AI in Investment Management

Ivan Sergienko, PhD, CFA
Head, Financial Products

ivan@elementai.com

CFA Montréal
7 February 2019

Element AI | Copyright © 2019 | Strictly Confidential

Human vs Machine

Neuromorphic Computing

Brain Neuron vs Silicon

	Biology	Silicon	Advantage
Speed	1 msec	1 nsec	1,000,000x
Size	1µm - 10µm	10nm - 100nm	1,000x
Voltage	~ 0.1V	V_{dd} ~1.0V	10x
Neuron Density	100K/mm^2	5k/mm^2	20x
Reliability	80%	< 99.9999%	1,000,000x
Synaptic Error Rate	75%	~ 0%	>10^9
Fan-out (-in)	10^3-10^4	3-4	10,000x
Dimensions	Pseudo 3D	Pseudo 3D	Similar
Synaptic Op Energy	~ 2 fJ	~10pJ	5000x
Total Energy	10 Watt	>>10^3 Watt	100,000x
Temperature	36C - 38C	5C - 60C	Wider Op Range
Noise effect	Stochastic Resonance	Bad	
Criticality	Edge	Far	

Source: “Neuromorphic Computing from Materials to Architecture”
US Department of Energy, 2015

Element AI | Copyright © 2019 | Strictly Confidential

	Biology	Silicon	Advantage
Speed	1 msec	1 nsec	1,000,000x
Size	1μm - 10μm	10nm - 100nm	1,000x
Voltage	~ 0.1V	V_{dd} ~1.0V	10x
Neuron Density	100K/mm^2	5k/mm^2	20x
Reliability	80%	< 99.9999%	1,000,000x
Synaptic Error Rate	75%	~ 0%	>10^9
Fan-out (-in)	10^3-10^4	3-4	10,000x
Dimensions	Pseudo 3D	Pseudo 3D	Similar
Synaptic Op Energy	~ 2 fJ	~10pJ	5000x
Total Energy	10 Watt	>>10^3 Watt	100,000x
Temperature	36C - 38C	5C - 60C	Wider Op Range
Noise effect	Stochastic Resonance	Bad	
Criticality	Edge	Far	

Speed: 1,000,000X for silicon

Biology
1 msec

Silicon
1nsec

Element AI | Copyright © 2019 | Strictly Confidential

	Biology	Silicon	Advantage
Speed	1 msec	1 nsec	1,000,000x
Size	1μm - 10μm	10nm - 100nm	1,000x
Voltage	~ 0.1V	V_{dd} ~1.0V	10x
Neuron Density	100K/mm^2	5k/mm^2	20x
Reliability	80%	< 99.9999%	1,000,000x
Synaptic Error Rate	75%	~ 0%	>10^9
Fan-out (-in)	10^3-10^4	3-4	10,000x
Dimensions	Pseudo 3D	Pseudo 3D	Similar
Synaptic Op Energy	~ 2 fJ	~10pJ	5000x
Total Energy	10 Watt	>>10^3 Watt	100,000x
Temperature	36C - 38C	5C - 60C	Wider Op Range
Noise effect	Stochastic Resonance	Bad	
Criticality	Edge	Far	

Total Energy: 1,000X for biology

Biology
10 Watts

Silicon
>>10^3 Watts

Element AI | Copyright © 2019 | Strictly Confidential

	Biology	Silicon	Advantage
Speed	1 msec	1 nsec	1,000,000x
Size	1μm - 10μm	10nm - 100nm	1,000x
Voltage	~ 0.1V	V_{dd} ~1.0V	10x
Neuron Density	100K/mm^2	5k/mm^2	20x
Reliability	80%	< 99.9999%	1,000,000x
Synaptic Error Rate	75%	~ 0%	>10^9
Fan-out (-in)	10^3-10^4	3-4	10,000x
Dimensions	Pseudo 3D	Pseudo 3D	Similar
Synaptic Op Energy	~ 2 fJ	~10pJ	5000x
Total Energy	10 Watt	>>10^3 Watt	100,000x
Temperature	36C - 38C	5C - 60C	Wider Op Range
Noise effect	Stochastic Resonance	Bad	
Criticality	Edge	Far	

