

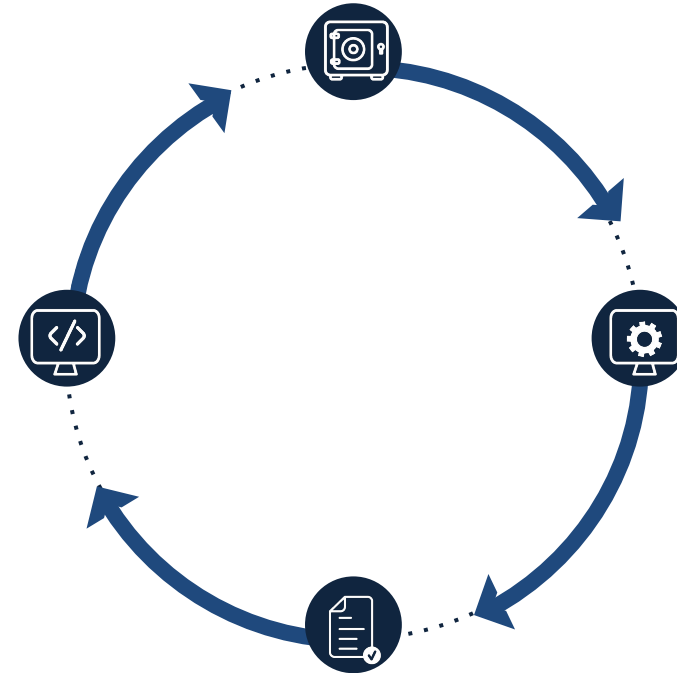
Automated Analysis of Testing Reports using Machine Learning Techniques

Murad Mamedov, QA Analyst

SECR, November 2019

Hindsight on Automation

automated tests → continuous integration



Hindsight on Automation

CI tasks:

- get source code from repository
- build project
- run test library
- deploy project
- send reports

Hindsight on Automation

CI tasks:

- get source code from repository
- build project
- run test library
- deploy project
- send reports

Hindsight on Automation

CI tasks:

- get source code from repository
- build project
- run test library
- deploy project
- **send reports**

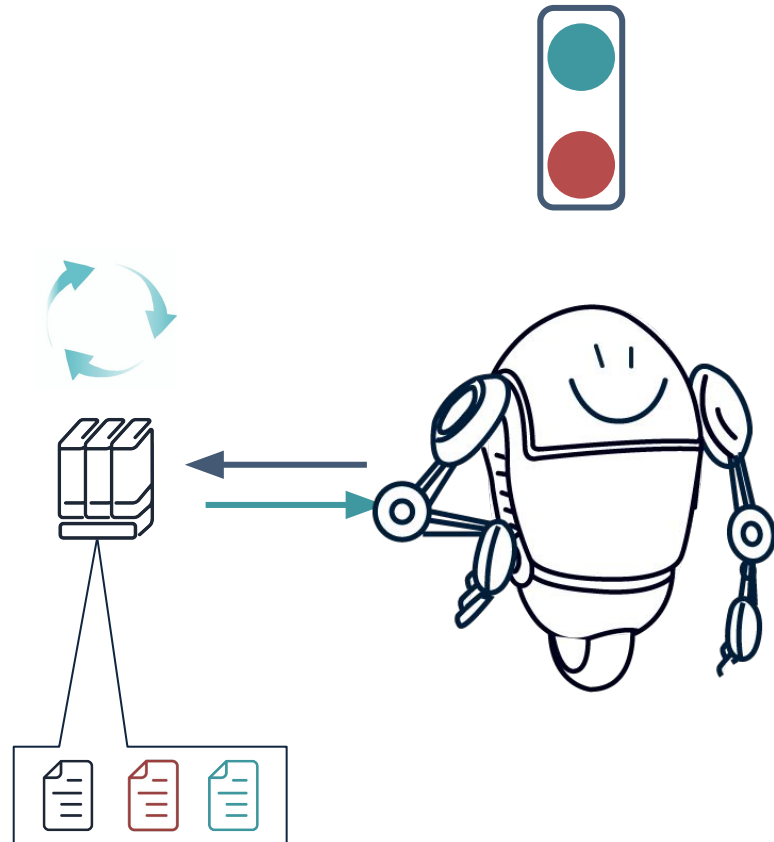
Usual QA Needs

- human factor exclusion
- knowledge management
- standardization
- labor costs reduction

