MODEL MANAGEMENT OR „GETTING YOUR LIFE BACK“

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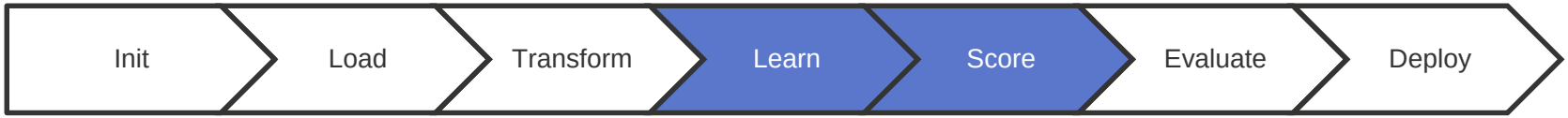
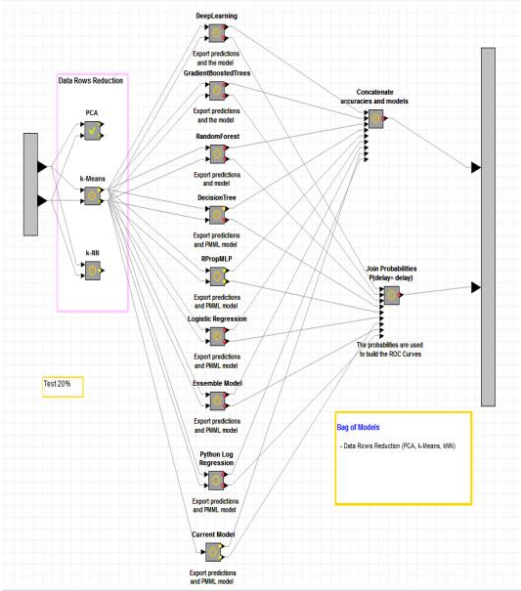
Solutions In the Market: Bags of Models





Very Important but just one part of the modelling process!

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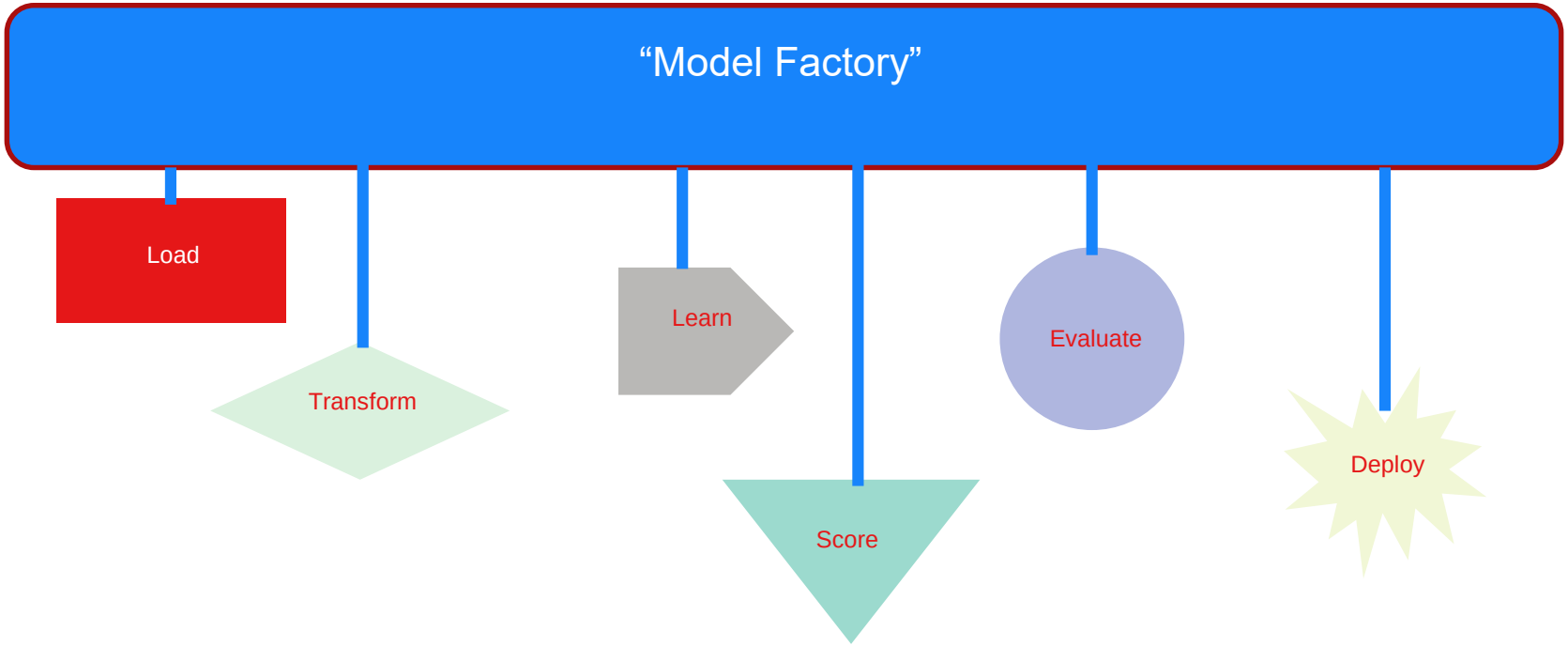
Solutions In the Market: “Pulling products together”



Very Important for some vendors because it corrects major architectural design flaws

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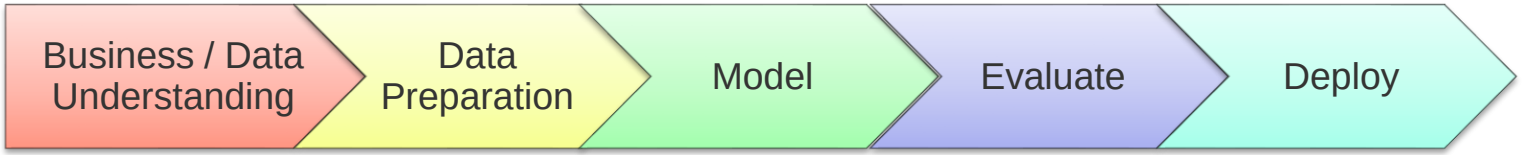
Predictive History: The Analytic Process Wars…

- KDD-Process
- SEMMA
- CRISP ✔



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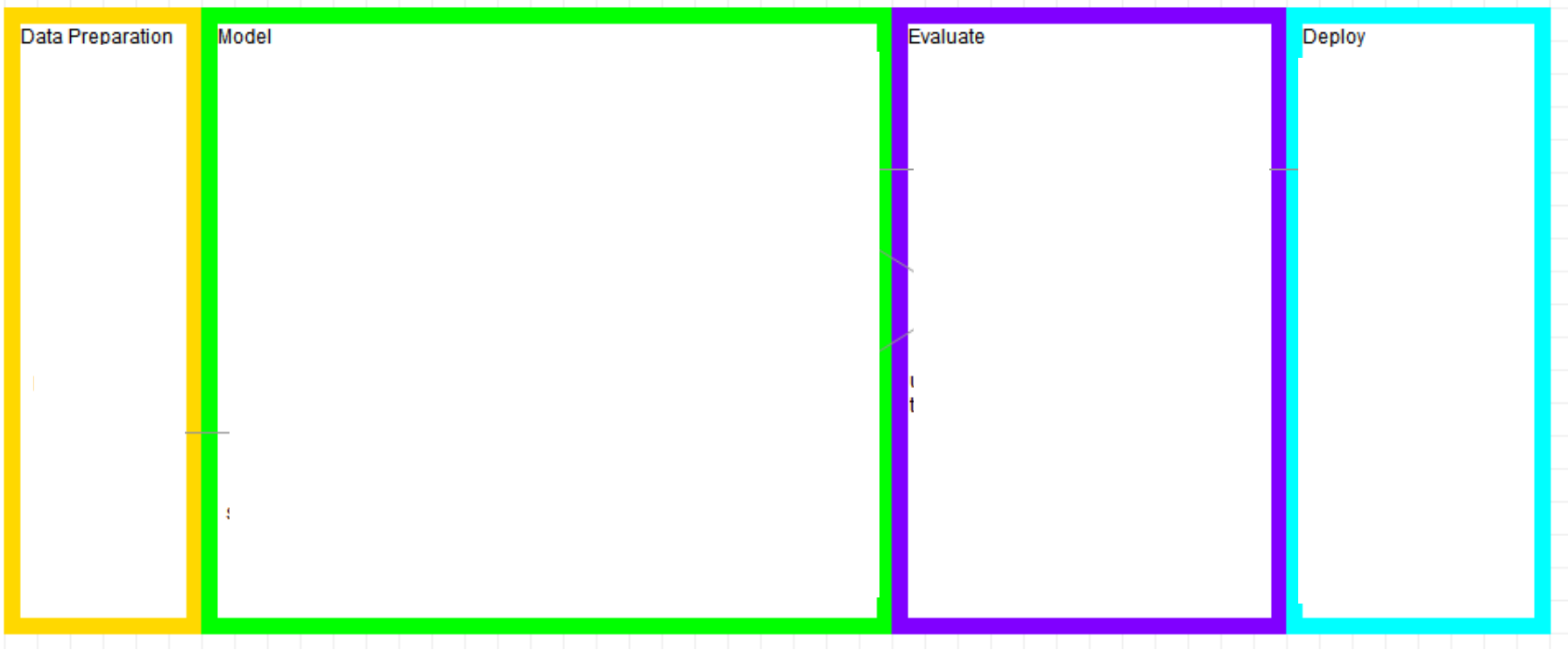
CRISP with your favorite package