Synaptic Error Rates: >10^9 for silicon

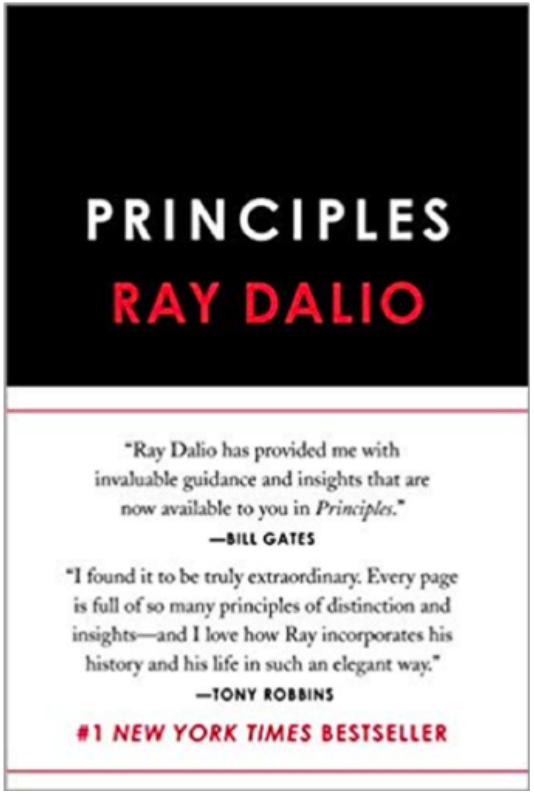
Biology
75%

Silicon
~0%

See also: Lillicrap T.P. et all, *Nat. Commun.* (2016)

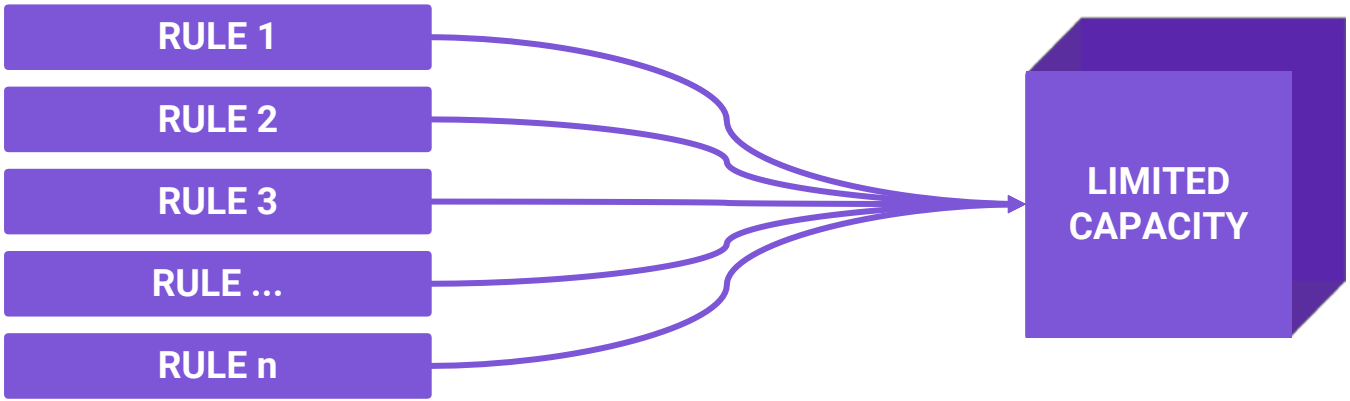
Element AI | Copyright © 2019 | Strictly Confidential

Systems of Intelligence



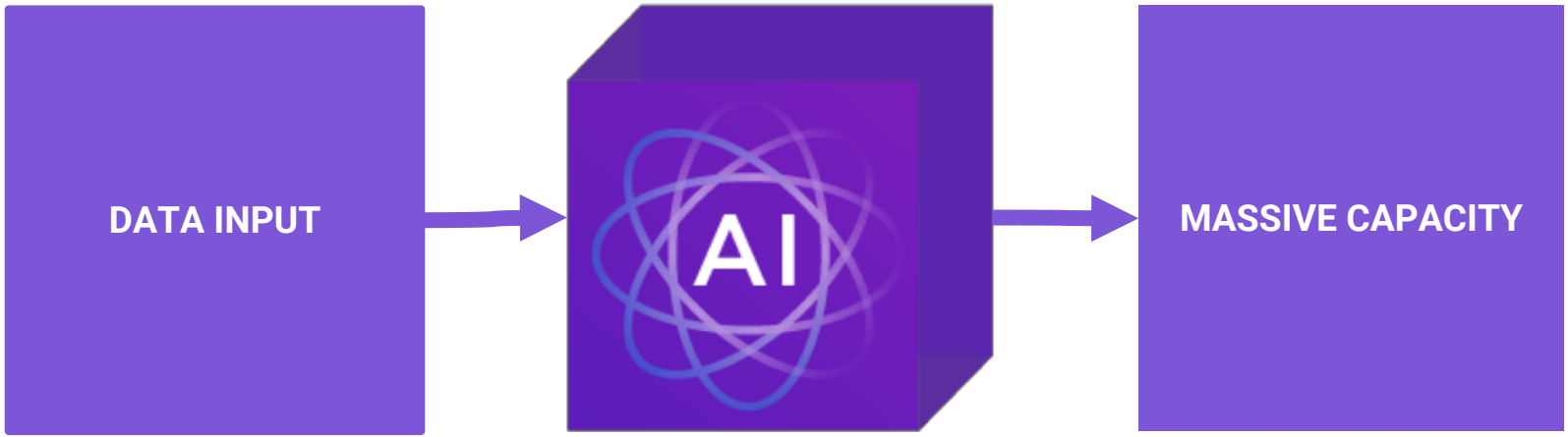
Element AI | Copyright © 2019 | Strictly Confidential

