



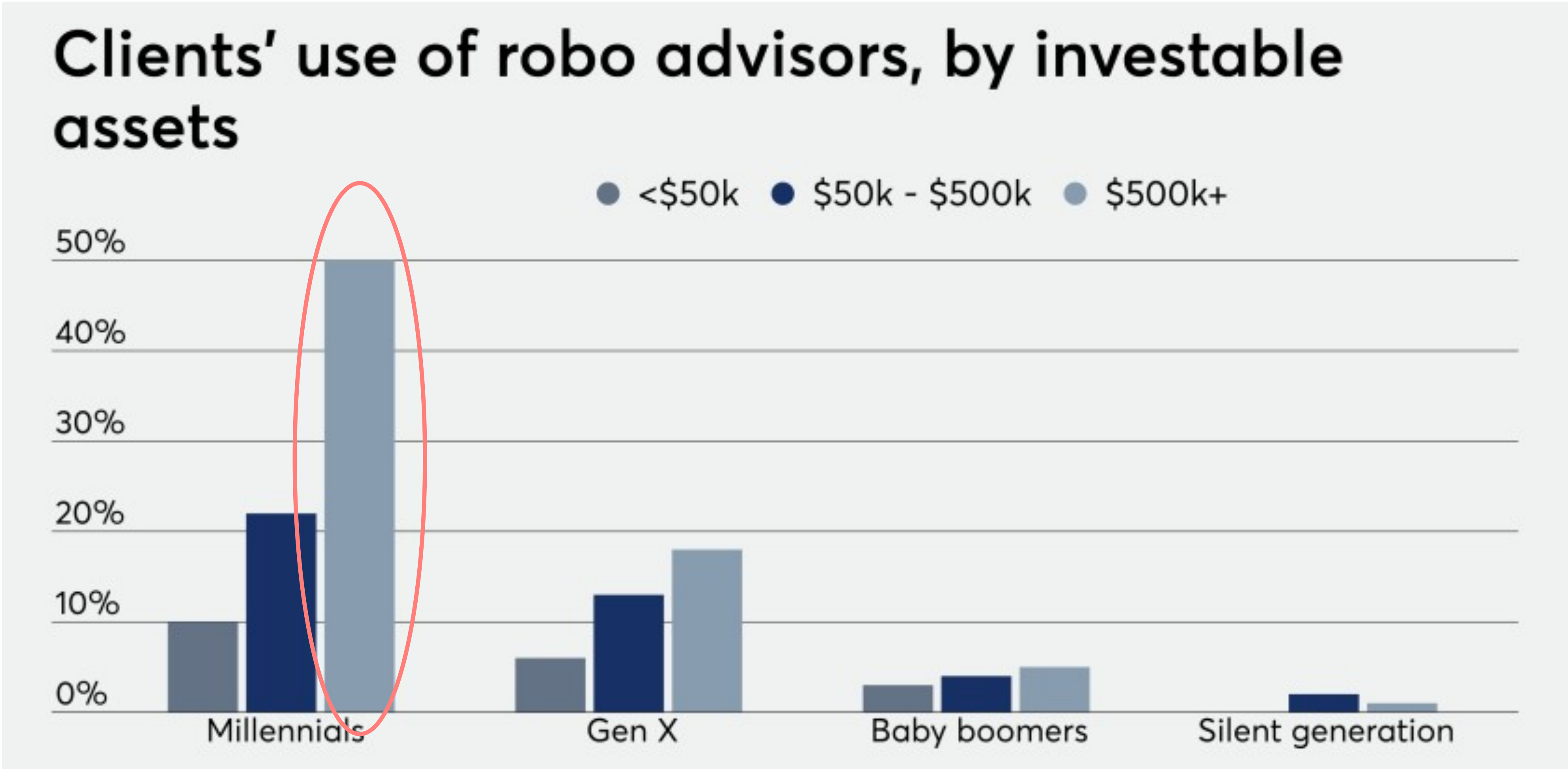
Robo-Advisors

Intersection of Asset Management and