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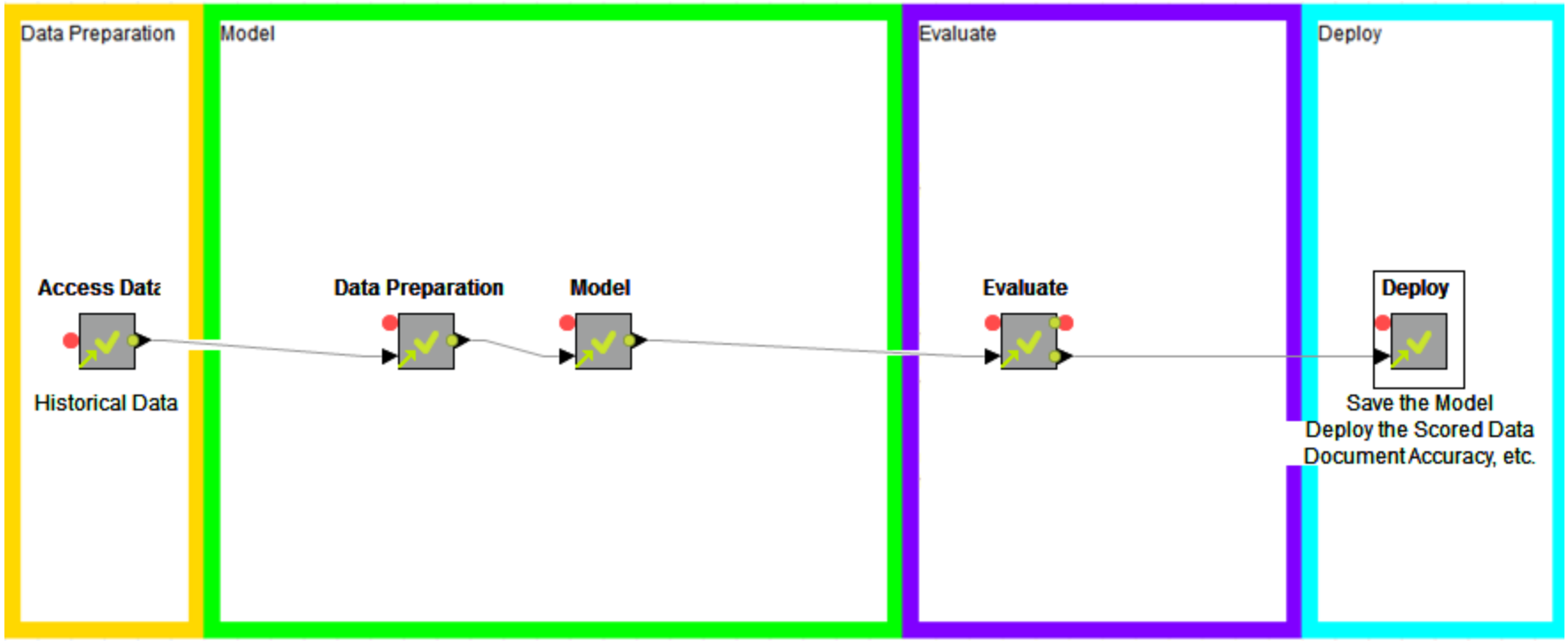
CRISP with your favorite package



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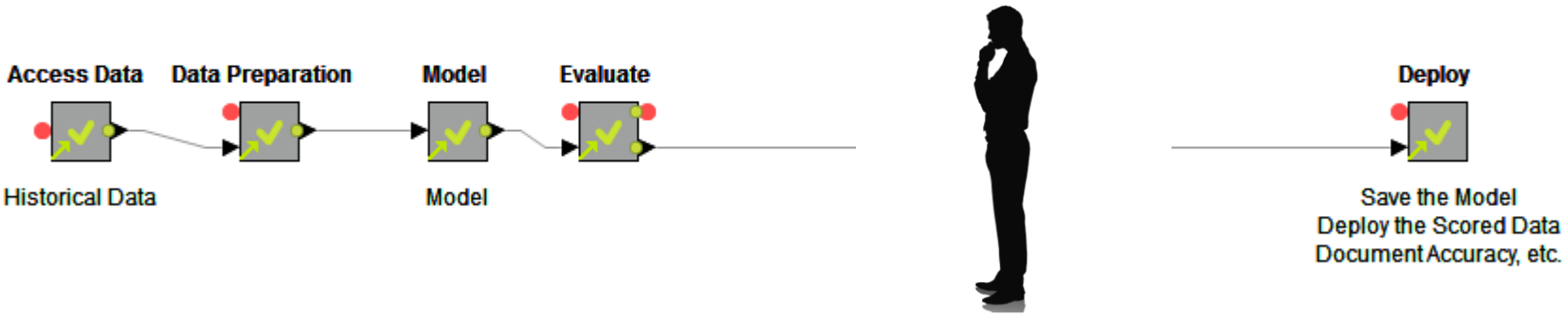
CRISP with your favorite package



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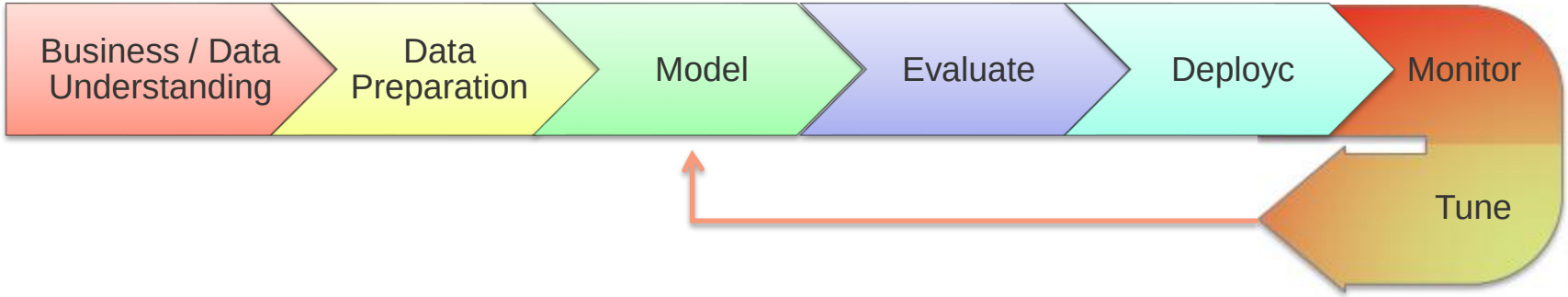
CRISP and Reality: Something missing…



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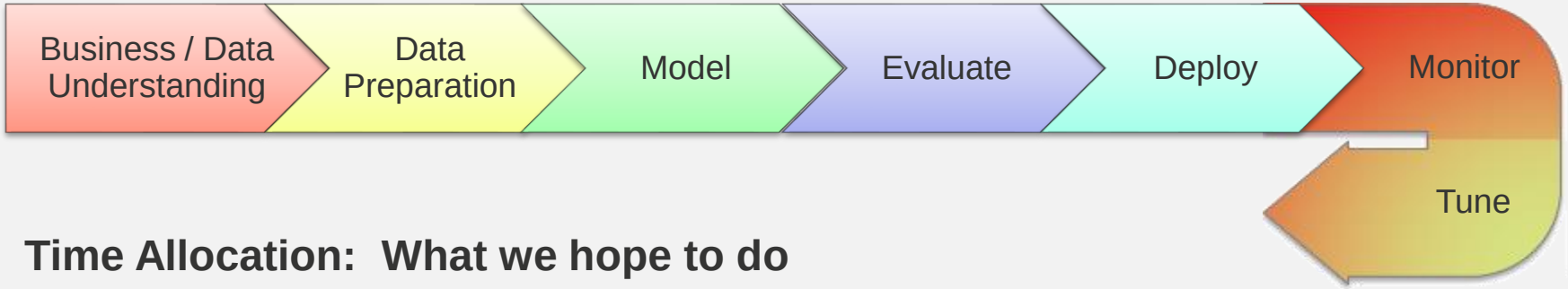
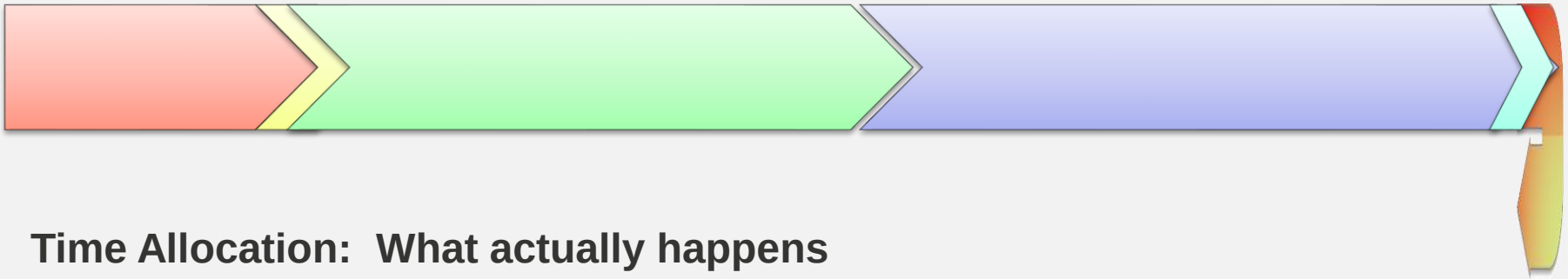
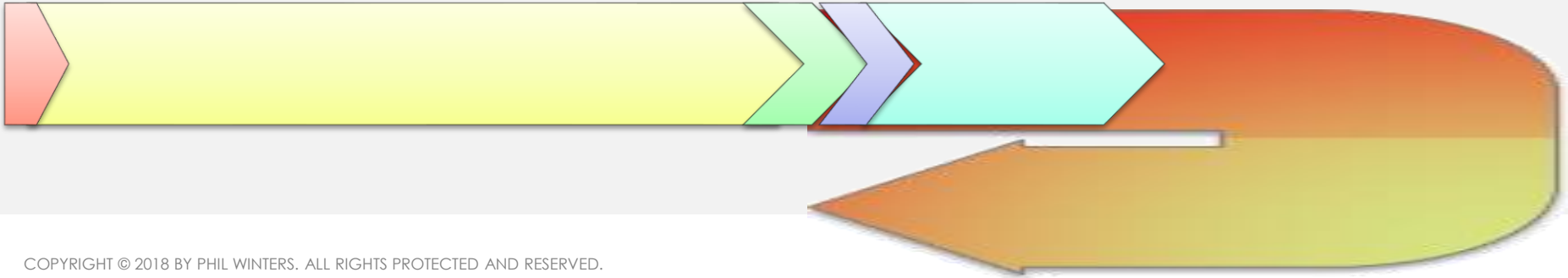