✗ Rules-based has limited capacity (*eg* Vision, NLP)



Element AI | Copyright © 2019 | Strictly Confidential

Deep learning has solved this



Element AI | Copyright © 2019 | Strictly Confidential

Three use cases

01 Equity and Fixed Income Research

02 Efficient Portfolio Rebalancing

03 Personalised Wealth Management

Element AI | Copyright © 2019 | Strictly Confidential

01

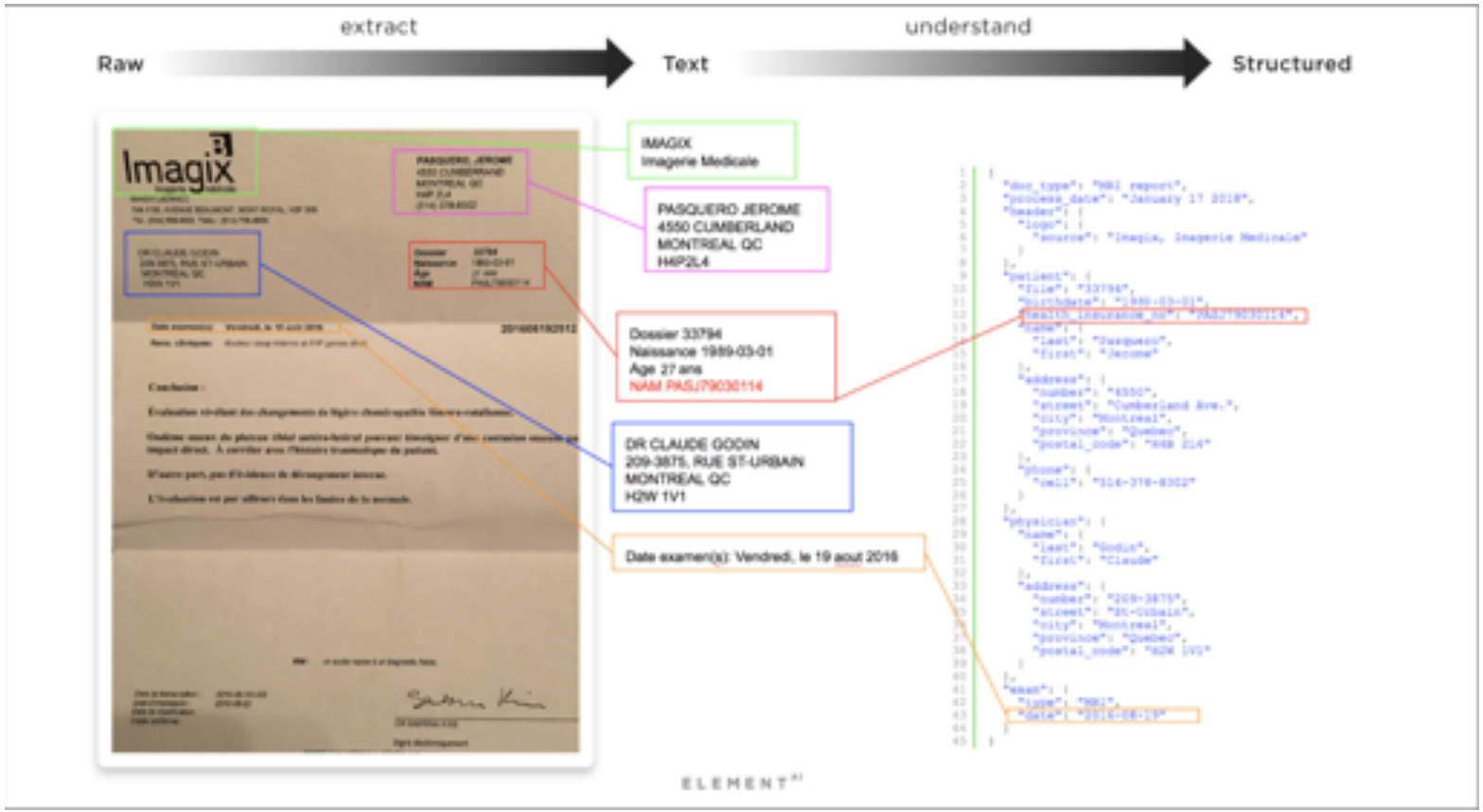
Equity and Fixed Income Research

Element AI | Copyright © 2019 | Strictly Confidential

AI Can Read!

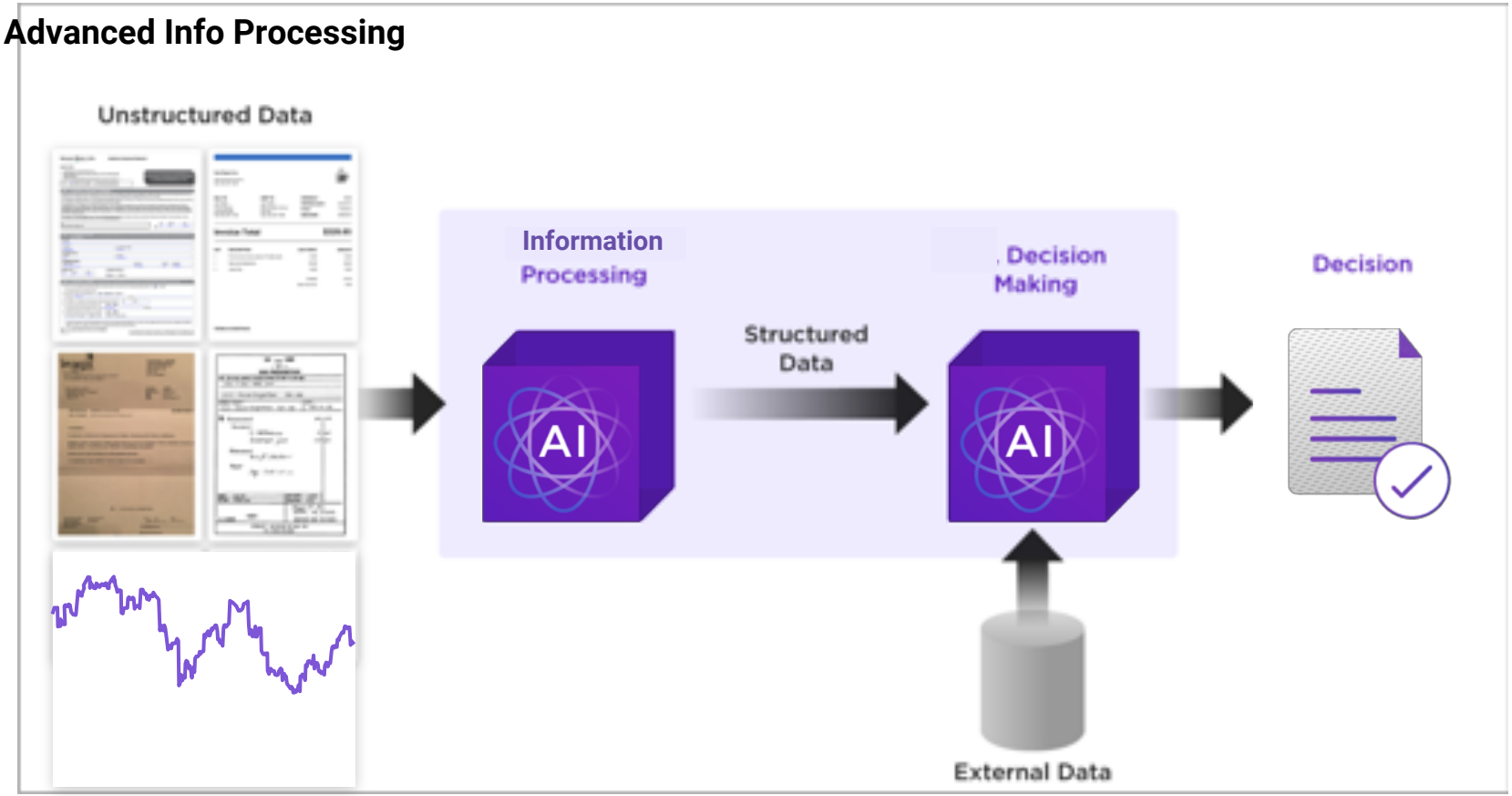
Element AI | Copyright © 2019 | Strictly Confidential