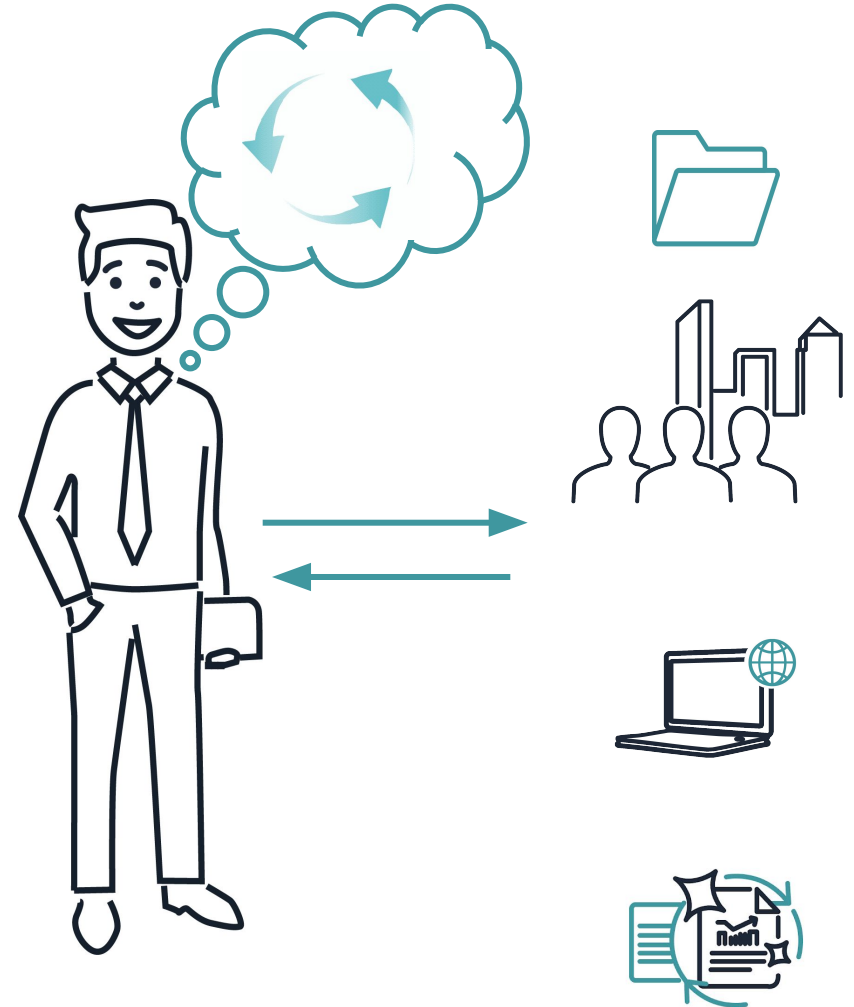
An Ideal Test Report

- Failures Root Causes Explanation
- Failures prioritization
- Recommendations for test's fix

Let's Automate Decision Making



vs.



Who is Responsible?