Time Allocation: What we hope to do



Time Allocation: What actually happens



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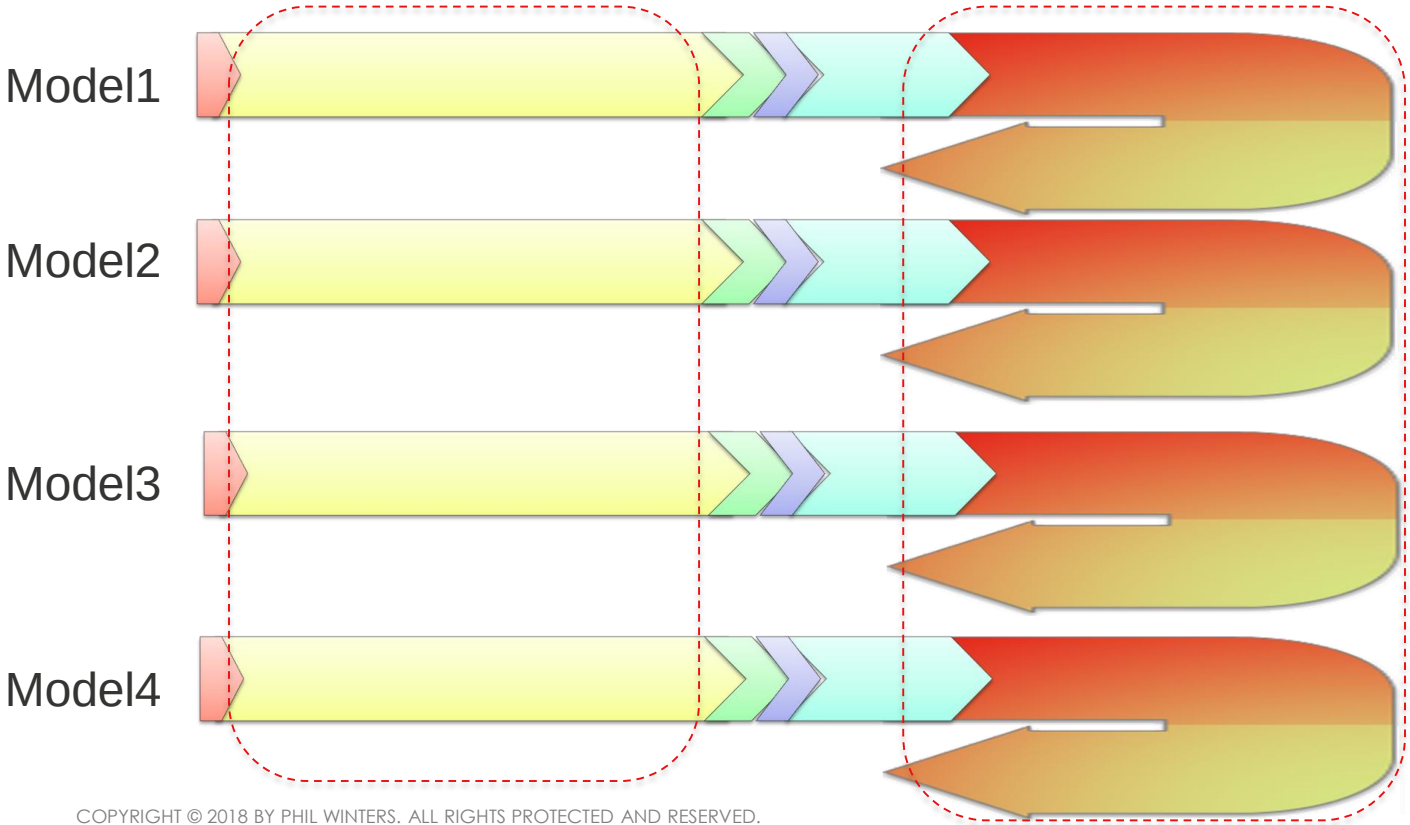
Your Life = 4 models??????



80% OF YOUR WORK LIFE DOING THE THINGS THAT YOU HATE...

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Models

...capture a snap shot of the data (today's reality)

...need to be updated when data (reality) changes

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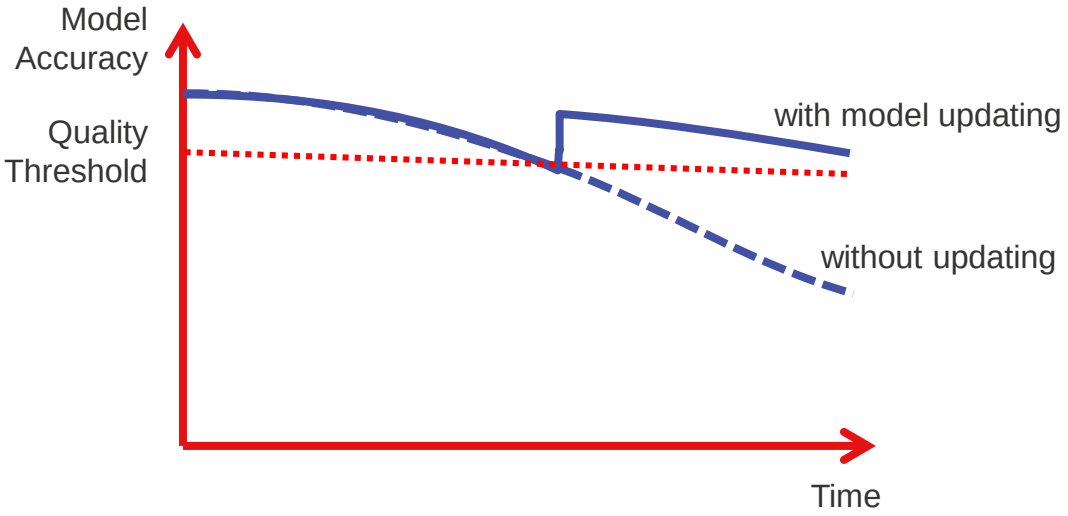
Models in Time



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Model Updating

Issues:

- Training of new Model
  vs Updating of Existing One
- Training/Updating/Replacing every time?
- Evaluation on Old
  vs. New vs. Benchmark Data

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Models

and it gets worse:

...models rely on specific data preparations...

...deployment is an entire drama in itself. (offline vs. real-time scoring, (web)service, executable, model standards, scalability...)

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My Life: Easy Peazy Lemon Squeazy….

- Advanced Price Prediction (Forecasting)
- 29000 models
- Built, Trained, Scored, Tested, Monitored, Retrained

- Run Daily in 45 Minutes
- Totally Automated “Hands Off”

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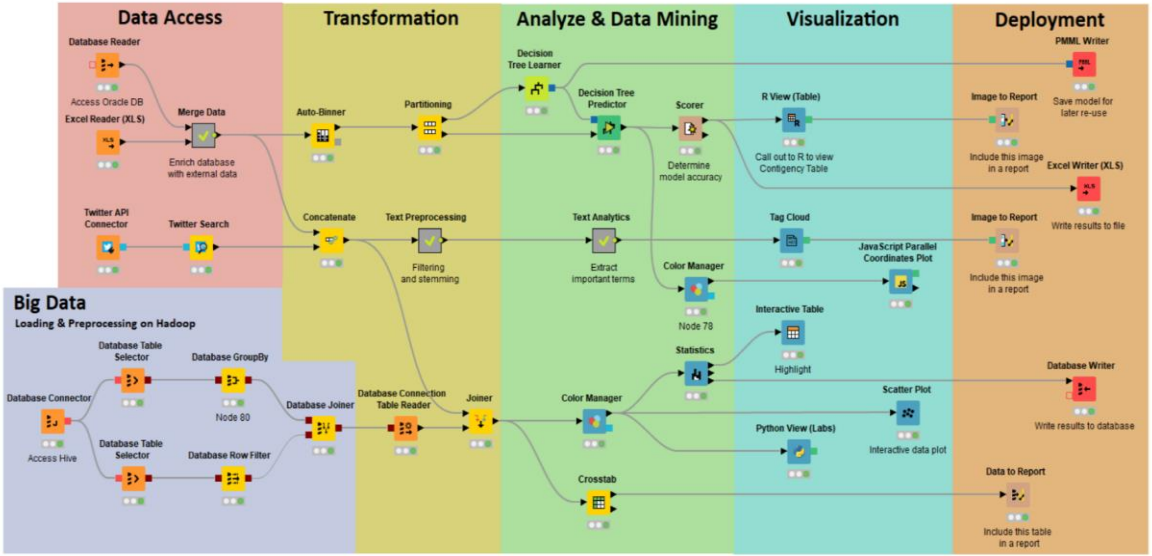
Model Learning: a concrete Example