Basic information processing



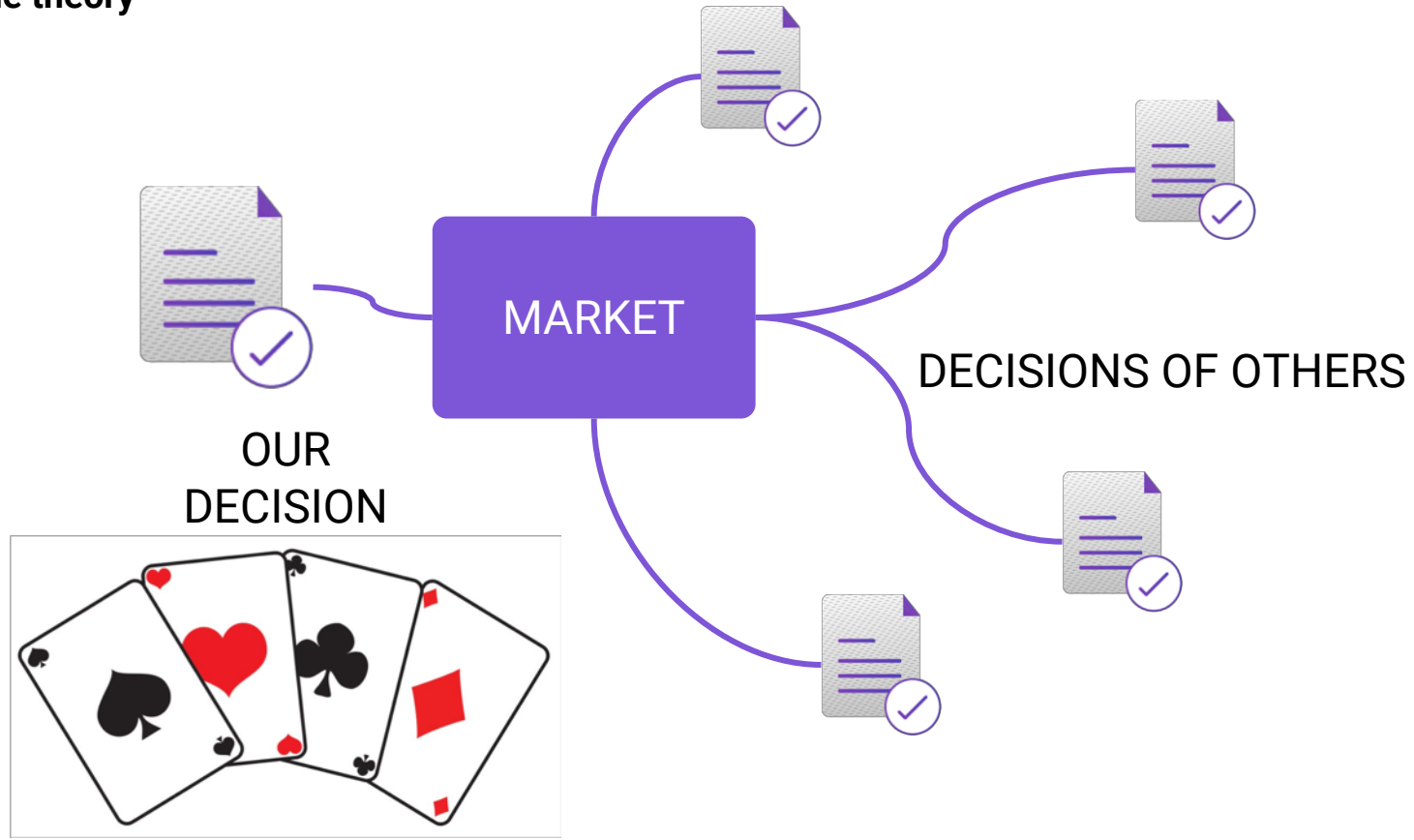
Element AI | Copyright © 2019 | Strictly Confidential

