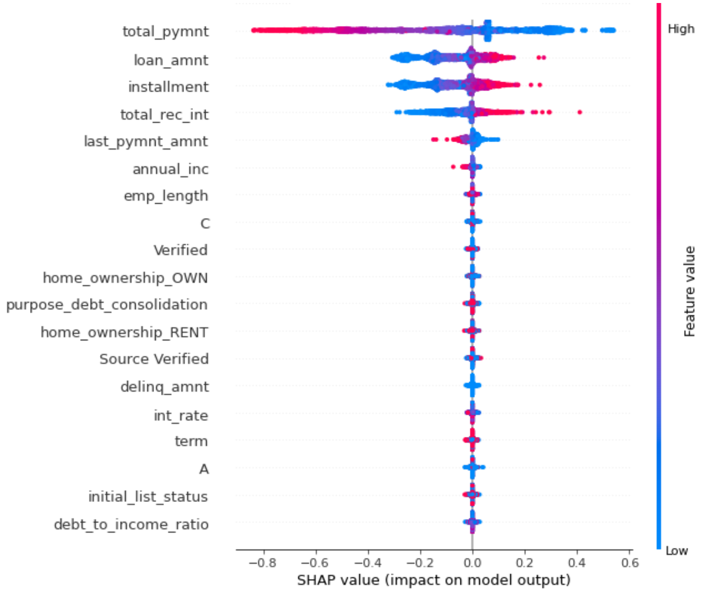


To explore the **utility of state-of-art XAI frameworks in the context of credit risk management**

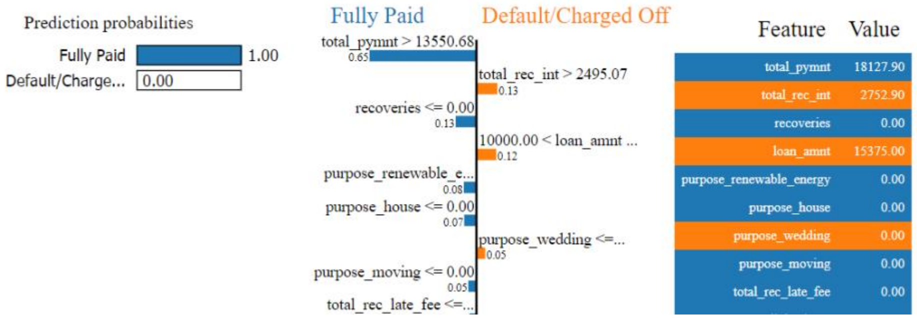
Stability and robustness of explanations

Human-centric and mathematical issues

HUMAN-CENTRIC Issues



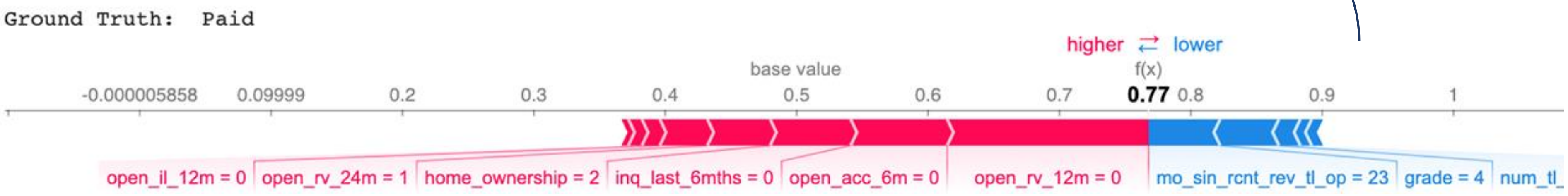
SHAP



LIME

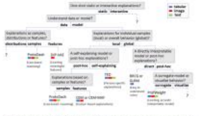
- Explanations for **model developers**
- Could provide value for end users as well – however, **counterfactual explanations preferred**
- Visualization **only suited for model developers**

SHAP



TECHNICAL Issues

- Issue with the **different estimation procedures**
  - the exact computation of the Shapley value is computationally intensive
  - Feature selection can be crucial
    - The choice of features that count as players can affect the resulting explanations
- Not applicable to time series data
- Only few attempts to address such issues (with no solutions proposed for time series data)



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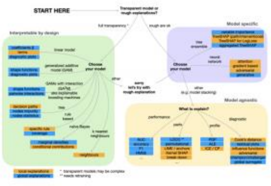

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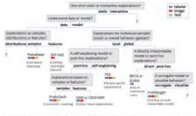

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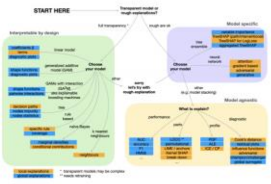

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