Machine Learning

Mike Choi

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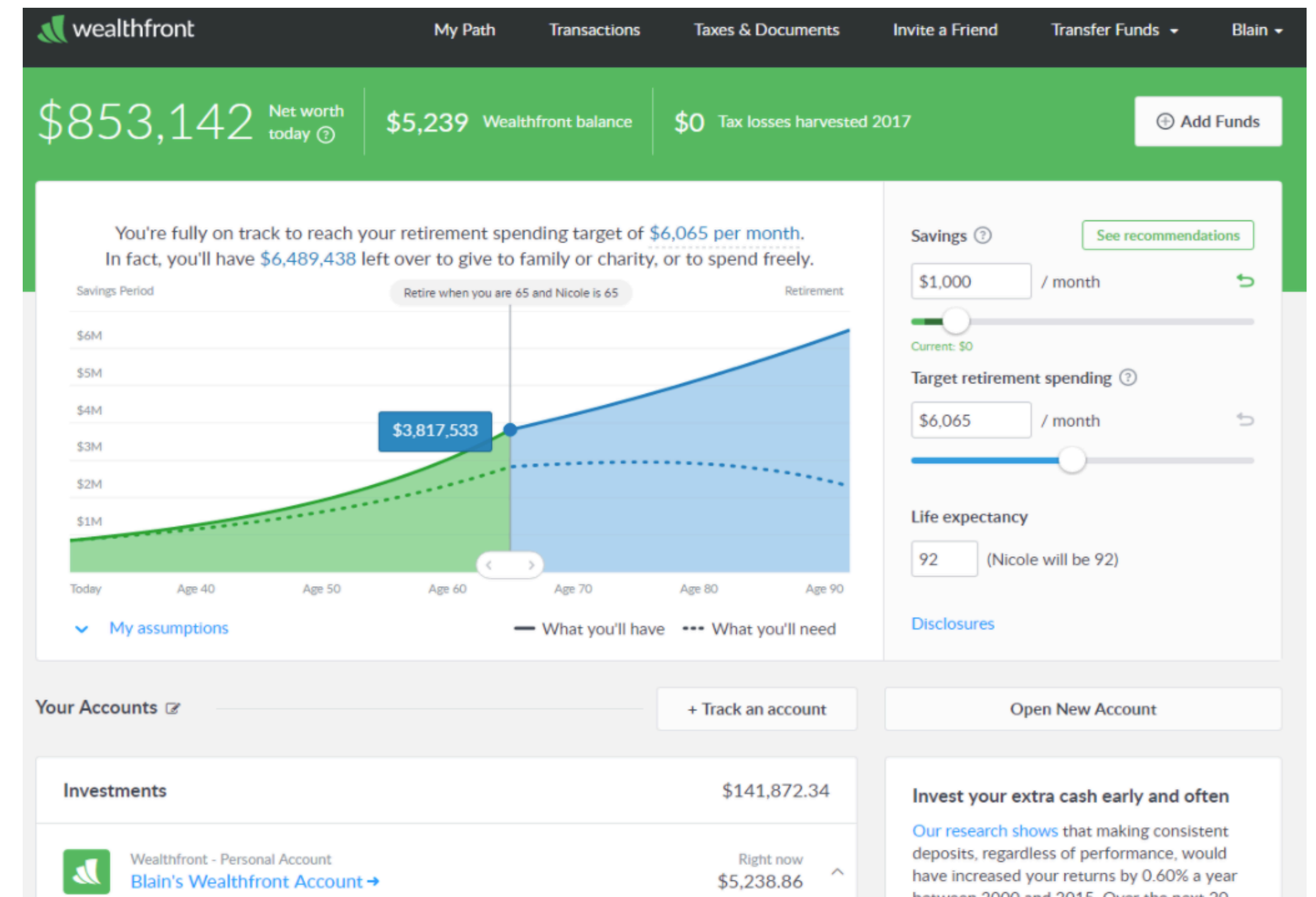
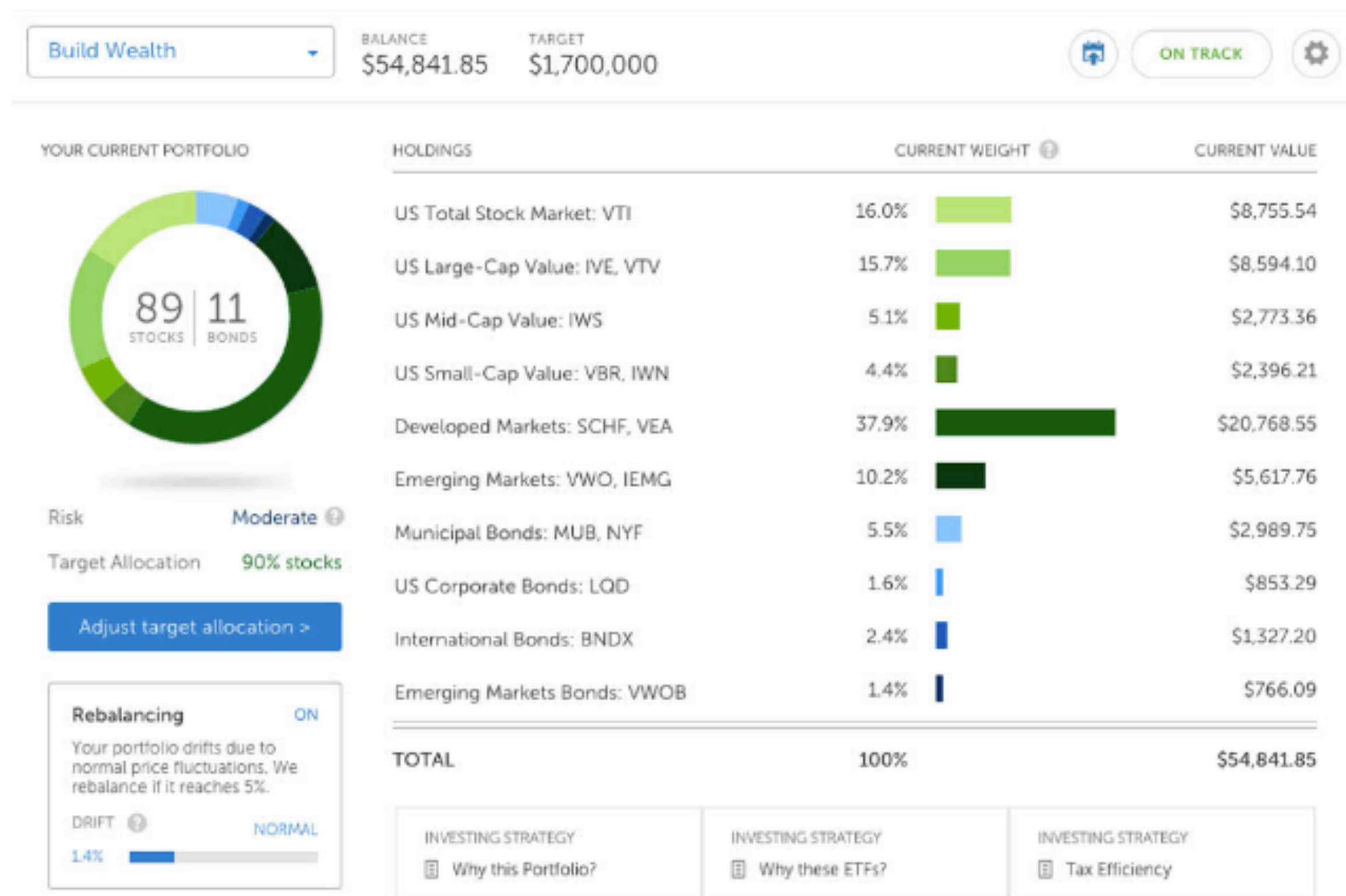
WHY LOOK AT ROBO ADVISORS?