Advanced Info Processing



Element AI | Copyright © 2019 | Strictly Confidential

Game theory



Element AI | Copyright © 2019 | Strictly Confidential

02

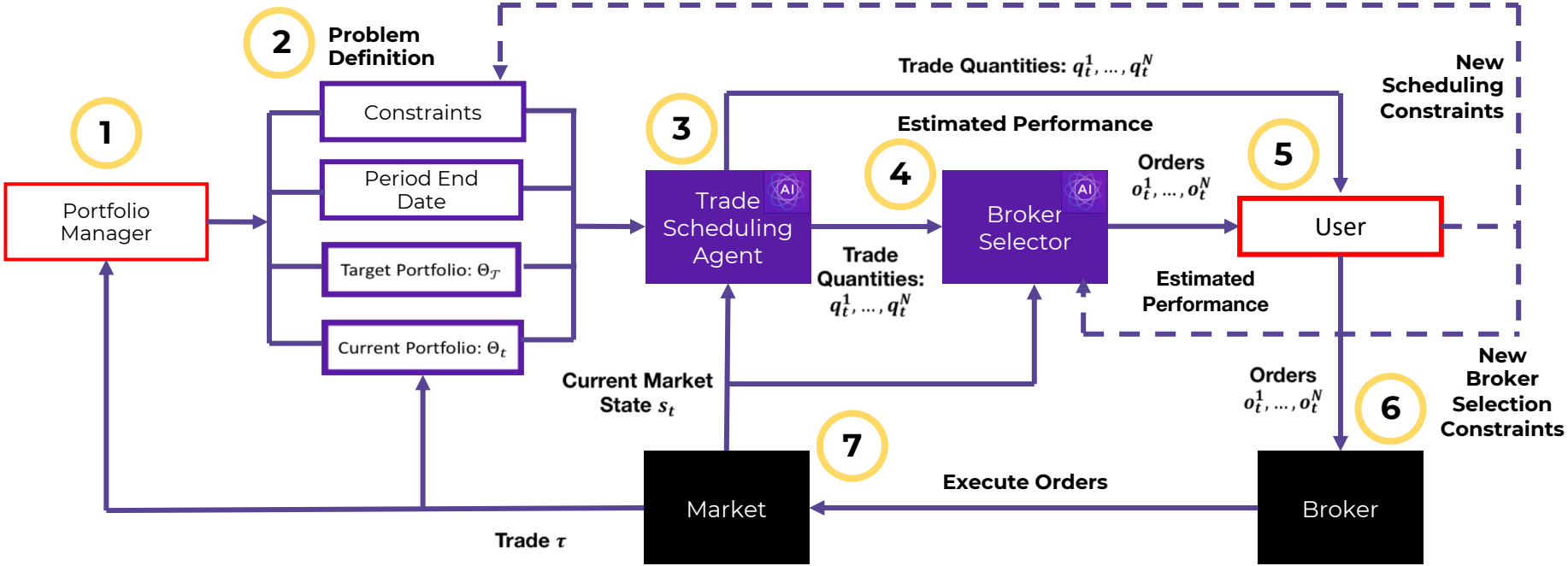
Efficient Portfolio Rebalancing

Element AI | Copyright © 2019 | Strictly Confidential

Portfolio Rebalancing Requires Tradeoffs

Element AI | Copyright © 2019 | Strictly Confidential

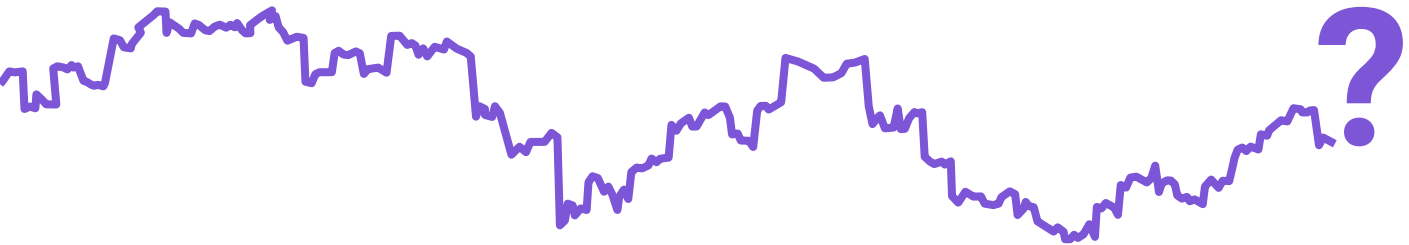
Portfolio Rebalancing Process



Element AI | Copyright © 2019 | Strictly Confidential

✗ Limited Forecasts

Traditional forecasting methods such as historical averages have limited capabilities and accuracy. Moreover they are limited to a single type of data source.