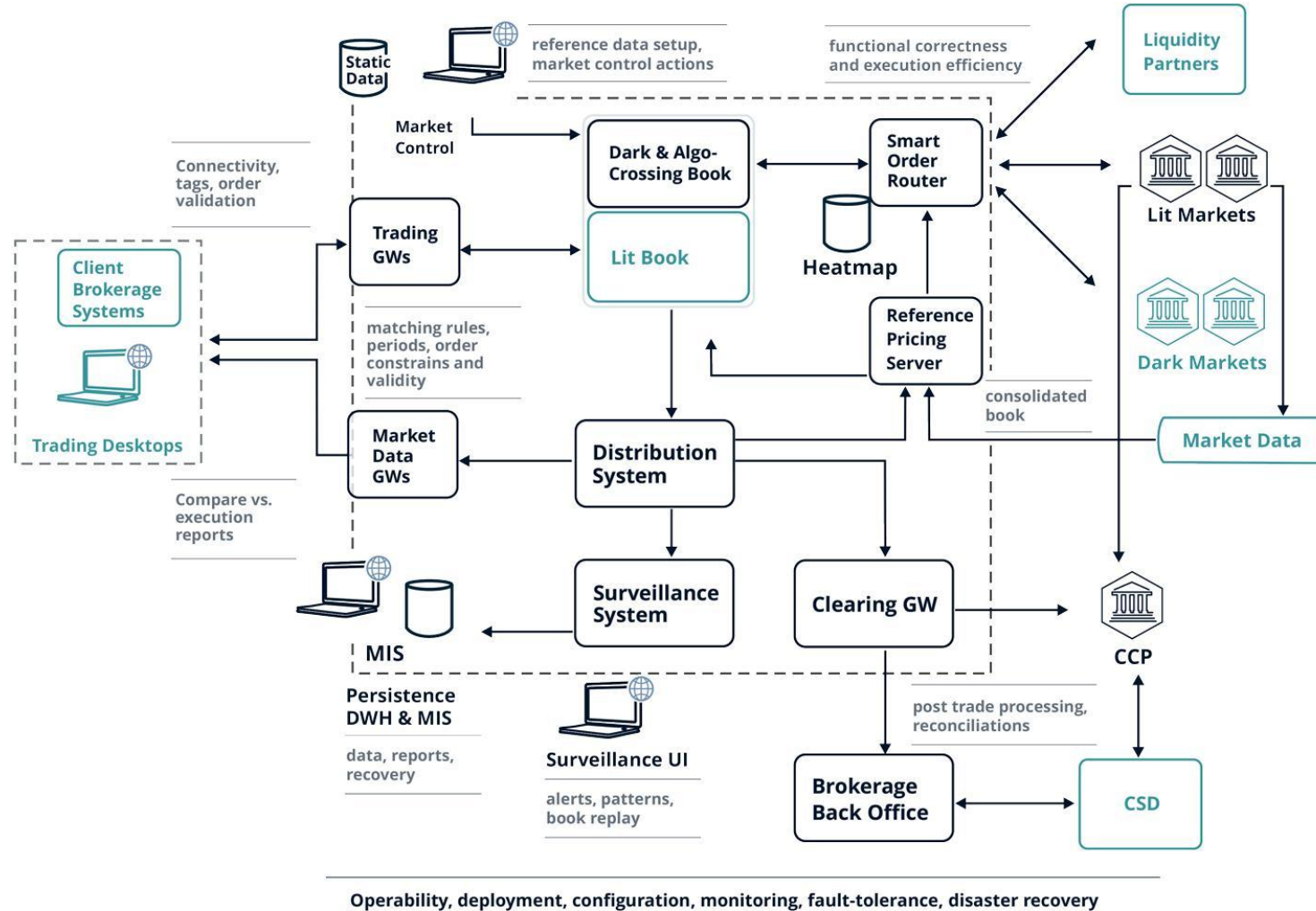


dev



qa

How We Got the Need



How We Got the Need

- Test library: +60000 test-cases
- 3-7 runs per sprint
- 10-20k tests per run
- Growing complexity of the software
- Relentless integration of checks
- Coverage Deepening

Task Determination

- Detailed Analytics & Recommendations
- Understanding of each failure
- Failures Source Detection
- Relevant Message Recognition

Task Determination

- Detailed Analytics and Recommendations
 - ↑ Understanding of each failure
 - ↑ Failures Source Detection
 - ↑ Relevant Message Recognition

Relevant message recognition

Passed Step of Test Case:

send NewOrderSingle (**PASSED**) [0.001s]

- receive ExecutionReport (**PASSED**) [0.001s]:

+ Input Parameters

- Verification: Message (**PASSED**):

Field	Expected Result	Actual Result	Status
...
OrdType	LIMIT	LIMIT	PASSED
Status	NEW	NEW	PASSED
...

Relevant message recognition

Failed Step of Test Case:

send NewOrderSingle (**PASSED**) [0.001s]

- **receive** ExecutionReport (**FAILED**) [0.421s]:

+ Input Parameters

+ **Verification: Similar message [1]. Failed/Passed/Conditionally Passed/NA: 4/26/0/6 (FAILED)**

+ **Verification: Similar message [2]. Failed/Passed/Conditionally Passed/NA: 2/28/0/6 (FAILED)**

+ **Verification: Similar message [3]. Failed/Passed/Conditionally Passed/NA: 1/29/0/6 (FAILED)**

- **Verification: Similar message [4]. Failed/Passed/Conditionally Passed/NA: 1/29/0/6 (FAILED):**

Field	Expected Result	Actual Result	Status
...
OrdType	LIMIT	LIMIT	PASSED
Status	NEW	REJECTED	FAILED
...