Source: Hearts & Wallets survey, September 2020.

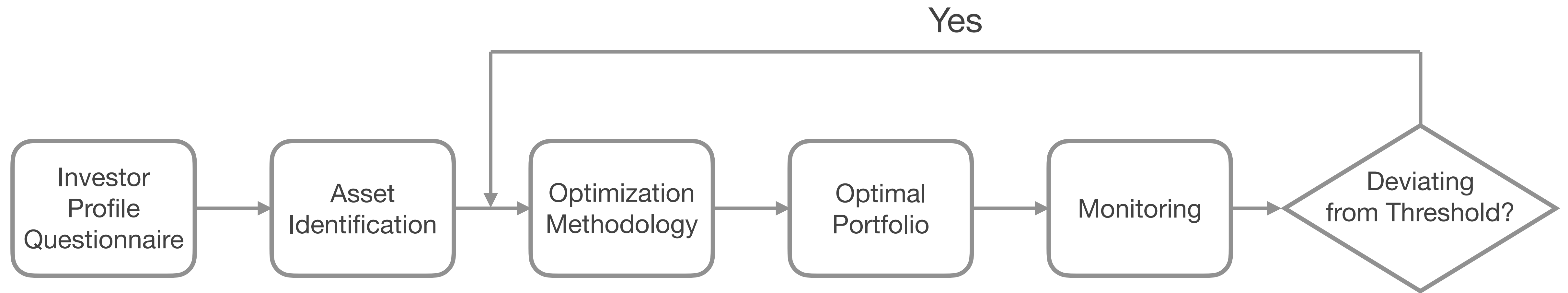
WHAT IS A ROBO-ADVISOR?

- An online investment platform that uses machine learning algorithms to determine **automated** portfolio allocations and rebalancing for investors.



Source: Betterment, Wealthfront.

HOW DOES IT WORK?



A NASCENT INDUSTRY TAKING SHARE FROM TRADITIONAL FINANCIAL ADVISORS

	Robo-advisors	Traditional asset managers
Global AUM*	~\$1.4 trillion	~\$100 trillion
Growth in AUM* (5-year CAGR)	~90% CAGR	~5% CAGR
Top 5 players (as of 2020)	Vanguard (\$148B) Schwab (\$41B) Wealthfront (\$20B) TD Ameritrade (\$18B) Betterment (\$18B)	BlackRock (\$7.3T) Vanguard (\$6.1T) UBS Group (\$3.5T) Fidelity (\$3.3T) State Street (\$3.1T)

