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A brief intro to applications of Machine Learning in Finance

Jason Zhou & Jeff Hou

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Intro to AQUMON

- Startup founded in 2016.
- Gives asset allocation advice to retail customers, institutional customers and professional individuals.
- Strong algorithm development and IT infrastructure team.
- Covers multiple asset classes (stocks, mutual funds, ETFs, futures, FX, etc.)
- Self-developed trading system that can place orders in many exchanges globally in less than 5ms.

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Intro to AQUMON

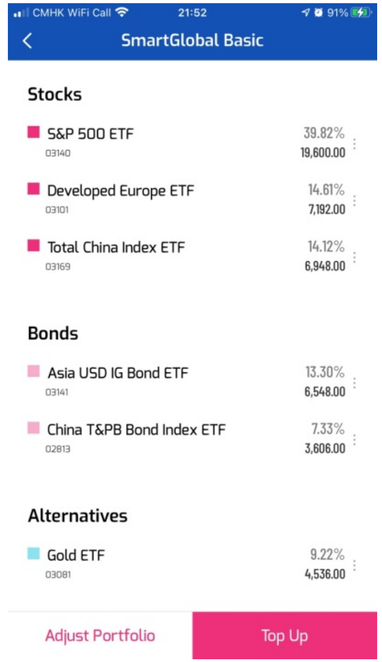
B2C

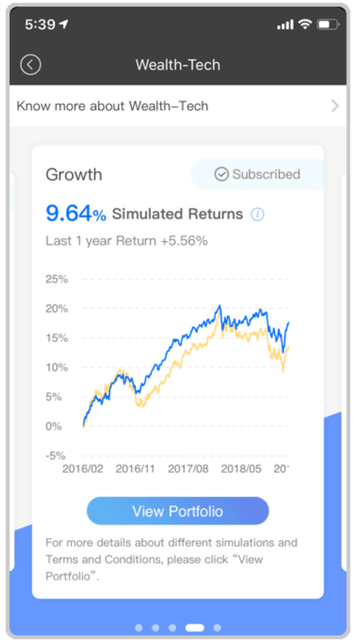
- Risk Preference
- Regional Preference (HK/US)
- …

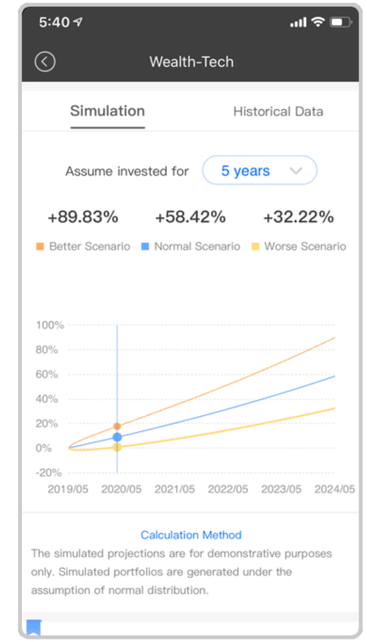
- Asset Allocation Advice
  - Recommended Financial Securities
  - #Shares

B2B

- Asset Allocation Advice
- Trading System
- Mutual Fund selection platform
- …







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Applications of Quantitative Methods in Financial Market

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Risk Management in Payments

Jeff Hou

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Cases

- Fraud Payment Detection (Account/Card being stolen and used by others)
- Anti-money Laundry
- Cash out/advance (Withdrawing cash from credit cards)
- Other regulatory / compliance items…

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Challenges

- Rule-based system is highly experience dependent but highly inaccurate
  - 90%-95% reported by AML rule are wrong.
- Fraud cases are rare and not reported, especially for Credit Card Cash-out.
- Fast enough to make the judgement and complicated enough to make the right judgement.
- Pattern varies greatly along time.

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Alipay Risky Payments Detection

- Millions of transaction records.
- 297 features + 1 date -> label (risky / non-risky).
- Supervised Learning, binary classification.

label	date	f1	f2	f3	f4	f5	f6	f7	...	f290	f291	f292	f293	f294	f295	f296	f297
0	20170905	0	1	0	1	100803.0	0	2	...	2.0	1.0	1.0	2.0	2.0	2.0	1.0	2.0
0	20170905	1	1	1	0	100804.0	0	6	...	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
0	20170905	1	0	2	1	NaN	1	4	...	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
0	20170905	0	0	1	0	100803.0	1	6	...	2.0	2.0	3.0	2.0	2.0	2.0	2.0	2.0
0	20170905	1	1	1	1	100803.0	1	3	...	1.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0