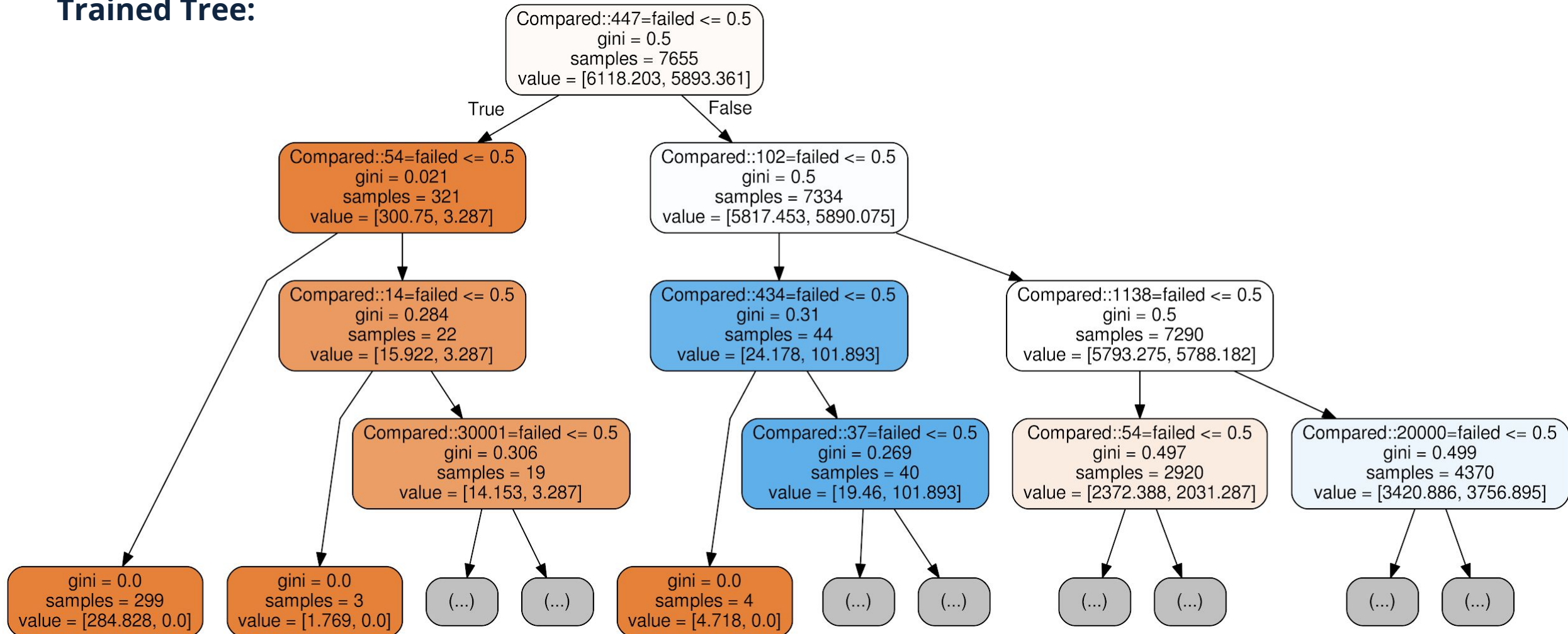
Relevant message recognition

Differences in Fields:

message a	OrdType	2	2	PASSED
	TimeInForce	0	0	PASSED
	Side	1	1	PASSED
	OrderQty	2000	5000	FAILED
	Price	100	100	PASSED
message b	OrdType	2	2	PASSED
	TimeInForce	0	0	FAILED
	Side	2	2	FAILED
	OrderQty	1000	1000	PASSED
	DisplayQty	1000	1000	PASSED