Element AI | Copyright © 2019 | Strictly Confidential

Overgeneralized

Analysis performed at the sector or regional level makes large assumptions about the constituent stocks and does not account for individual company events or dynamics.

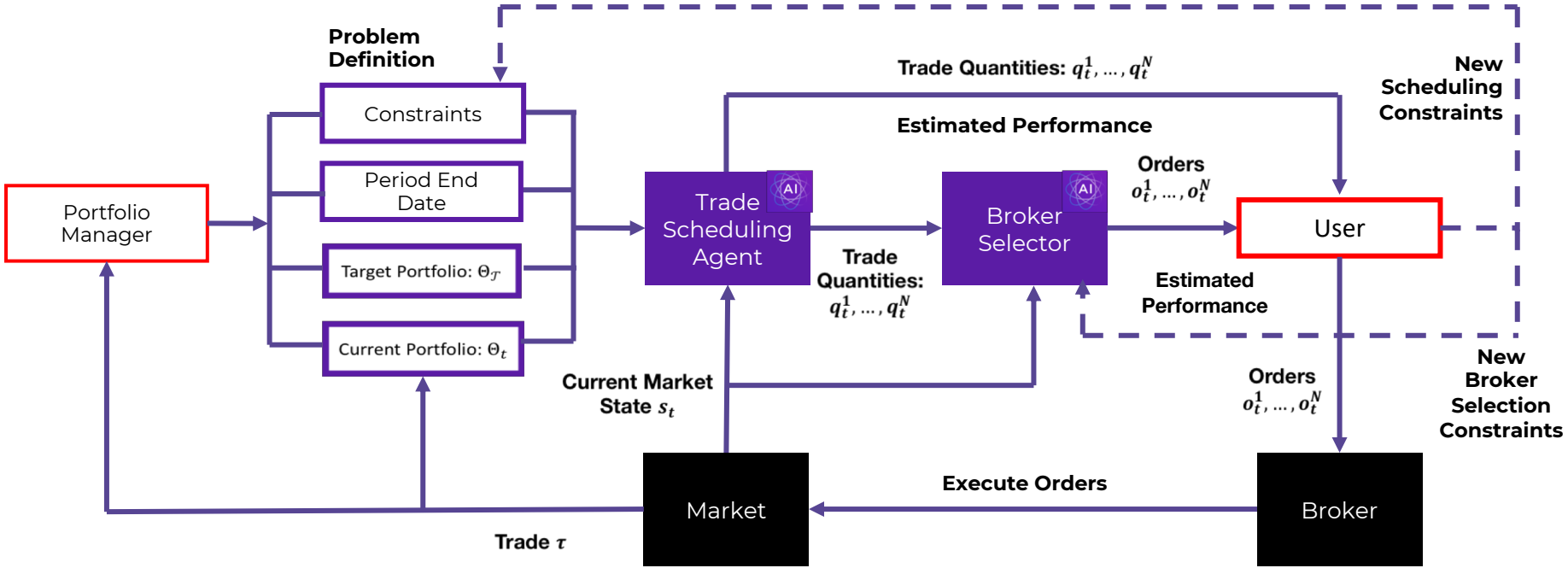
Element AI | Copyright © 2019 | Strictly Confidential

Non-Scalable

Even if analysis was performed for each individual stock, acting on this knowledge and implementing decisions for every stock in a portfolio requires extensive time and resources.

