

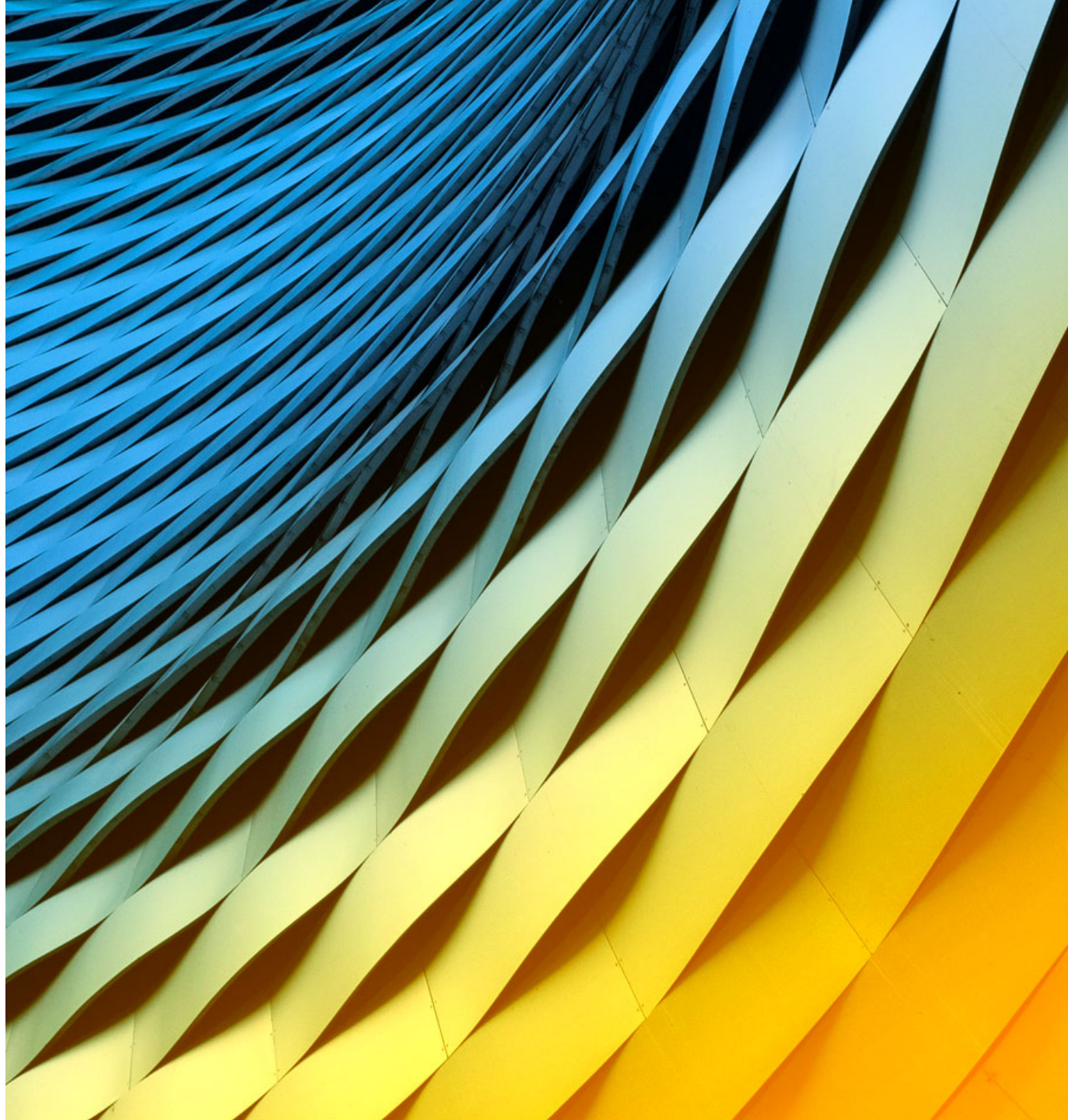
PredictNow.AI – Tail Hedging in the Age of Machine Learning

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Founder
PredictNow.AI

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Tail Hedging in the Age of Machine Learning



PredictNow.ai

Ernest Chan, Ph.D.
Founder of PredictNow.ai

Ernest Chan

- Founder of [PredictNow.ai](https://www.predictnow.ai), a financial machine learning SaaS.
- Quantitative hedge fund manager (www.gtscm.com) and well-known quant finance author (www.epchan.com) and blogger (epchan.blogspot.com).
- 26 years of machine learning R&D experience, starting at IBM T.J. Watson Research Center.
- Author of *Quantitative Trading*, *Algorithmic Trading*, and *Machine Trading* (Wiley 2009, 2013, 2017).
- Quoted by Wired, New York Times, Bloomberg, CNBC, and Wall Street Journal.
- Ph.D. in Physics from Cornell University.