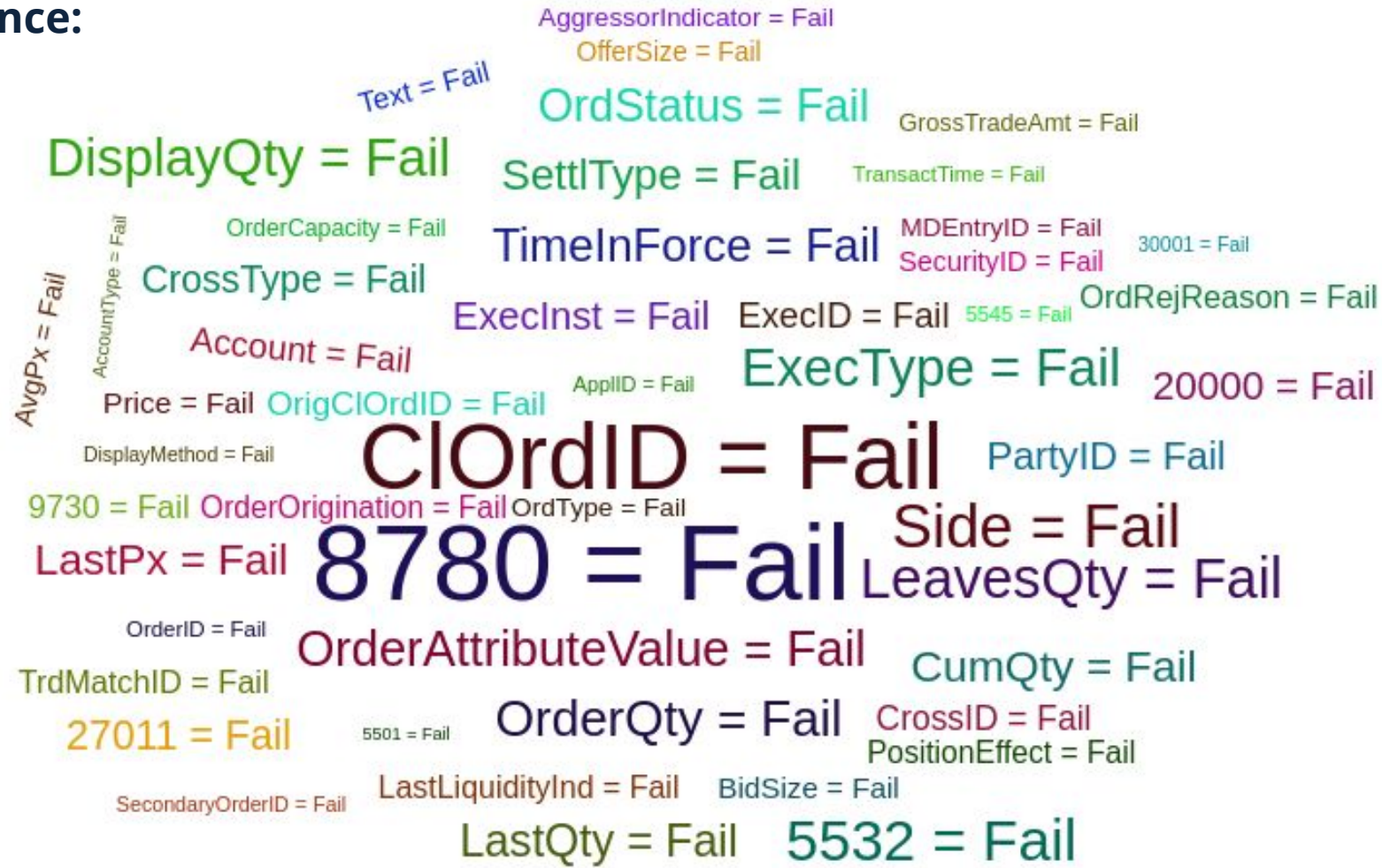
Relevant message recognition

Trained Tree:



Relevant message recognition