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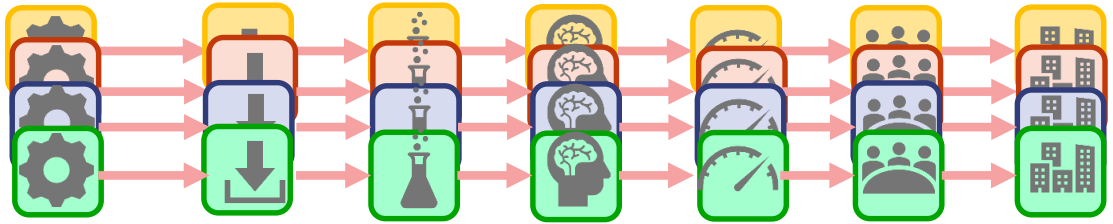
More Model Processes

Tough choice:

- one pipeline fits all

vs.

- individual pipelines for all.



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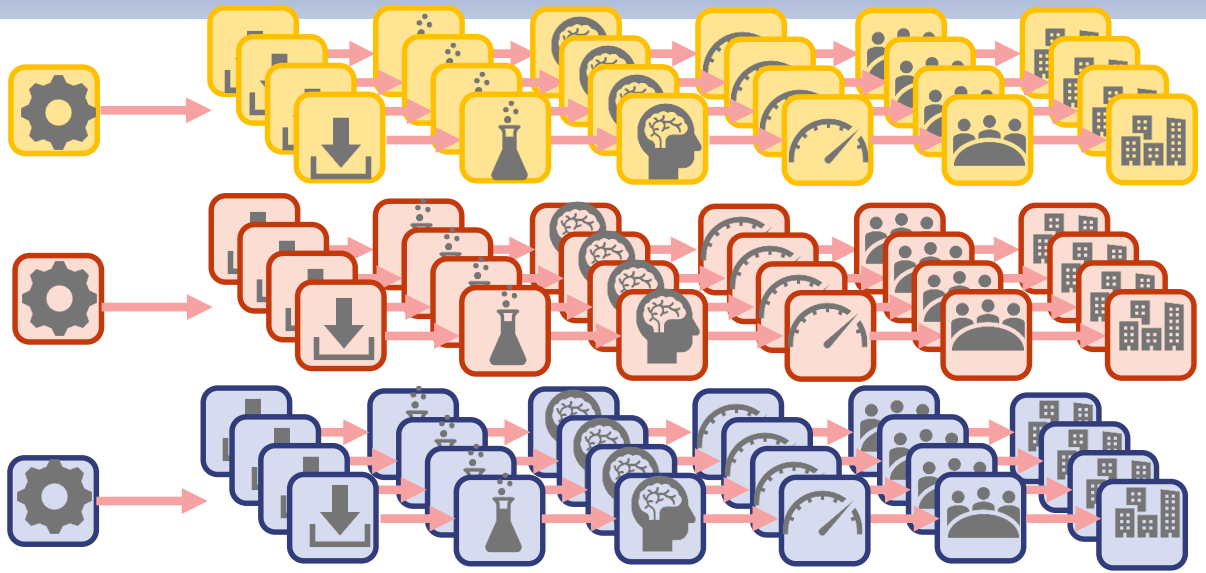
Model Families



- Issues with many families:
  too many pipelines with likely repetitive pieces...

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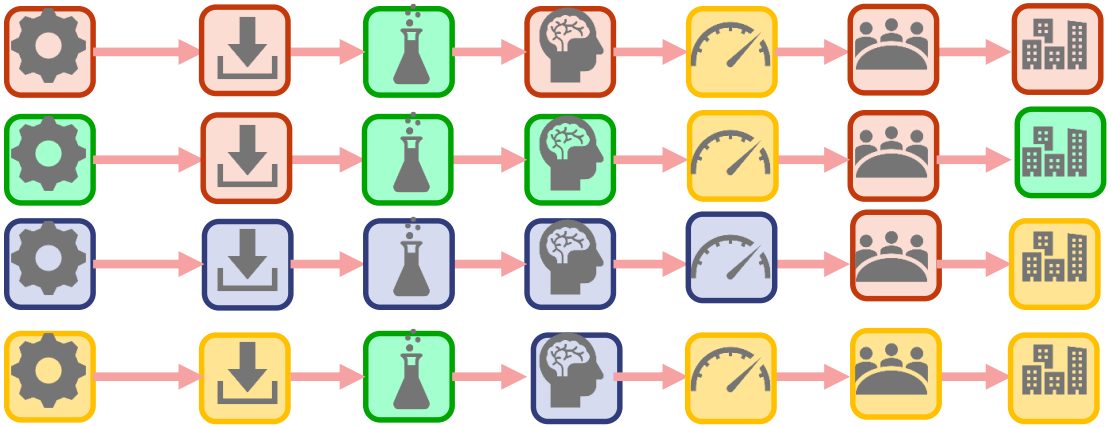
Model Factories



- Pipeline = sum of its pieces.
- Reuse what's reusable.

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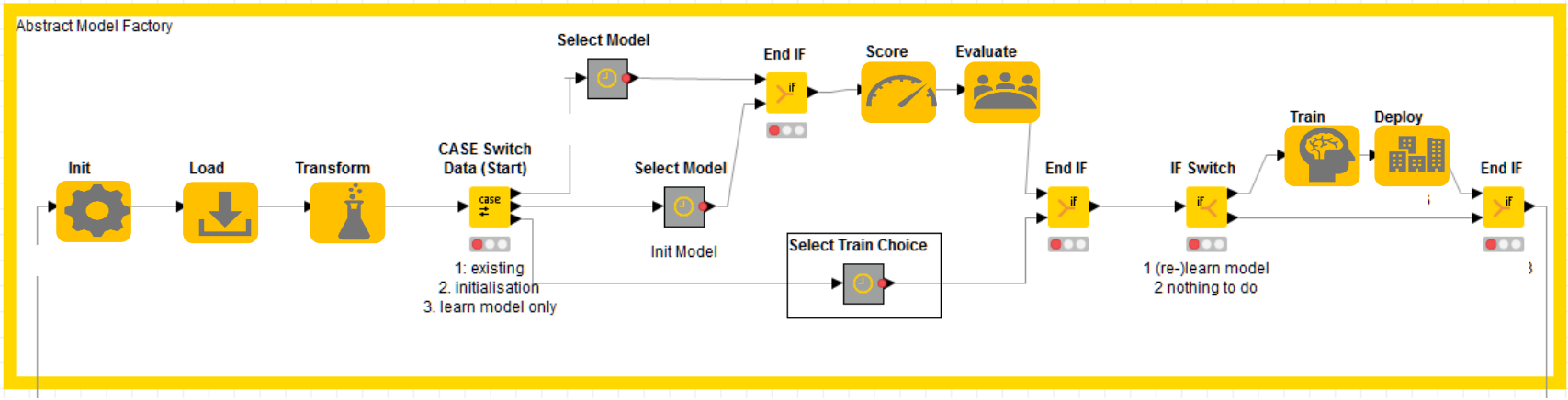
Model Management Process



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Model Factory Concepts + Terminology

Process Definition:

Process 1 (“Purchase Propensity”)
Process 2 (“...”)
Process 3 (“Churn Pred.”)

Modeling Process Configuration:

Product1	Process1 (parameters...)
Product2	Process1 (parameters...)
Product3	Process1 (parameters...)
Topic4	Process2 (parameters...)
Topic5	Process2 (parameters...)
New1	Process 3(parameters…)
….	