Returns all over the map in 2020 Q1

- Renaissance Institutional Equities Fund: ~ -18%
- Bridgewater Pure Alpha Fund: ~-20%
- D.E. Shaw Oculus Fund: ~+7%
- AQR Managed Futures Fund: ~+3%
- AQR Diversified Convexity Fund: ~+40%

Source: Preqin

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Tail Hedge Strategies won?

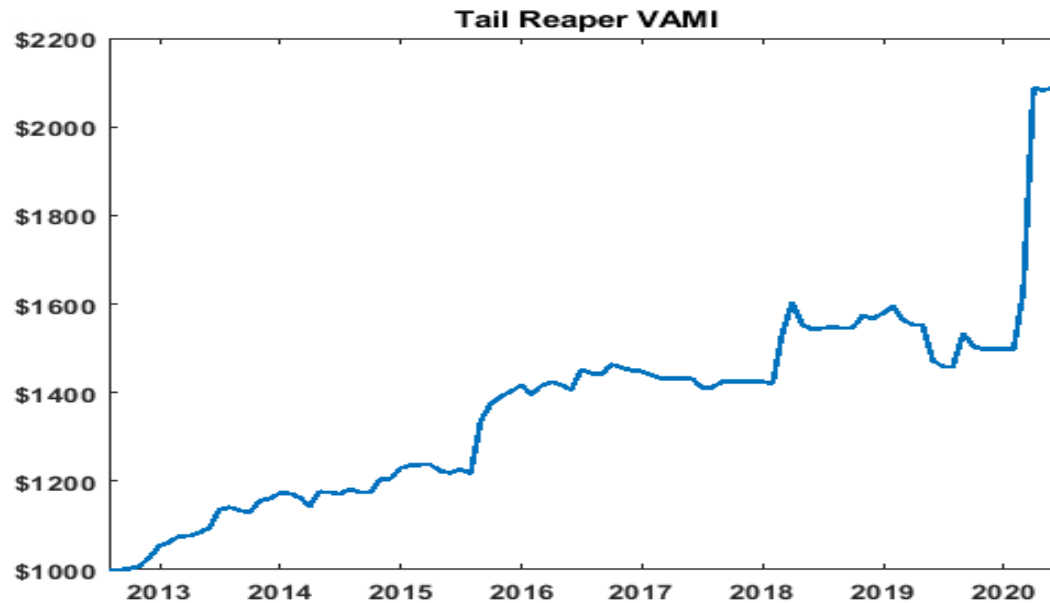
- Mark Spitznagel of Universa Capital up > 4000% in Q1.
 - But what were his returns in calmer years?



The CBOE Eurekahedge Tail Risk Index is shown for illustrational purposes only.

Tail Hedge Strategies won?

- QTS Capital's Tail Reaper strategy up 80% gross in 2020 Q1, but 30% drawdown in 2020 H2.



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Machine Learning to the Rescue