Feature Importance:



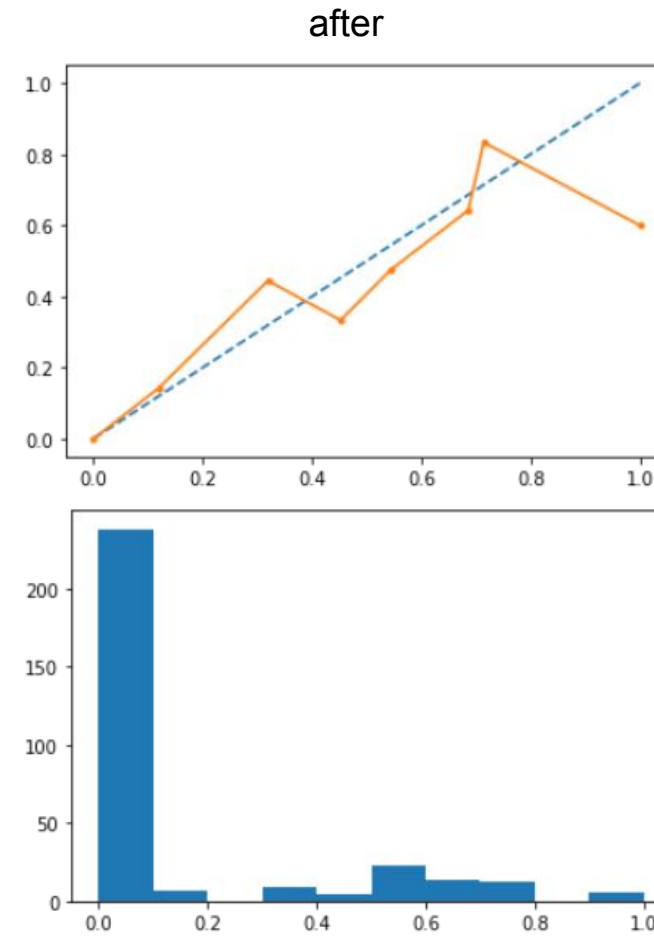
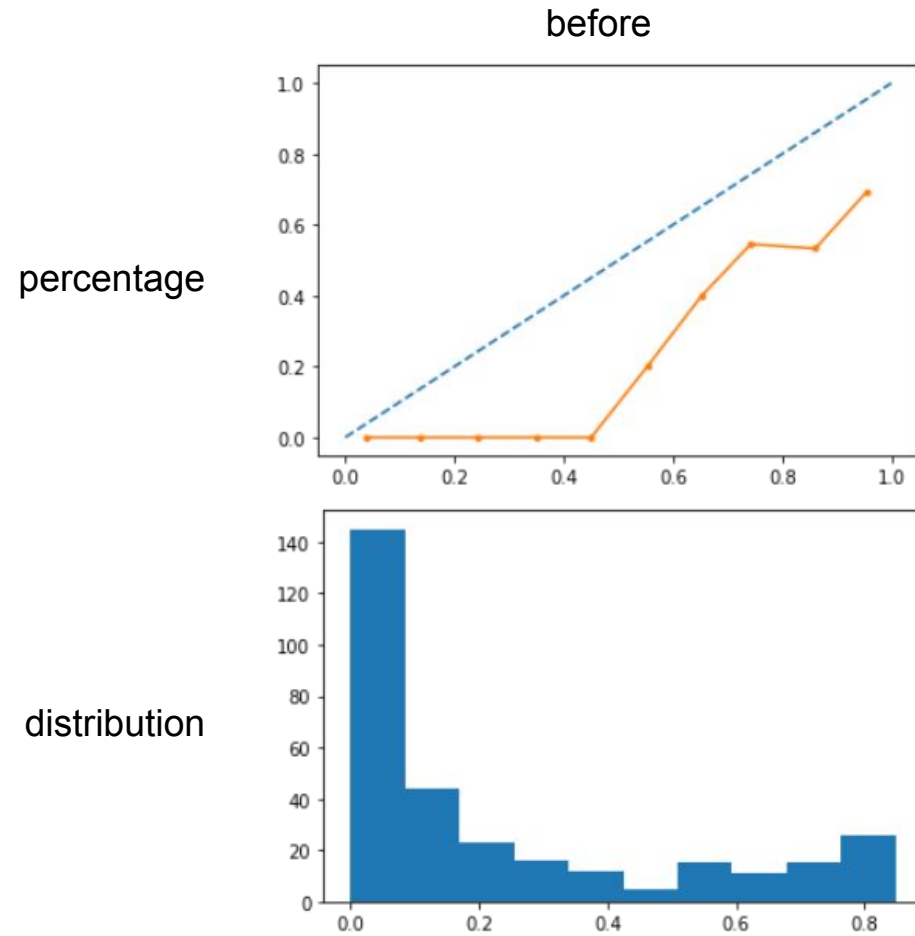
Relevant message recognition