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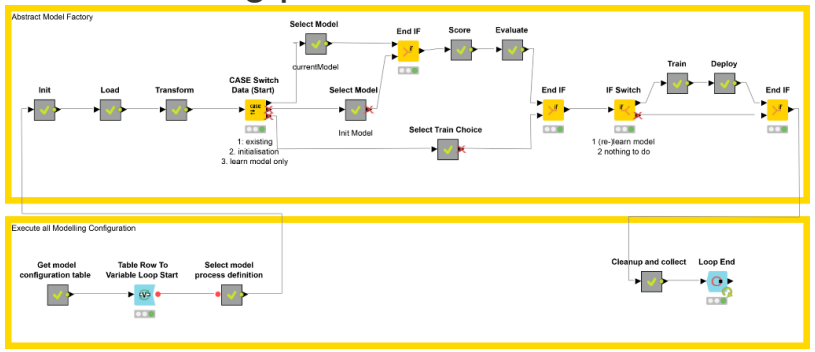
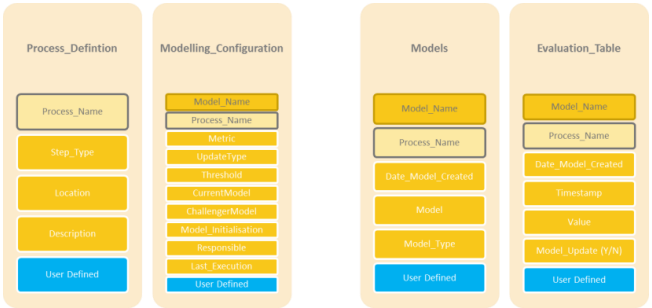
The Next Generation Model Factory

Using a platform and well defined metadata to create, execute, monitor and control all aspects of modelling processes





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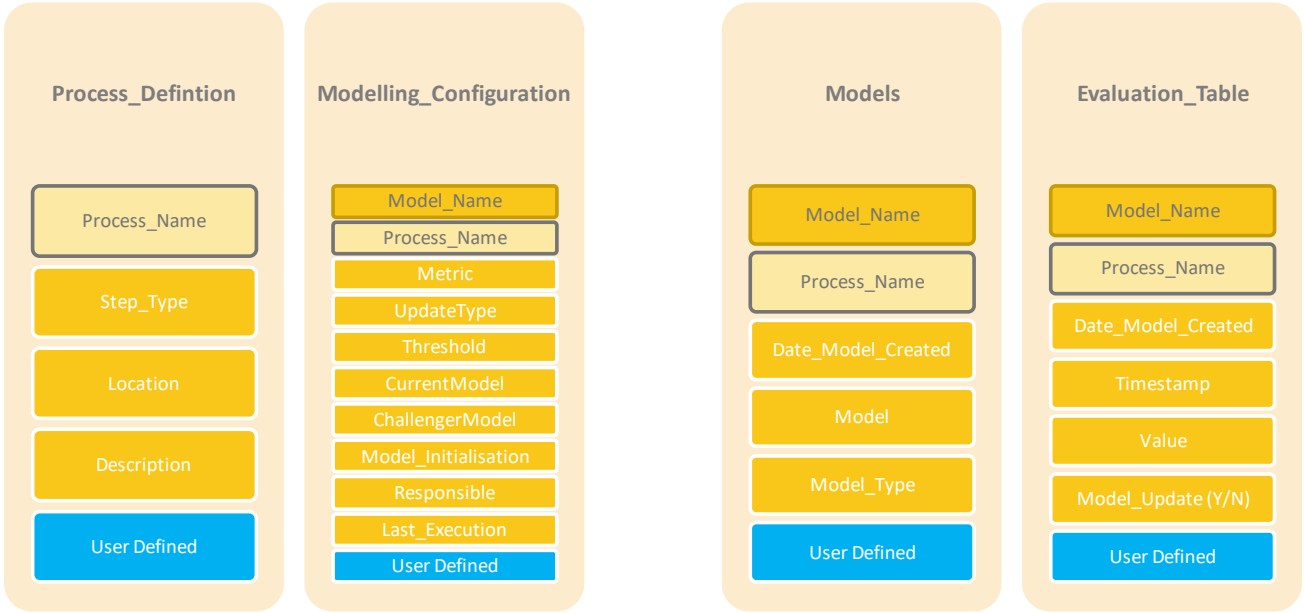
The Tables



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Model_Process Table

Process 1 (“Customer Seg”)
Process 2 (“…”)
Process 3 (“Churn Pred.”)

Process_Name	Step_Type	Location
AirBNB RentApp Prediction	INIT	/AirBNB/workflows/rentedAppPred/AirBnB_rentAppPred_01_Init
AirBNB RentApp Prediction	LOAD	/AirBNB/workflows/rentedAppPred/AirBnB_rentAppPred_02_Load
AirBNB RentApp Prediction	TRANSFORM	/AirBNB/workflows/rentedAppPred/AirBnB_rentAppPred_03_ET
AirBNB RentApp Prediction	LEARN	/AirBNB/workflows/rentedAppPred/AirBnB_rentAppPred_05_Training
AirBNB RentApp Prediction	SCORE	/AirBNB/workflows/rentedAppPred/AirBnB_rentAppPred_04_Evaluation
AirBNB RentApp Prediction	EVALUATE	/_Process_Step_Templates/workflows/Templates/06_Evaluate_take_firstRowAndCell
AirBNB Price Prediction Cities	INIT	/AirBNB_Cities/workflows/Predict_App_Price/01_Init_for_Cities
AirBNB Price Prediction Cities	LOAD	/AirBNB_Cities/workflows/Predict_App_Price/02_Load_for_Cities
AirBNB Price Prediction Cities	TRANSFORM	/AirBNB/workflows/PricePred/AirBnB_PricePred_03_ET
AirBNB Price Prediction Cities	LEARN	/AirBNB/workflows/PricePred/AirBnB_PricePred_05_Training
AirBNB Price Prediction Cities	SCORE	/AirBNB/workflows/PricePred/AirBnB_PricePred_04_Evaluation
AirBNB Price Prediction Cities	EVALUATE	/_Process_Step_Templates/workflows/Templates/06_Evaluate_take_firstRowAndCell

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Model_Configuration Table

Modeling Process Configuration:

Product1 Process1 (parameters...)
Product2 Process1 (parameters...)
Product3 Process1 (parameters...)
Topic4 Process2 (parameters...)
Topic5 Process2 (parameters...)
New1 Process 3(parameters...)
....

Model_Name	Process_Name	Metric	Threshold	Current...	Update_Type	Model_Initialisation	ChallengerModel	Responsible	Last_Execution
Empty_Template	_Template	none	0.667	?	?	?	?	iris.adae@knime.com	?
Hong_Kong	AirBNB Price Prediction Cities	RMSD	16.172	?	Automatic	all	all	modelFactory@knime.com	2017-03-12;00:40:39.473
Seattle	AirBNB Price Prediction Cities	RMSD	1.13	?	Automatic	all	all	modelFactory@knime.com	2017-03-12;00:41:07.675
Vancouver	AirBNB Price Prediction Cities	RMSD	0.36	?	Automatic	all	all	modelFactory@knime.com	2017-03-12;00:41:52.390
Venice	AirBNB Price Prediction Cities	RMSD	0.259	?	Automatic	all	all	modelFactory@knime.com	2017-03-12;00:42:30.529
all	AirBNB Price Prediction Cities	RMSD	3.176	?	Automatic	?	?	?	2017-03-12;00:42:49.153
2_Beds	AirBNB Price Prediction	RMSD	0.538	?	Automatic	?	?	iris.adae@knime.com	2017-03-12;00:43:22.296
>2_Beds	AirBNB Price Prediction	RMSD	2.414	?	Automatic	?	?	iris.adae@knime.com	2017-03-12;00:43:39.25
CS_TV_000127	Product Price Trend	RMSD	0	?	Automatic	CS_TV_002128	?	phil.winters@knime.com	2017-03-12;00:44:06.966
CS_TV_002128	Product Price Trend	RMSD	0	?	Automatic	CS_TV_000127	?	phil.winters@knime.com	2017-03-12;00:44:24.550
IE_WM_002651	Product Price Trend	RMSD	0	?	Automatic	PC_WM_001953	?	phil.winters@knime.com	2017-03-12;00:44:49.73
PC_WM_010138	Product Price Trend	RMSD	1	?	Automatic	PC_WM_001953	?	phil.winters@knime.com	2017-03-12;00:45:22.492
>2_Beds	AirBNB RentApp Prediction	RMSD	26.136	?	Automatic	?	?	iris.adae@knime.com	2017-03-12;00:46:12.738
2_Beds	AirBNB RentApp Prediction	RMSD	98.853	?	Automatic	?	?	iris.adae@knime.com	2017-03-12;00:46:24.704
Boston	AirBNB Price Prediction Cities	RMSD	3.565	?	Automatic	all	?	?	2017-03-12;00:47:21.674
Amsterdam	AirBNB Price Prediction Cities	RMSD	8.164	?	Automatic	all	all	modelFactory@knime.com	2017-03-12;00:48:11.664
Geneva	AirBNB Price Prediction Cities	RMSD	0.475	?	Automatic	all	all	modelFactory@knime.com	2017-03-12;00:48:40.8
IE_TV_008995	Product Price Trend	Trend	1	?	Manual	?	?	test@knime.com	2017-03-12;00:49:13.709
PC_WM_001953	Product Price Trend	RMSD	1	?	Automatic	PC_WM_010138	?	phil.winters@knime.com	2017-03-12;00:49:29.256