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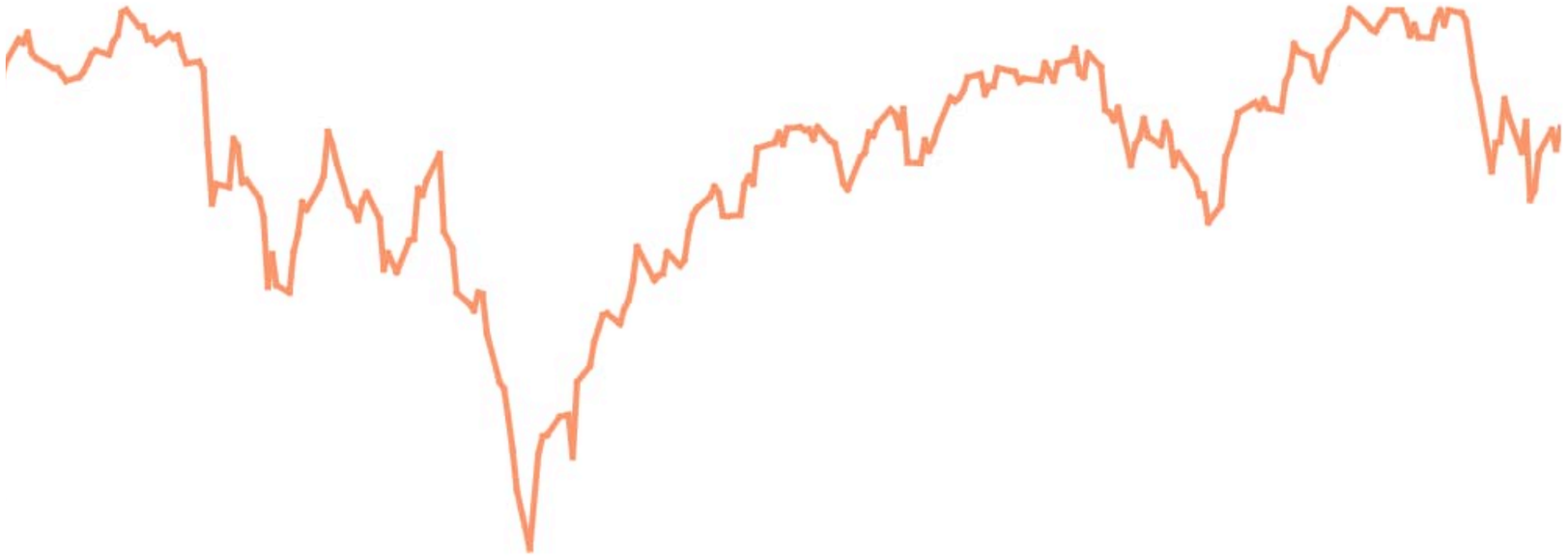
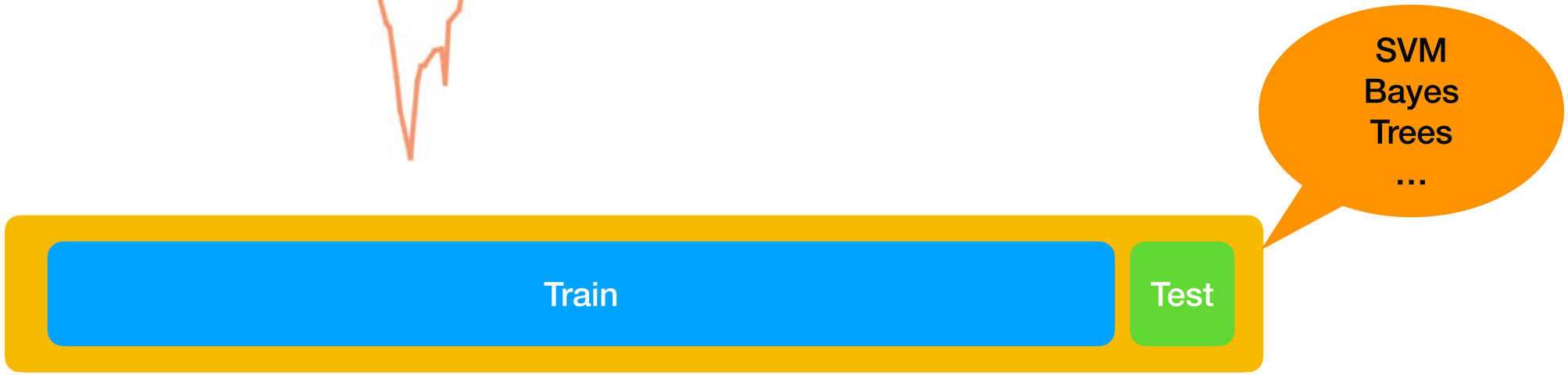
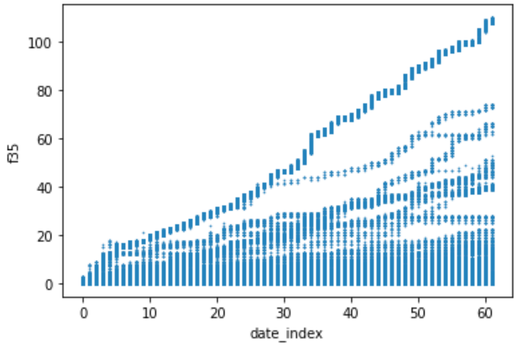
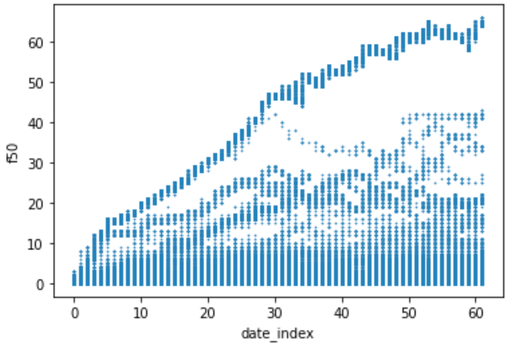
Alipay Risky Payments Detection