Source: Statista

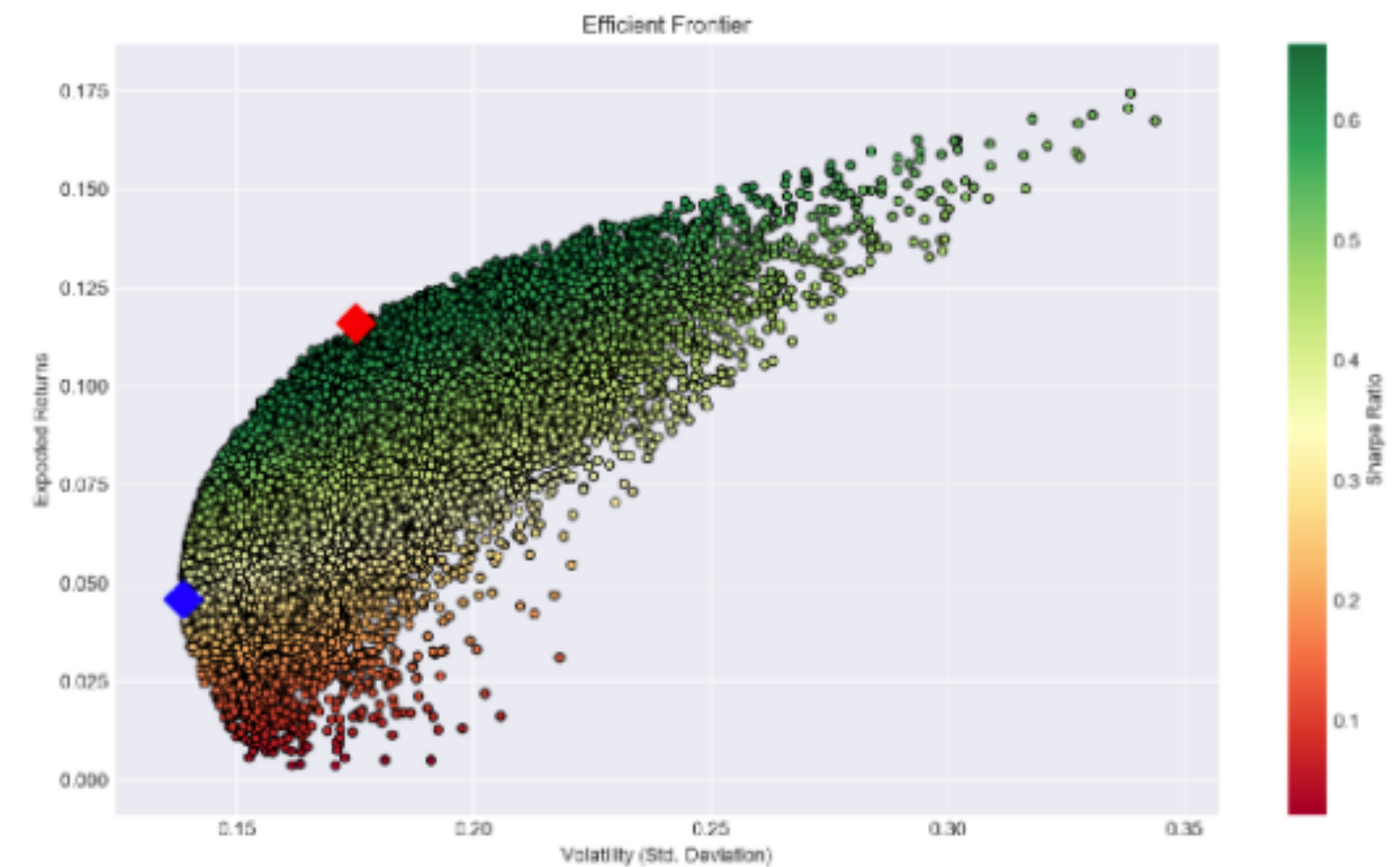
* AUM is an abbreviation for assets under management.

APPLICATIONS OF DATA SCIENCE IN ROBO-ADVISORY

- Leveraging big data in investor profiling
 - Predicting consumption patterns and life expectancy using expenditures data
 - Personal financial data merged with job market data to provide insights into future income and corresponding risks
 - Predicting risk tolerance and liquidity needs using customer's investment and credit history, as well as behavioral data such as social media posts

APPLICATIONS OF DATA SCIENCE IN ROBO-ADVISORY

- Optimizing asset allocation with statistical/ML models
 - Main question: How do you maximize the expected return for a given level of portfolio risk?
 - Based on mathematical models:
 1. Mean-variance model
 2. Black-Letterman model
 3. Full-scale optimization model
 - Improving portfolio optimization through Lasso and Ridge regularization and sparsity



A SIMPLE ROBO ADVISOR ALGORITHM – CODE WALKTHROUGH

CURRENT LIMITATIONS OF ROBO-ADVISORS

- Lack of personalization
- A limited investment universe
- A predominance of models that are too simple
- Unproven track record due to short history