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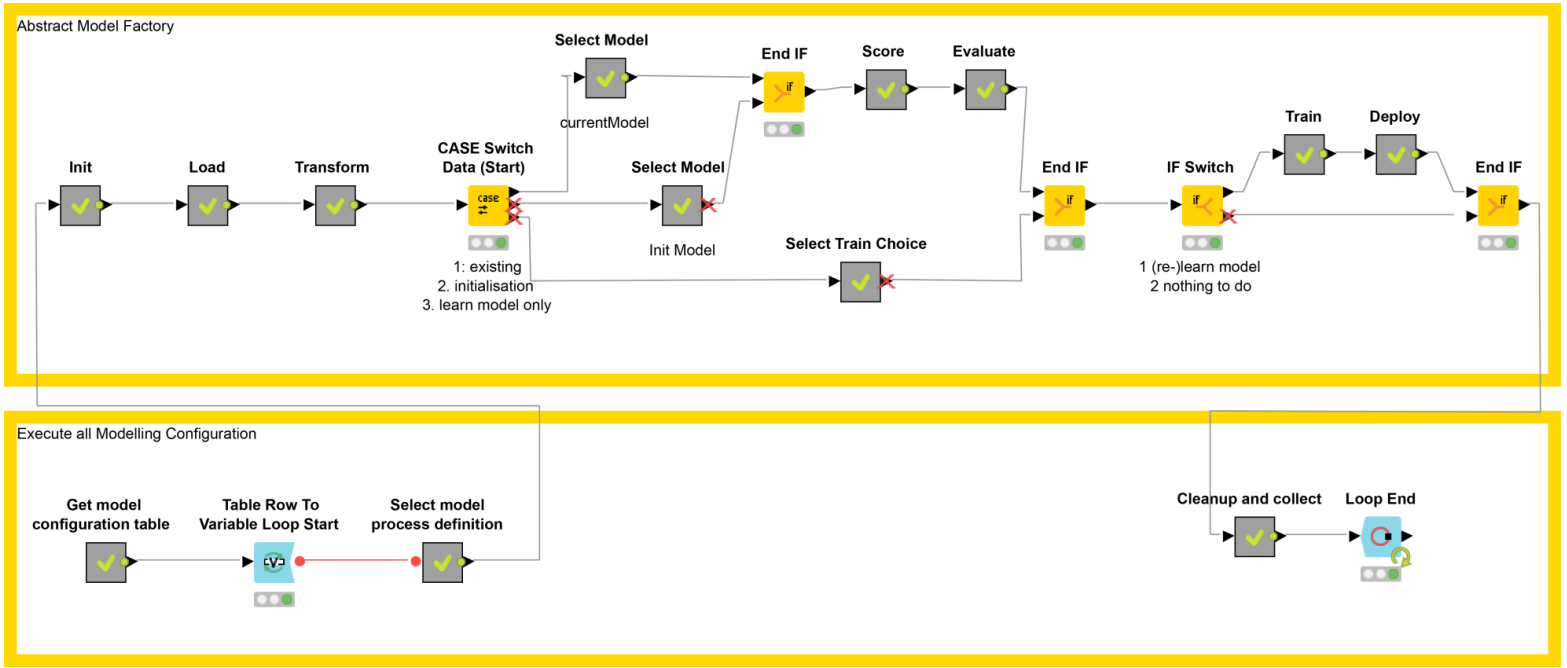
The KNIME Model Factory



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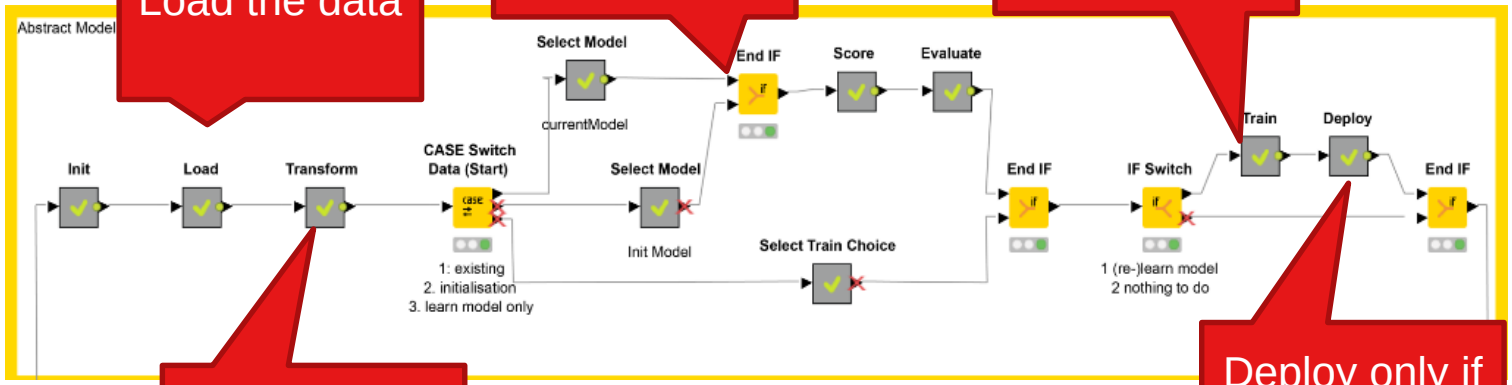
The Model Factory



Load the data

Evaluate only if model exists

Retrain if error exceeds threshold

Split into training and test set

Deploy only if update type allows it

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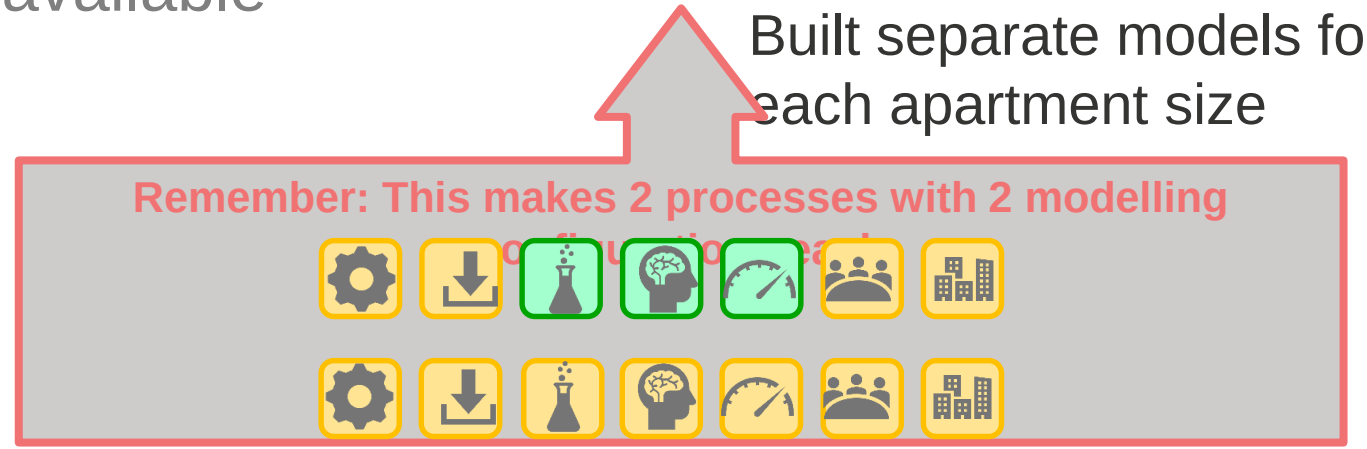
Use Case: AirBnB

- Data is freely available

Tasks

- Predict the appartment price
- Predict availabilty
- Built separate models for each apartment size



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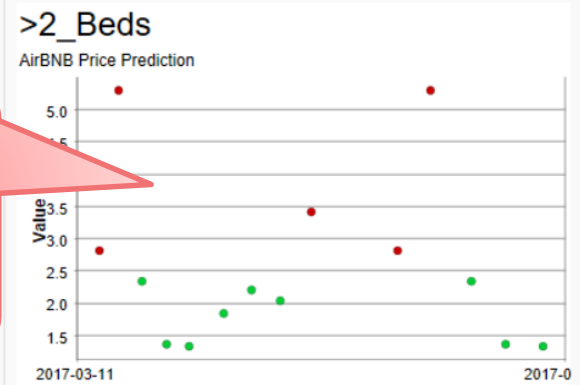
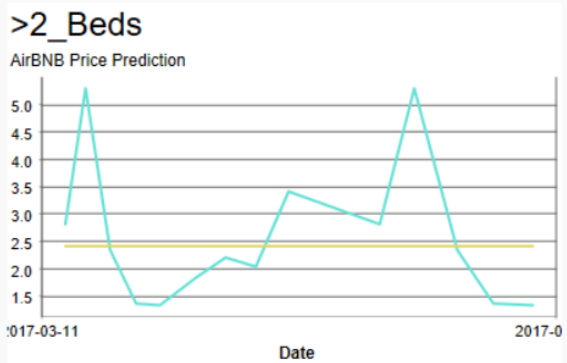
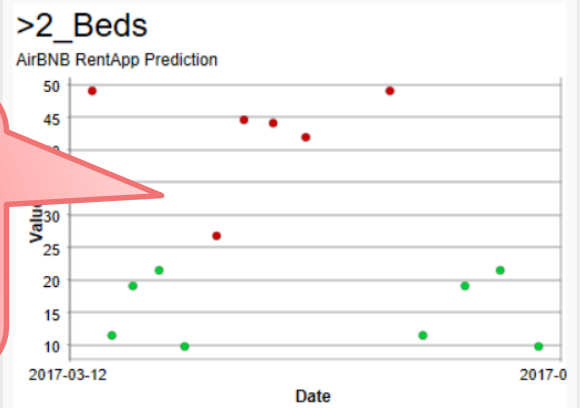
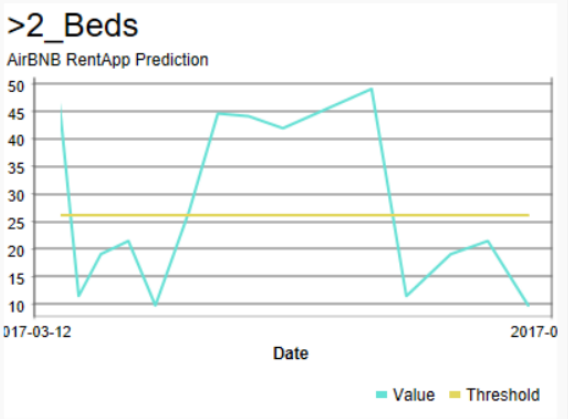
Results - AirBNB