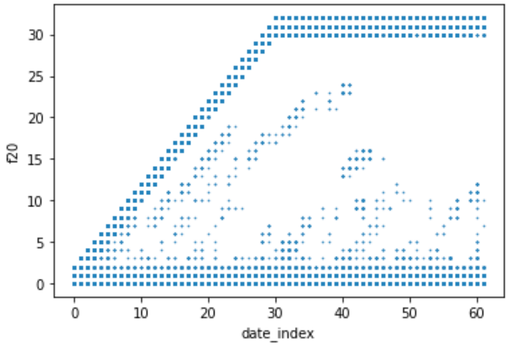




Alipay Risky Payments Detection







Features’ value varies a lot along time

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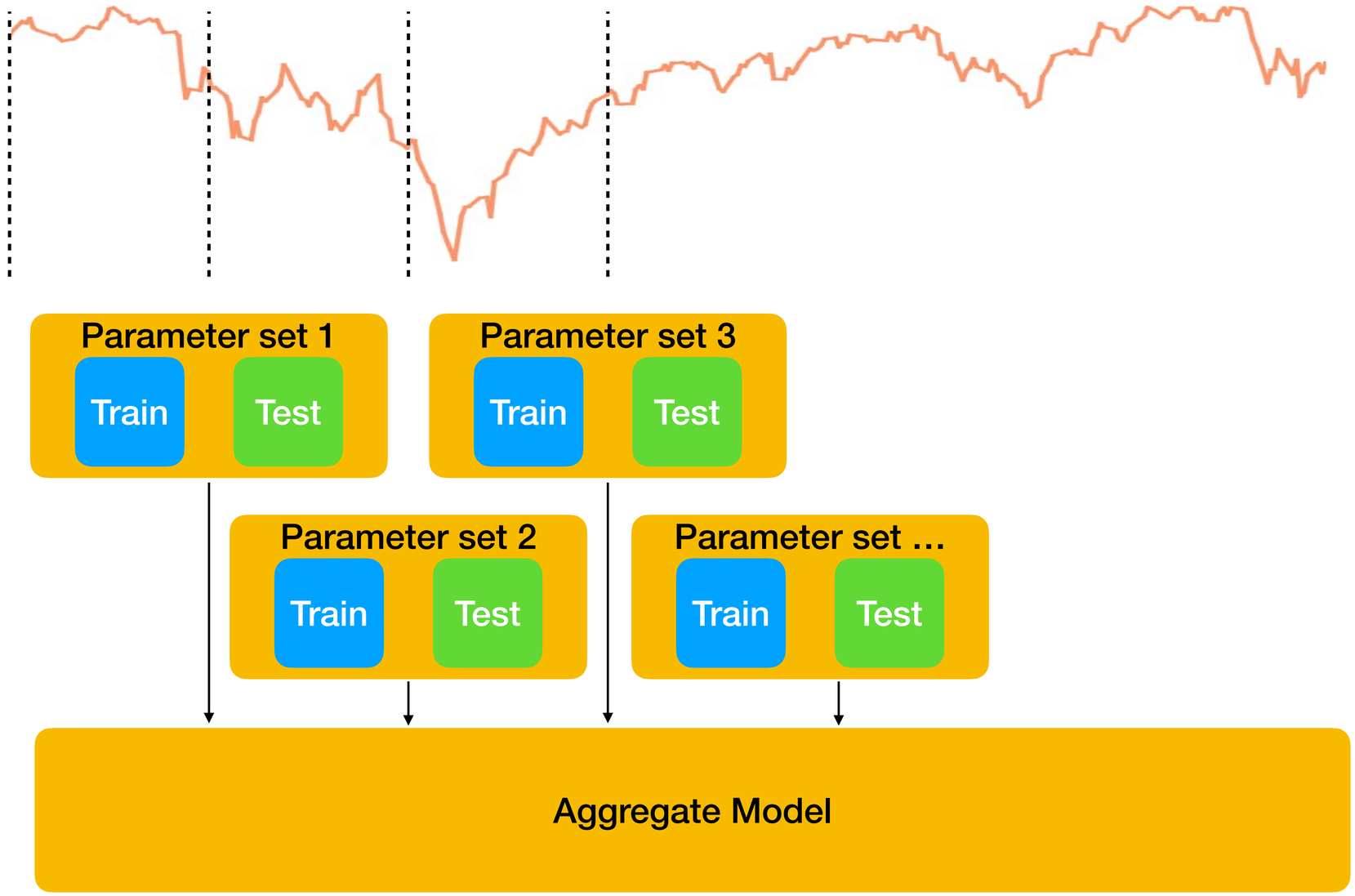
Alipay Risky Payments Detection