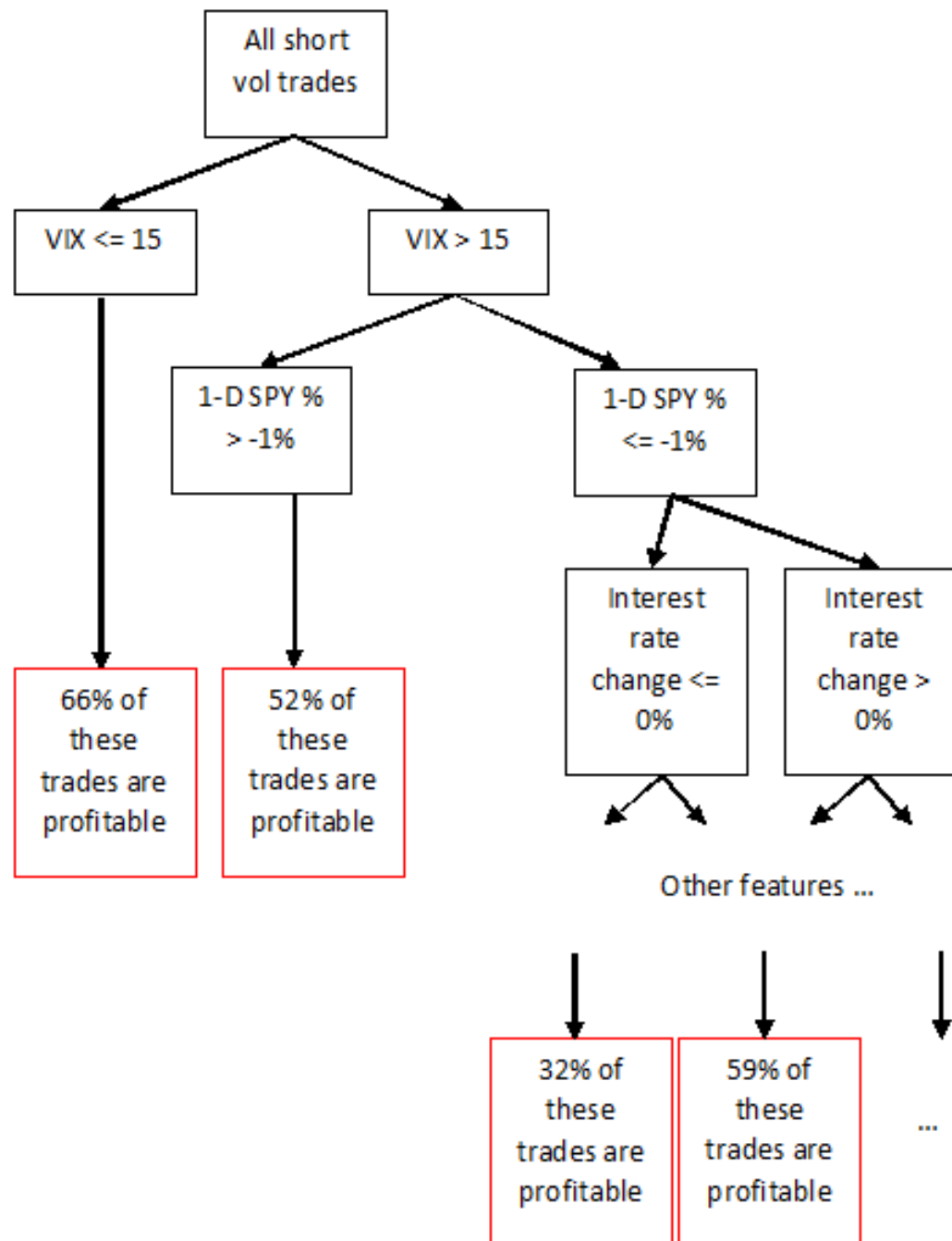
- Machine learning can **improve *any* strategy**
 - Simple trend-following strategy like Tail Reaper
 - Factor models (avoiding value traps!)
 - Even discretionary or fundamental strategies!
- Machine learning can compute **Probability of Profit** for a trade.
 - That trade can come from any strategy, as long as it has a track record (backtest or live).
 - We reduced drawdown from 40% to 30% in 2020 H2.

Do you know the **Probability of Profit** of Your Next Investment?

- Any child can compute their unconditional probability of profit.
 - “Winning ratio”
 - Useless for predicting whether next trade will be profitable *conditioned on current circumstances*.
- Machine learning can compute the **conditional probability of profit**.
 - *Conditioned on a set of predictors external to base strategy.*
 - “Meta-labeling” pioneered by Dr. Marcos Lopez de Prado.

What machine learning method to use?

- Logistic regression?
 - Linear models can't pick up nonlinear, hierarchical co-dependence. (See next slide.)
- Deep learning (neural networks)?
 - Financial data at the daily frequency are too sparse for machine learning models with $> 10K$ parameters.
 - GPT-3 has >175 *billion* parameters.
- Random forest fits the bill.



Input spreadsheet (for training and live trading)

	A	B	C	D	E
1	Trade ID	VIX	1-day SPY return	Change in interest rate	Return
2	1	15.6	0.01%	0%	1
3	2	14.2	0.55%	0%	0
4	3	13.4	1.10%	0%	0
5	4	17.9	-0.90%	0.25%	1
6	5	17.1	-0.50%	0%	1
7	6	19.1	-1.30%	0%	1

Output spreadsheet: Probabilities and expected outcome

	A	B
1	pred_target	
2		1
3		

	A	B
1	pred_probability	
2		0.57
3		

Performance Metrics

The range of the CV set is: 2016-02-10 to 2019-01-07
THE ACCURACY SCORE FOR CV = 0.5956284153005464
THE F1 SCORE FOR CV = 0.7333333333333333
THE AUC SCORE FOR CV= 0.4700473909191774

The range of the test set is: 2019-01-08 to 2019-09-27
THE ACCURACY SCORE FOR TEST = 0.5300546448087432
THE F1 SCORE FOR TEST = 0.5168539325842697
THE AUC SCORE FOR TEST= 0.6176872607982504