>2_Beds	AirBNB Price Prediction		
			
>2_Beds	AirBNB RentApp Prediction		

Accuracy for predicting with deployed model

Each red datapoint Resulted in a retrain of the model

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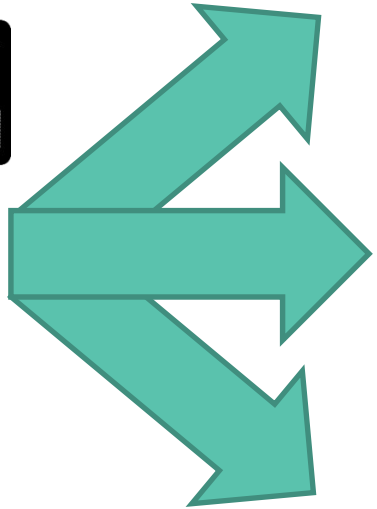
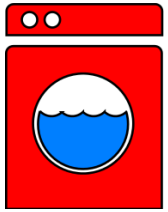
Use case: Trend prediction





- Price-Trend prediction
  - Predict if the price will go up, down or stay

Built one model per product

Retrain and deploy the model dynamically

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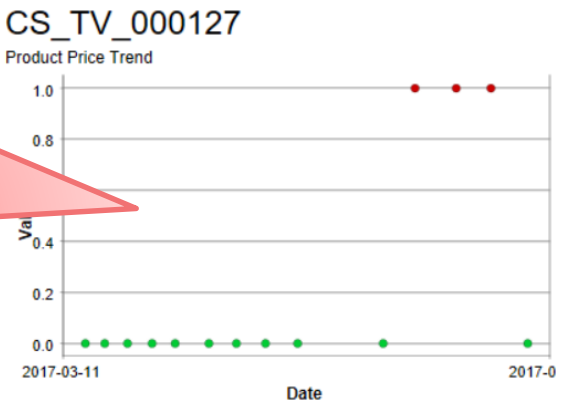
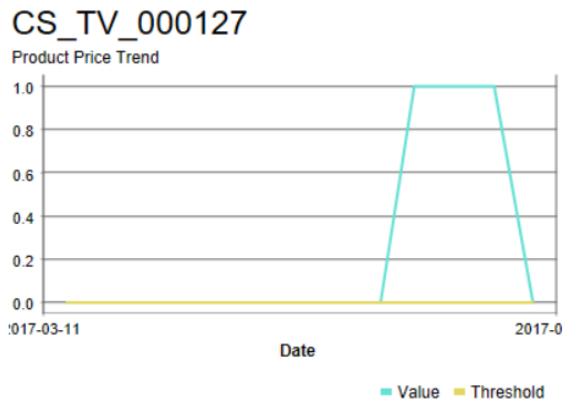
Results – Product Data

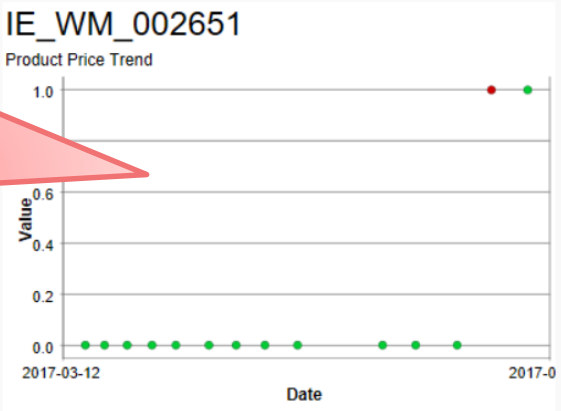
CS_TV_000127	Product Price Trend
IE_WM_002651	Product Price Trend

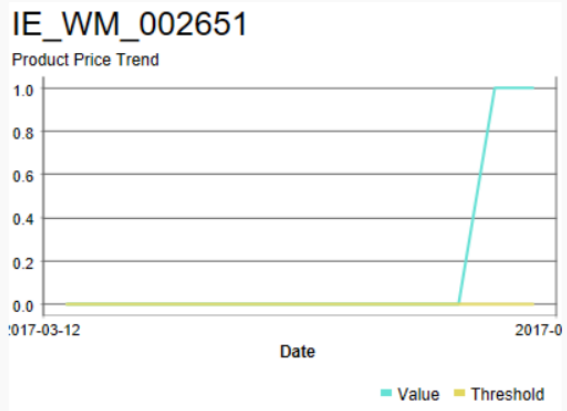
Accuracy for predicting with deployed model

Each red datapoint Resulted in a retrain of the model









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Modelling Process on different products

Same modelling workflow applied to multiple items.

- One Model Process
  - same workflow
  - Init configured to read the Configuration_Name
- Multiple Model Configurations
  - One for each Product or item
  - Configuration_Name = Product Name
  - Many products? Have a workflow build the model Configurations!

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A model MUST be in production for a new product

- A score must appear in production for a new item, but there is not enough data to create a model score.

Model_Name	Process_Name	Metric	Threshold	CurrentModel	Update_Type	Model_Initialisation	Challenger Model	Last_Execution	Responsible
CS_TV_000049	Product Price Tendence	RMSD	0.5	2017-03-06;20:25:26.650	Automatic	CS_TV_000459		2017-03-06;20:25:27.962	phil.winters@knime.com
Washington,_D.C	AirBNB Price Prediction Cities	RMSD	0.5	2017-03-06;20:25:13.24	Automatic	all		2017-03-06;20:25:14.657	modelFactory@knime.com
Vienna	AirBNB Price Prediction Cities	RMSD	0.5	2017-03-06;20:24:54.742	Automatic	all		2017-03-06;20:24:56.436	modelFactory@knime.com

- Process Configuration
  - Specify an existing Model_Initialization Process
  - This chooses a “similar” process configuration
  - Runs on the alternate data until there is enough to “retrain” on new data
    - Switch happens automatically.
  - More sophisticated might be for INIT to do a similarity search, then use the “closest” process configuration

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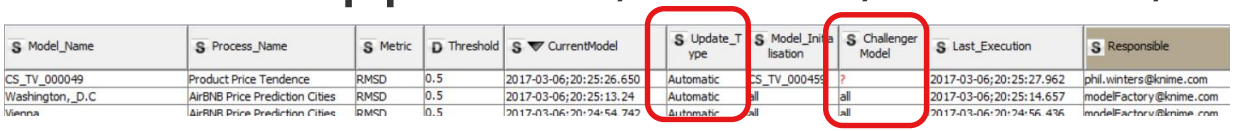
Challenge an existing model process

- with a new approach, model, method, data etc.



Model_Name	Process_Name	Metric	Threshold	CurrentModel	Update_Type	Model_Initialisation	Challenger Model	Last_Execution	Responsible
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Vienna	AirBNB Price Prediction Cities	RMSD	0.5	2017-03-06;20:24:54.742	Automatic	all	all	2017-03-06;20:24:56.436	modelFactory@knime.com

  - Create a new Model Process
  - Create a new Model Configuration
    - Set Update_Type = Challenger
    - A Challenger will never be Deployed !
  - Point the Champion Configuration to the Challenger
    - Statistics will be captured for both
  - When you are happy, swap them out.

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Manually Retrain process

- A production model_configuration that is only retrained when triggered

Model_Name	Process_Name	Metric	Threshold	CurrentModel	Update_Type	Model_Initialisation	Challenger Model	Last_Execution	Responsible
CS_TV_000049	Product Price Tendence	RMSD	0.5	2017-03-06;20:25:26.650	Automatic	CS_TV_000459	?	2017-03-06;20:25:27.962	phil.winters@knime.com
Washington,_D.C	AirBNB Price Prediction Cities	RMSD	0.5	2017-03-06;20:25:13.24	Automatic	all	all	2017-03-06;20:25:14.657	modelFactory@knime.com
Vienna	AirBNB Price Prediction Cities	RMSD	0.5	2017-03-06;20:24:54.742	Automatic	all	all	2017-03-06;20:24:56.436	modelFactory@knime.com

  - Model Process Configuration
    - Update_Type is set to MANUAL
      - Because we want to continue scoring and capturing information to evaluate
      - No Retraining will occur
    - Reset Type to MANUAL_RETRAIN
      - Retraining will then occur
      - At the end of the model process, the type will be reset to MANUAL

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Eliminating/Extending a process step from a Process Model

- Because the process is fundamentally different

- Create a new Model Process
  - Use “Empty” step templates to eliminate steps
  - Alternately, extend the Abstract Modelling Workflow

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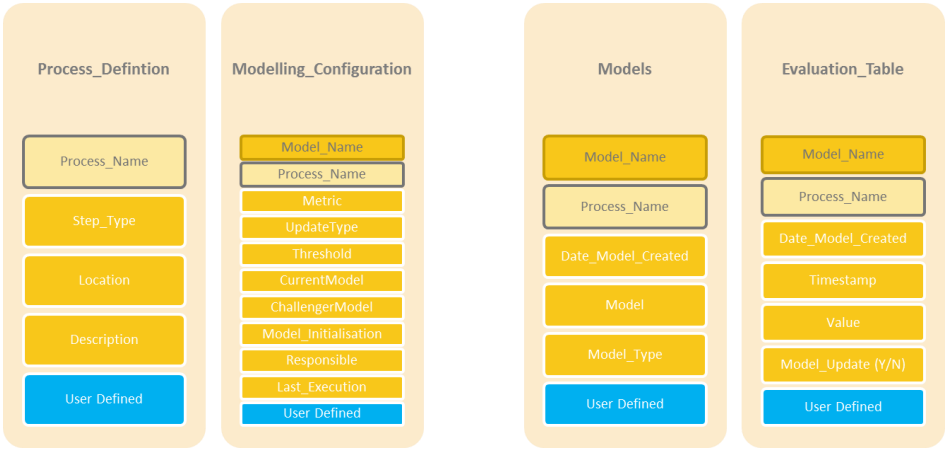
More Requirements for the Modelling Factory

- We have security, standards, teams, requirements…
- Extend the appropriate table with User-Defined Fields
  - These fields are then available within your model factory all as flow variables



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My Life: Easy Peazy Lemon Squeazy….