Narrow Range Example:

- **Action: 5 MCOF01FIX01 receive OrderMassCancelReport (FAILED) [2.005s]** : Wait MassCancelReport
 - + **Predictions: 3 PCs**
 - Collect Machine Learning data for this action
 - + **Input Parameters**
 - Sort verifications by fields:
 - + **Verification: Similar message [1]. Failed/Passed/ConditionallyPassed/NA: 3/4/0/8 (FAILED)** **94%**
 - + **Verification: Similar message [2]. Failed/Passed/ConditionallyPassed/NA: 3/4/0/8 (FAILED)** **94%**
 - + **Verification: Similar message [3]. Failed/Passed/ConditionallyPassed/NA: 2/5/0/8 (FAILED)** **81%**
 - + **Status**

Relevant message recognition

Calibration Output:



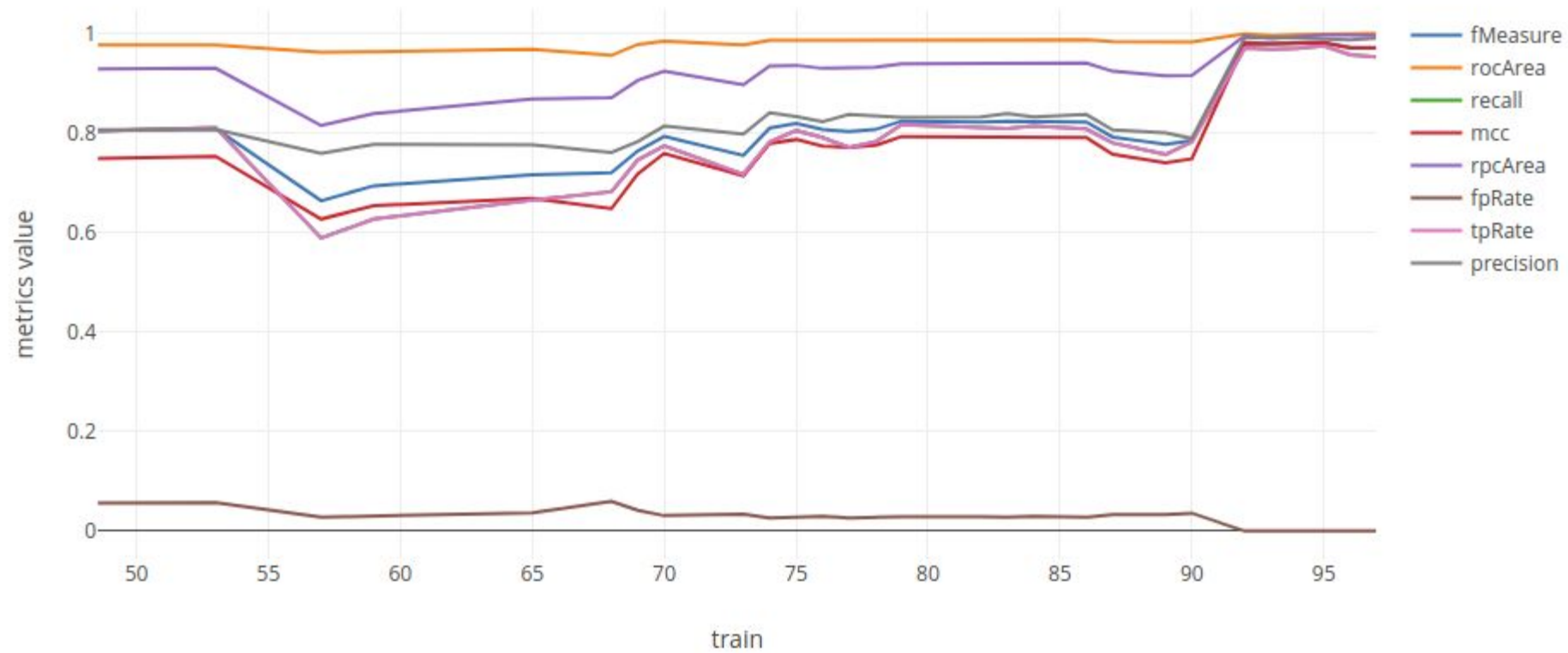
Relevant message recognition

Key activities on data:

- Data markup
- Dimensionality reduction
- Dataset Cleanup
- Calibration

Relevant message recognition

Metrics:



Next Level

- Detailed Analytics & Recommendations
- Understanding of each failure
- Failures Source Recognition
- ✓ Relevant message recognition

Failures Source Detection

Failures sources:

- test's code
- test data
- static reference data
- dynamic reference data
- SUT behavior

Failures Source Detection

Failures sources:

- autotest {
 - test's code
 - test data
- environment {
 - static reference data
 - dynamic reference data
 - SUT behavior

Failures Source Detection

The same dataset but:

- Only True-class examples
- Examples into signatures
- Split by message type

Failures Source Detection

	TimeInForce	Text	CumQty	ExecID	TransactTime	ExecType	LeavesQty	DisplayQty	SecurityID	ClOrdID	StopPx	Side	UnderlyingReferenceEntityType	MDEntryID	OrderID	OrderQty	LastQty	LastPx	AvgPx	SettleType	PositionEffect	MktBidFx	MisgType	MisgSeqNum	OrdStatus	LastLiquidityInd	GrossTradeAmt	TradingSessionID	OrdType	OrderCapacity	PartyID	Price	PartyIDSource	PartyRole	Account	agglo	kmeans	dbscan			
1844																																						0	0	-1	
599																																							0	0	-1
7825																																							0	0	-1
10644																																							0	0	-1
349																																							6	1	-1
478																																							6	1	-1
13302																																							8	2	-1
2493																																							3	3	-1
8087																																							3	3	-1
614																																							2	4	-1
465																																							2	4	-1
2794																																							2	5	-1
6370																																							2	5	-1

Failures Source Detection

	TransactTime	Text	OrderReason	OrderStatus	ExecType	DisplayQty	IsverZQty	CumQty	LastQty	LastPx	AvgPx	WorkingIndicator	TradeMatchID	TradeExplanationReason	TradeExplanationType	TypeOfTrade	TradeLiquidityIndicator	LastLiquidity	TradingSessionID	PriceDifferential	MktZQty	OrigOrdID	ExecInst	TimeInForce	OrderBook	Currency	SecurityExchange	OrderQty	Account	Price	SecurityID	OrdType	MDEntryID	COOrdID	OrderID	ExecID	Side	PartyID	PartyRole	PartySource	OrderCapacity	GroupID	DisplayMethod	ExecTime	AppID	CrossType	CrossID	StopPx	PriceType	MiscType	MiscSeqNum	HeartBlint	DefaultAppVerID	EncryptMethod	ResetSeqNumFlag	NewSeqNo	GapFillFlag	TotalAffectedOrders	MassActionReportID	MassActionType	MassActionResponse	MassActionScope	PositionEffect	Settlement	TradeSize	MktBidPx	GrossTradeAmt	TradeLimEans	counter	verdict
3761																																																							6	2	F													
8920																																																								6	1	F												
5020																																																								6	1	p												
99																																																								6	6	r												
7870																																																							6	1	r													
7036																																																						6	1	r														
2232																																																								6	2	r												
3248																																																								6	4	r												
6960																																																								6	4	r												
1963																																																									6	10	r											
8648																																																								6	1	r												
12405																																																								6	1	r												