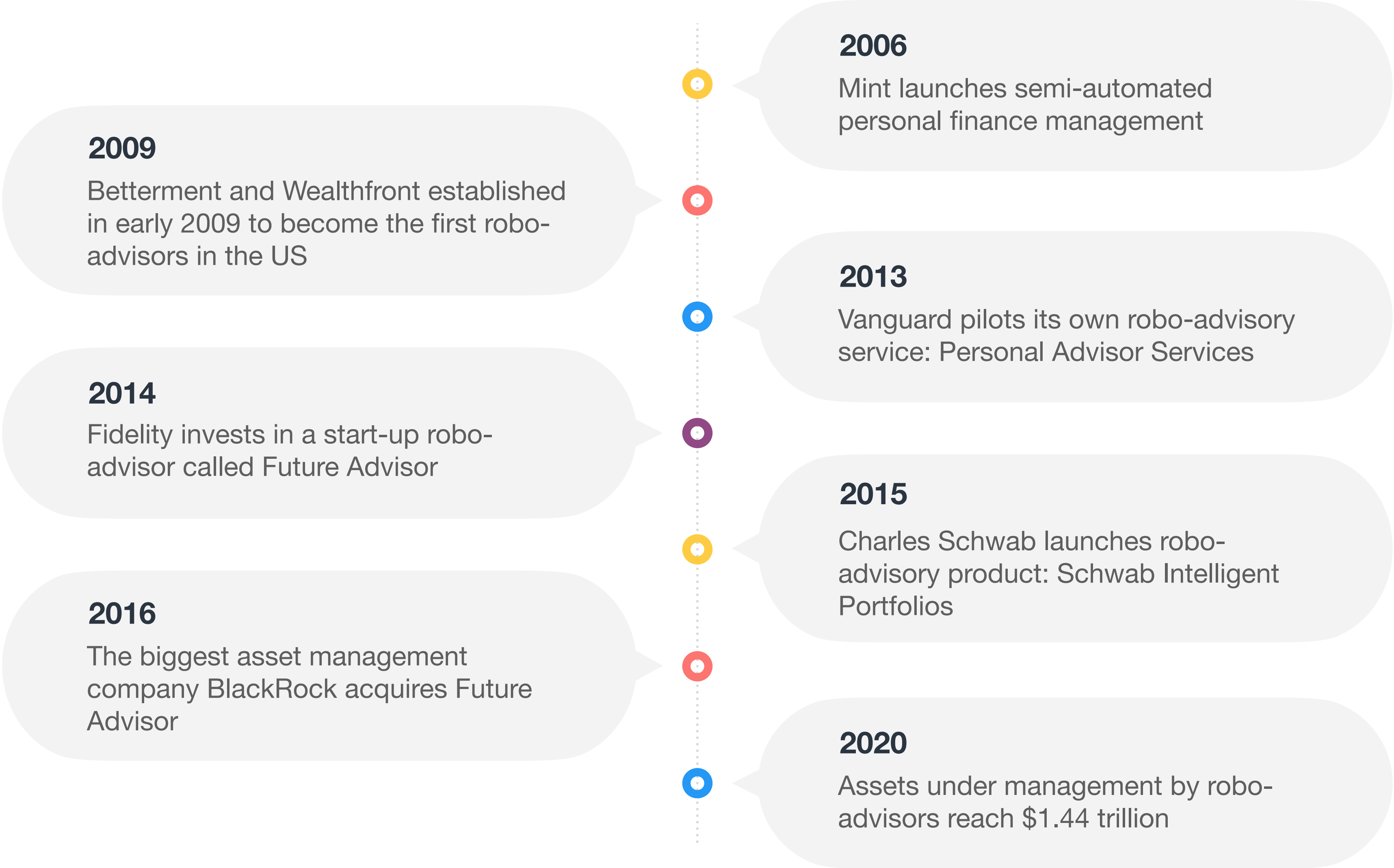
ROBO-ADVISORS OF TOMORROW

- Tailor-made solutions leveraging big data
- A voice and word recognition interface
- Application of deep learning in fundamental investing
- Hybrid of robo and human advisor



Thank you!
Questions?

APPENDIX I – A BRIEF HISTORY OF ROBO-ADVISORS



APPENDIX II – WHY CHOOSE ROBO-ADVISORS OVER TRADITIONAL FINANCIAL ADVISORS?

- Lowered costs and management fees
- An automated process
- The opportunity to bypass behavioral biases
- Potential for high quality analysis and user experience