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Alipay “AlphaRisk” Engine

- Active PU Learning (Active Learning + two-step Positive Unlabelled (PU) Learning)
- Gather Data and Label some risk payments as Positive samples (P)
- Initialise the model
- while stopping criteria not reached
  - Sampling
    - Label the Unlabelled set (U) with the current model
    - Pick out a few samples with the lowest certainty
    - Perform K-Means on them and select some points from each cluster
  - Labelling
  - Update P set (drop N, mentioned later)
  - two-step PU learning to update the model

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Alipay “AlphaRisk” Engine

- Two step PU learning
  - Step 1
    - Put some samples from P set as spy into U set.
    - EM
      - E: predict label probability
      - M: update model parameters
  - Step 2
    - Label samples in U scoring lower than spies as N.
- The model chosen is GBRT.

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Alipay “AlphaRisk” Engine

- Advantages compared to Supervised Learning
  - Labels are difficult to acquire
    - Fraud cases are rare and not reported
    - Labelling a sample as Negative needs to filter out all fraud conditions
    - Expert labelling is very time consuming
- Advantages compared to Unsupervised Learning
  - Models like Isolation Forest not scalable with the growth of the number of features
  - Graph algos requires high computational power -> hard to make it fast enough for payments.
- Active Learning + Semi-supervised Learning