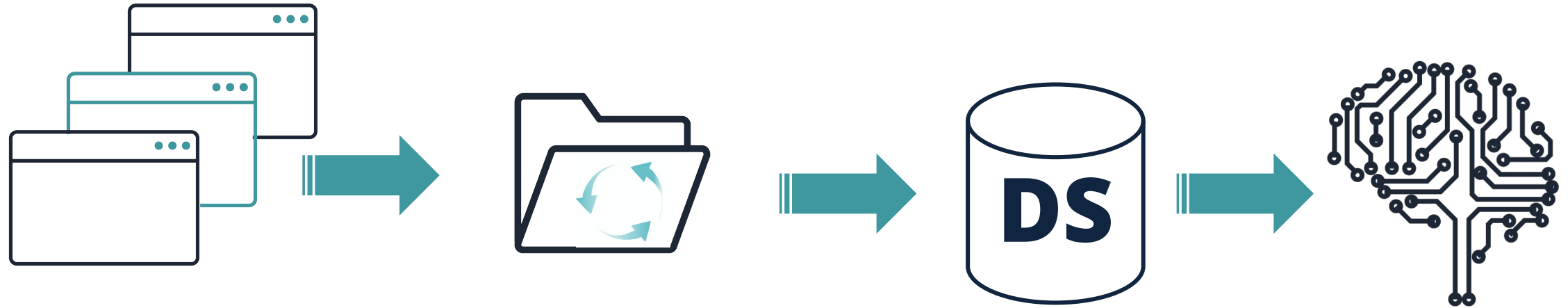
Failures Source Detection

	TransactTime	Text	OrderReason	OrderStatus	ExecType	DisplayQty	LeavesQty	CumQty	LastQty	LastPx	AvgsPx	WorkingIndicator	TradeMatchID	TradeExplanationReason	TradeExplanationType	TypeOfTrade	TradeLiquidationIndicator	LastLiquidated	TradingSessionID	PriceDifferential	MinQty	OrigOrderID	ExecInst	TimeInForce	OrderBook	Currency	SecurityExchange	OrderQty	Account	Price	SecurityID	OrdType	MidEntryID	OrderID	OrderID	ExecID	Side	PartyID	PartyRole	PartySource	OrderCapacity	GroupID	DisplayMethod	ExpireTime	AppID	CrossType	CrossID	StopPx	PriceType	MiscType	MiscSeqNum	HeartBlint	DefaultAppVerID	EncryptMethod	ResetSeqNumFlag	NewSeqNo	GapFillFlag	TotalAffectedOrders	MassActionReportID	MassActionType	MassActionResponse	MassActionScope	PositionEffect	SettleType	BidSize	MktBidPx	GrossTradeAmt	Label_Em_eans	counter	verdict
1230																																																						10	24	to														
914																																																					10	6	to															
5015																																																					10	4	to															
948																																																				10	1	m																
8688																																																					10	1	m															
2235																																																					10	1	to															
3601																																																					10	3	m															
1264																																																					10	11	m															
1139																																																							10	2	m													
1460																																																						10	1	m														
1184																																																							10	2	p													
5254																																																						10	2	p														
5144																																																							10	1	p													
51																																																							10	2	p													
8189																																																							10	1	p													
10807																																																							10	1	p													
14133																																																							10	1	p													
12414																																																							10	1	to													
13135																																																							10	1	to													

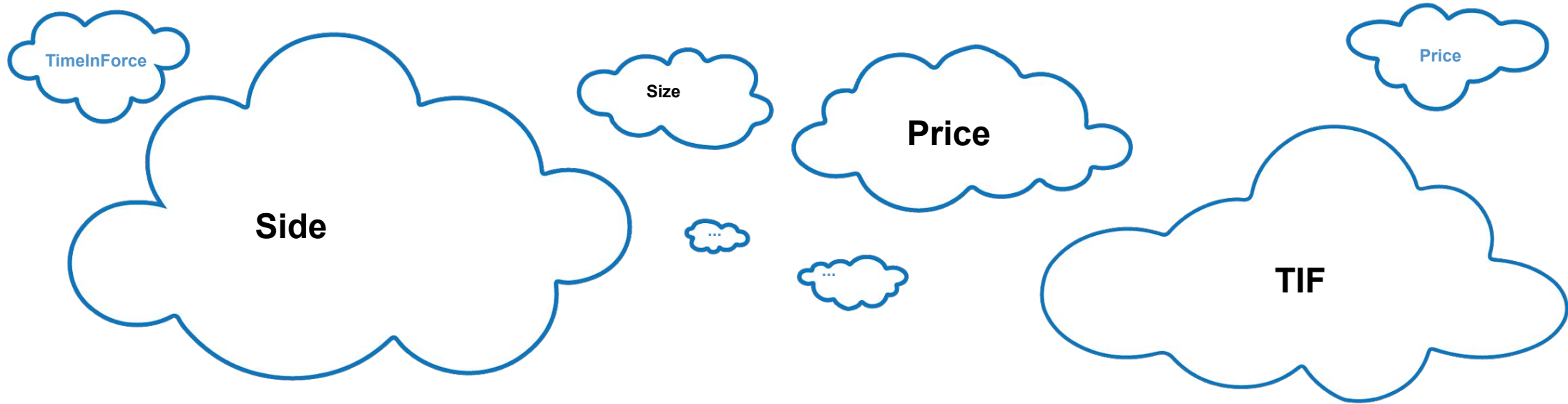
Further Work

- Enlarge Dataset in semi-automated way
- Reach 99% accuracy in failure recognition
- Enhance Data Pipeline

Data Pipeline



Conclusion



Buy order

100 lots of shares by \$2000

**till the end
of day**