- Advanced Price Prediction (Forecasting)
- 29000 models
- Built, Trained, Scored, Tested, Monitored, Retrained

- Run Daily in 45 Minutes
- Totally Automated “Hands Off”

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My Life with Which? Consumer Association UK

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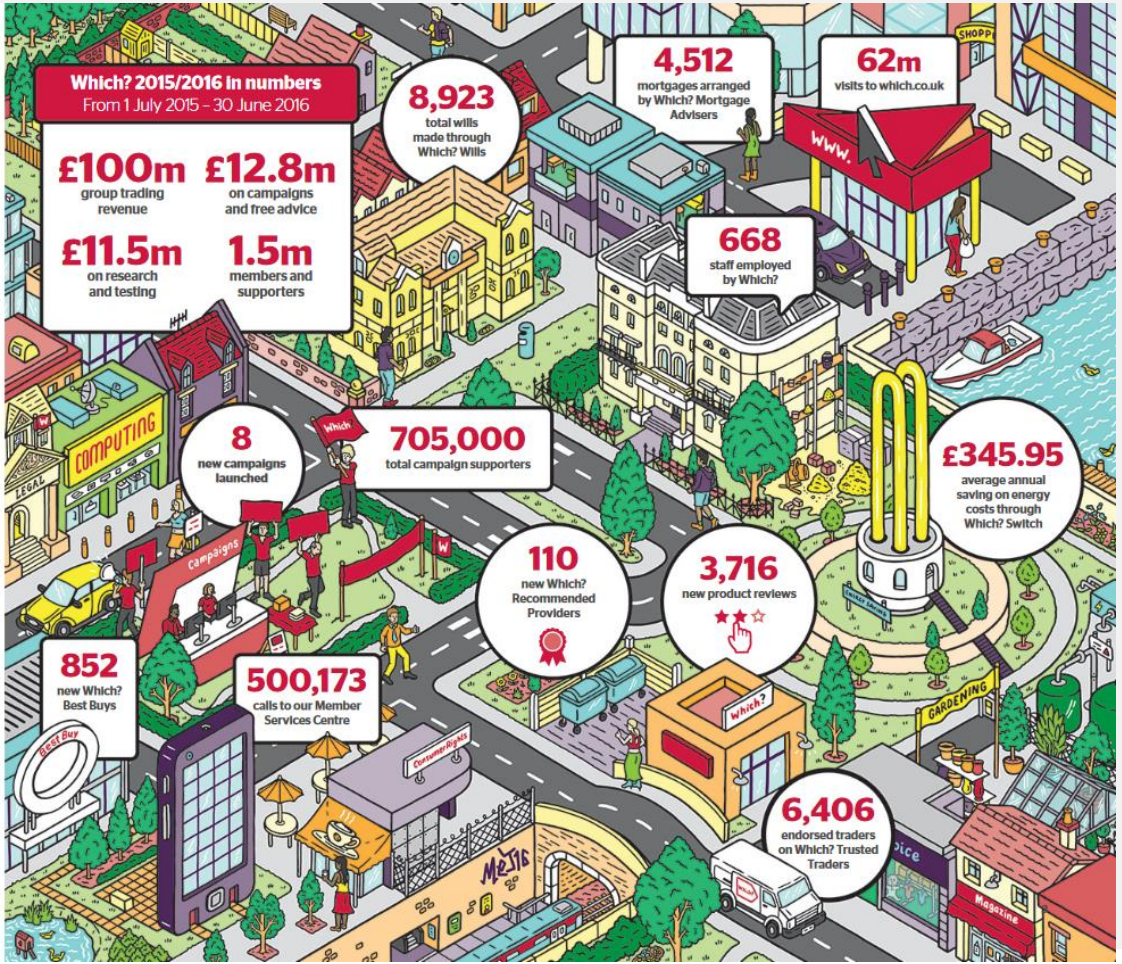
Which? exists to make individuals as powerful as the organisations they deal with in their daily lives



Which?

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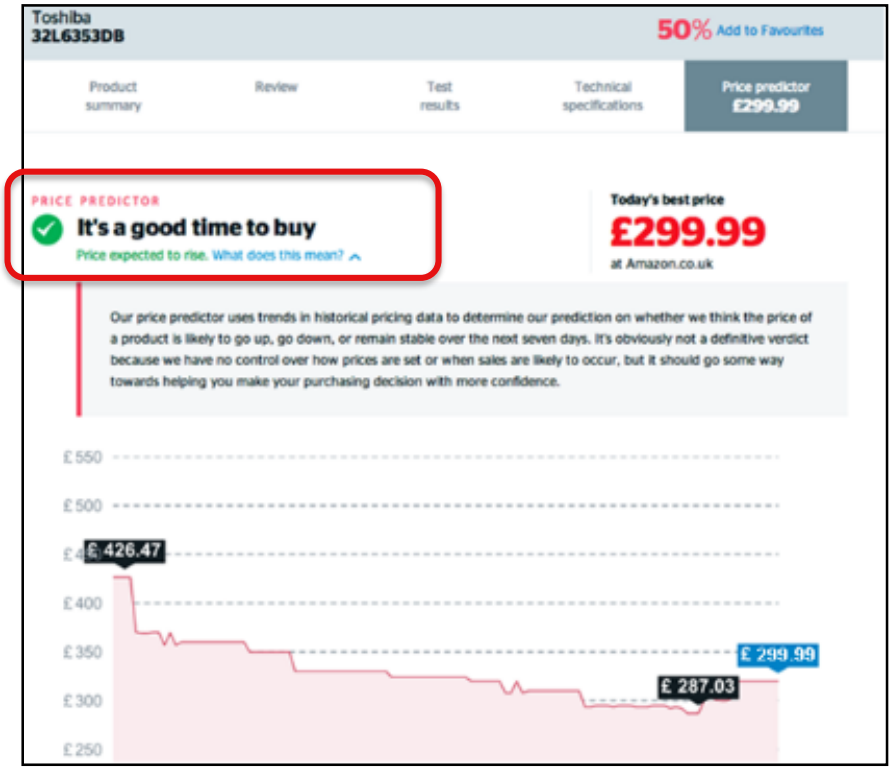
Ensemble of Decision Tree + Linear Regression



"Which? members tell us the price prediction is the most value service on the website. "

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Model Factory / Management / Automation Options

- Build your own system
  - With your favorite Package
- Take an existing, free, open source example
  - KNIME Analytics Platform
- Buy a Package
  - KNIME Server (to schedule the factory)
  - IBM SPSS Deployment Manager on IBM SPSS
  - SAS Model Management on SAS
  - Fico (but its all magic…)
  - Others? Talk to me !!!!!

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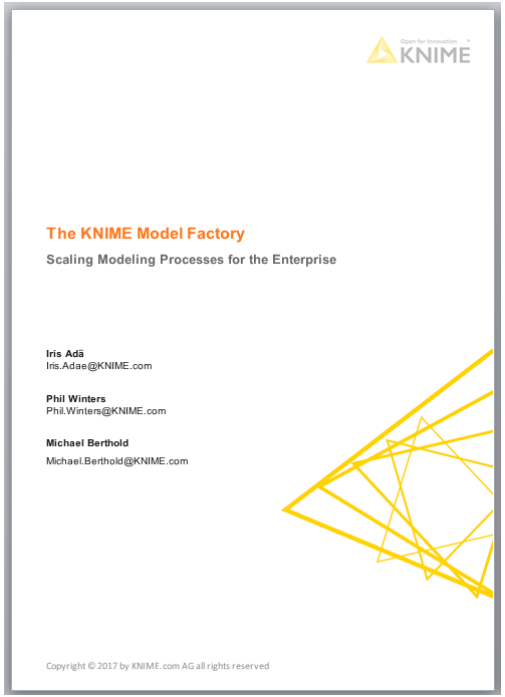
What's available: Model Factory

Examples:

- 26_Model_Process_Management
  - Factory
    - _Configuration_Template
    - Model_Factory
  - helperWorkflows
    - tempDataCopies
    - SetThresholdsToMedian
    - Webportal_CheckState
    - Webportal_SeeAll
    - Webportal_Update
    - Webportal_Update_Type_Change
  - Metainfo
    - Create_Log_Tables
    - Edit_Tables_Locally
    - Evaluation_Table.table
    - Modelling_Configuration.table
    - Models.table
    - Process_Definition.table
  - Process
    - _Metanodes
    - _Process_Step_Templates
    - AirBNB
    - AirBNB_Cities
    - Products

White paper



Next step:
Download it, learn and customize it for your own needs!

www.knime.com/whitepapers

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phil.winters@ciagenda.com