Output spreadsheet: Probabilities and expected outcome

	A	B
1	pred_target	
2		1
3		

	A	B
1	pred_probability	
2		0.57
3		

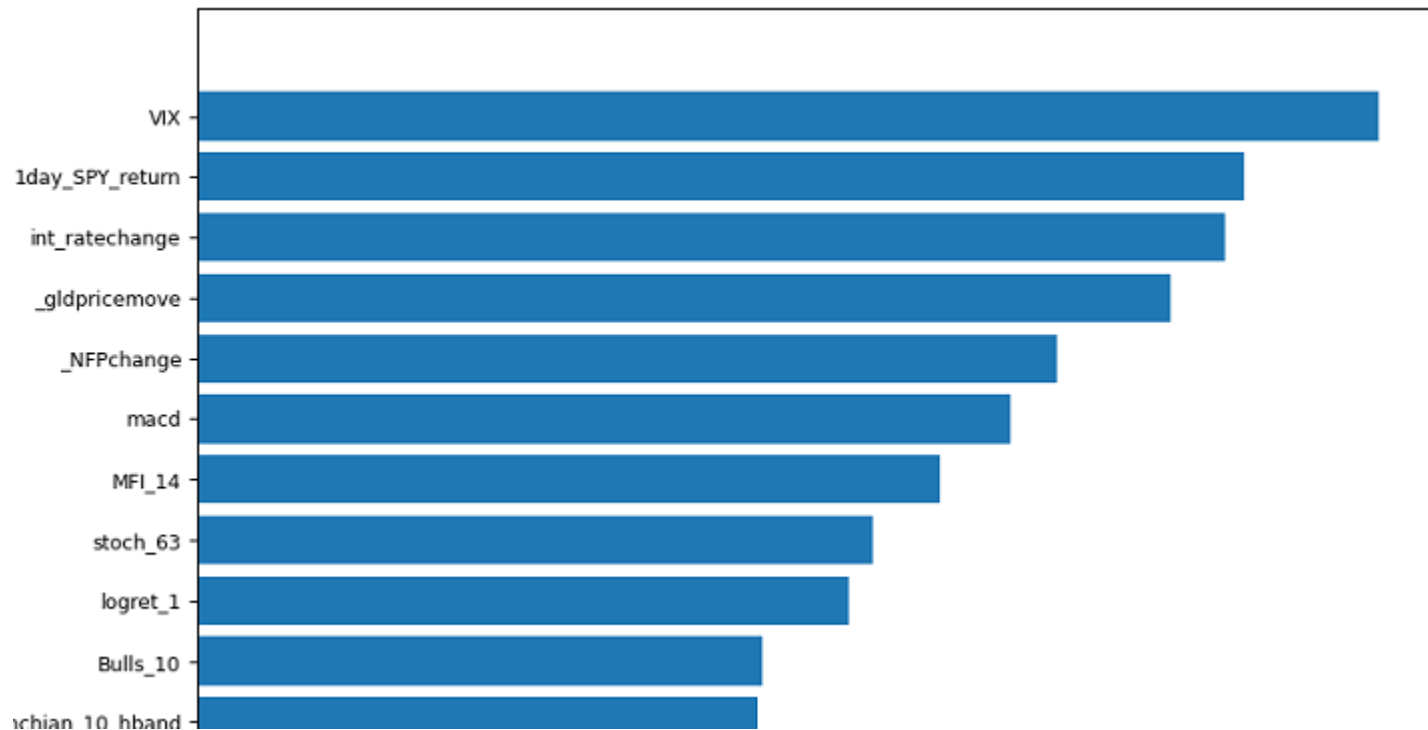
Usage: Capital Allocation and Risk Management

- If Probability of Profit of the next trade too low: can avoid entering it.
- Can scale trade size based on this Probability.
- E.g Tail Reaper did not enter a single trade Nov 2019 – Jan 2020.
 - ML did not detect tail risk.
 - Starting Feb 1, 2020, ML predicted high probability of tail movements!

Usage: Feature Selection

- Fundamental or discretionary traders dislike black boxes.
- Nobody can explain precisely how ML produces Probability of Profit.
- But we can rank the features that produce this probability.

Output feature importance rankings:



Cluster-based Feature Selection

Topic	Cluster Scores	Features
Fundamental	0.667	d/p, d/y, e/p, b/m, ntis, tbl, lty, dfy, dfr, infl
Technical	0.333	d/e, svar, ltr, tms

Feature Selection

- Feature selection helps improve “interpretability” of machine learning results.
- Feature selection helps traders directly incorporate features into their base strategies.
- Selecting only important features improves the calculation accuracy of machine learning model.
 - Man and Chan, “The best way to select features?” JFDS Winter, 2021.
 - Man and Chan, “Cluster-based Feature Selection” STA Journal Winter, 2021.

Conclusions

- Tail hedge strategies benefited from crises but lost money in calm markets.
- Machine learning (metalabeling) is designed to help reduce losses.
 - What is Probability of Profit of a trade?
- Feature selection can help traders understand what important market variables to explore.

Thank you!

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- Or visit <https://predictnow.ai>