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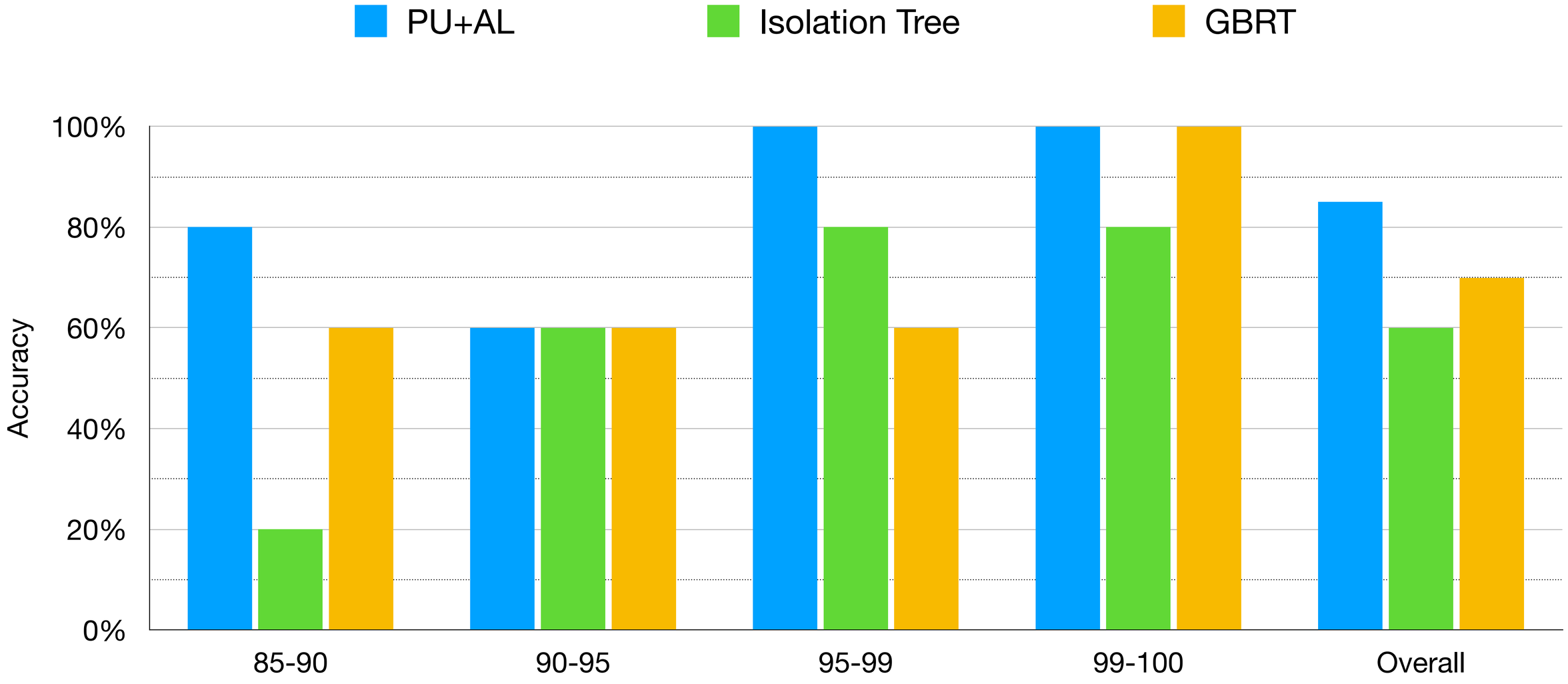
Alipay “AlphaRisk” Engine



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Reference

- Alipay AlphaRisk https://mp.weixin.qq.com/s/dj_JaHeaafihl57qdCig7Q
- Two-step PU Learning https://www.cs.uic.edu/~liub/S-EM/unlabelled.pdf
- AI in Risk Management by PwC https://www.pwchk.com/en/consulting/publications/reshaping-banking-with-artificial-intelligence.pdf p.53-p.58

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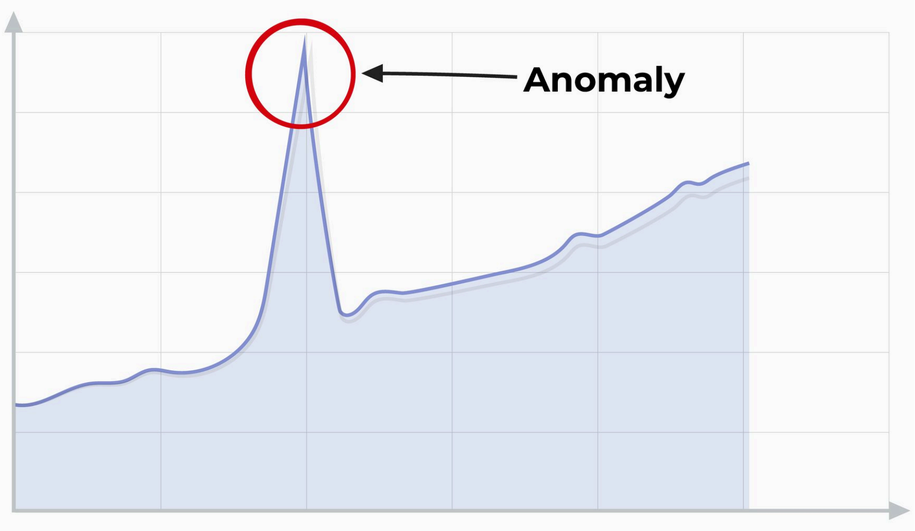
Extra Cases

- Time Deposits business for “W bank”.
  - cross sell (active user in security trading)
  - patterns (e.g. sensitive to interest rates)
- Anomaly detection in stock price
  - the price we receive may be WRONG!
  - harmful to our strategy



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Thanks