Element AI | Copyright © 2019 | Strictly Confidential

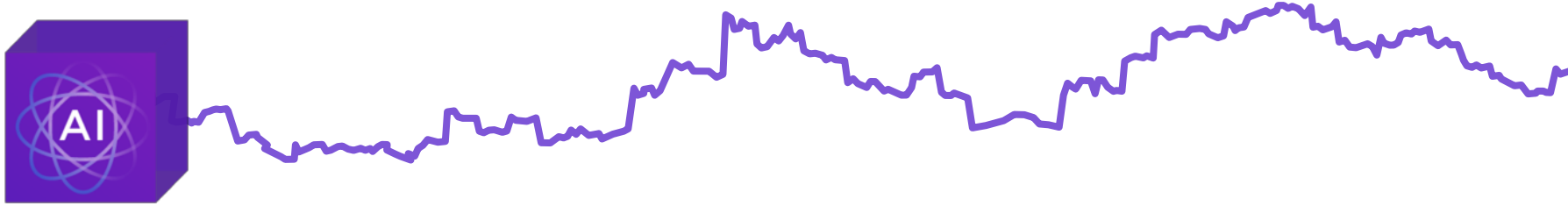
Continuous Optimisation



Element AI | Copyright © 2019 | Strictly Confidential

Powerful Forecasts

Deep neural networks to power its internal forecasts



Element AI | Copyright © 2019 | Strictly Confidential

Intelligent Scalability

Simplify the rebalancing process by optimizing decisions for each individual stock

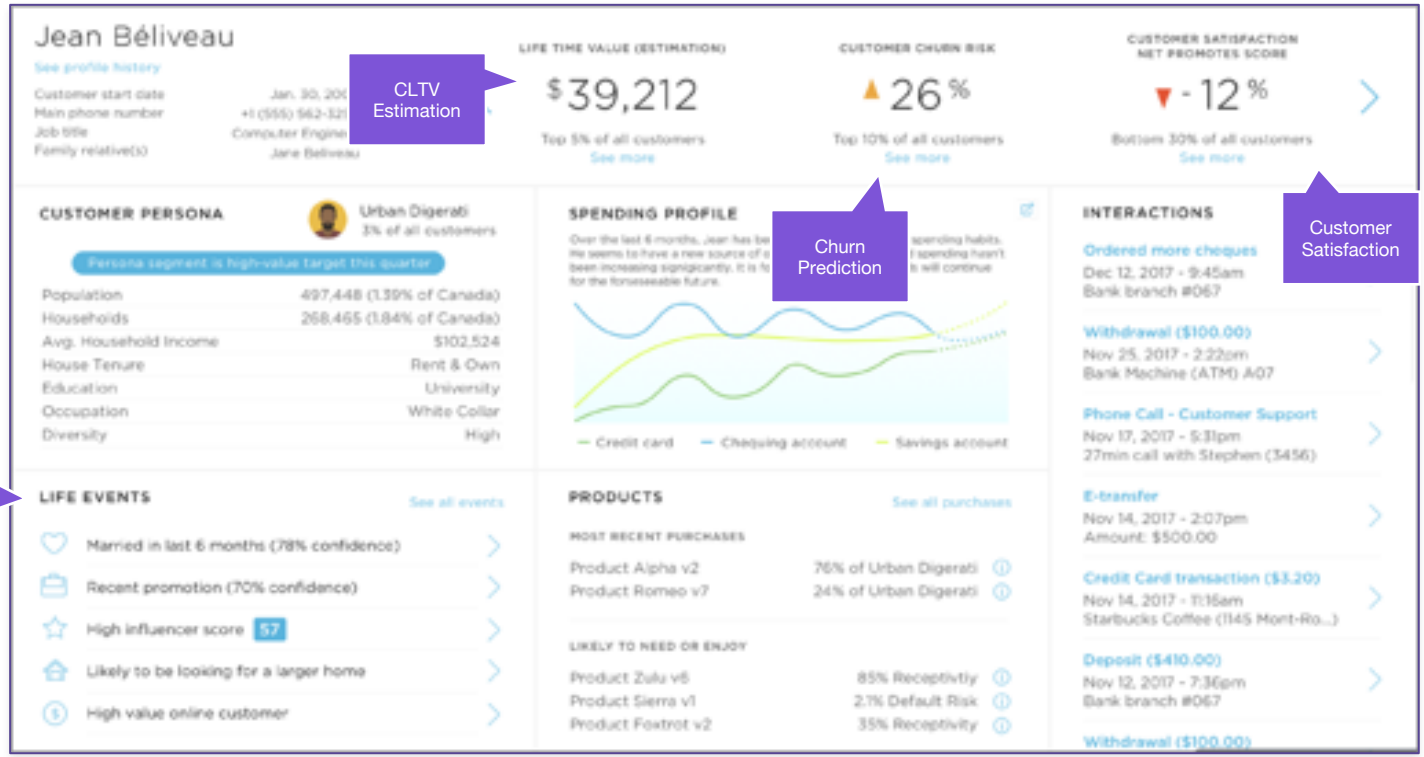
Element AI | Copyright © 2019 | Strictly Confidential

03

Personalised Wealth Management

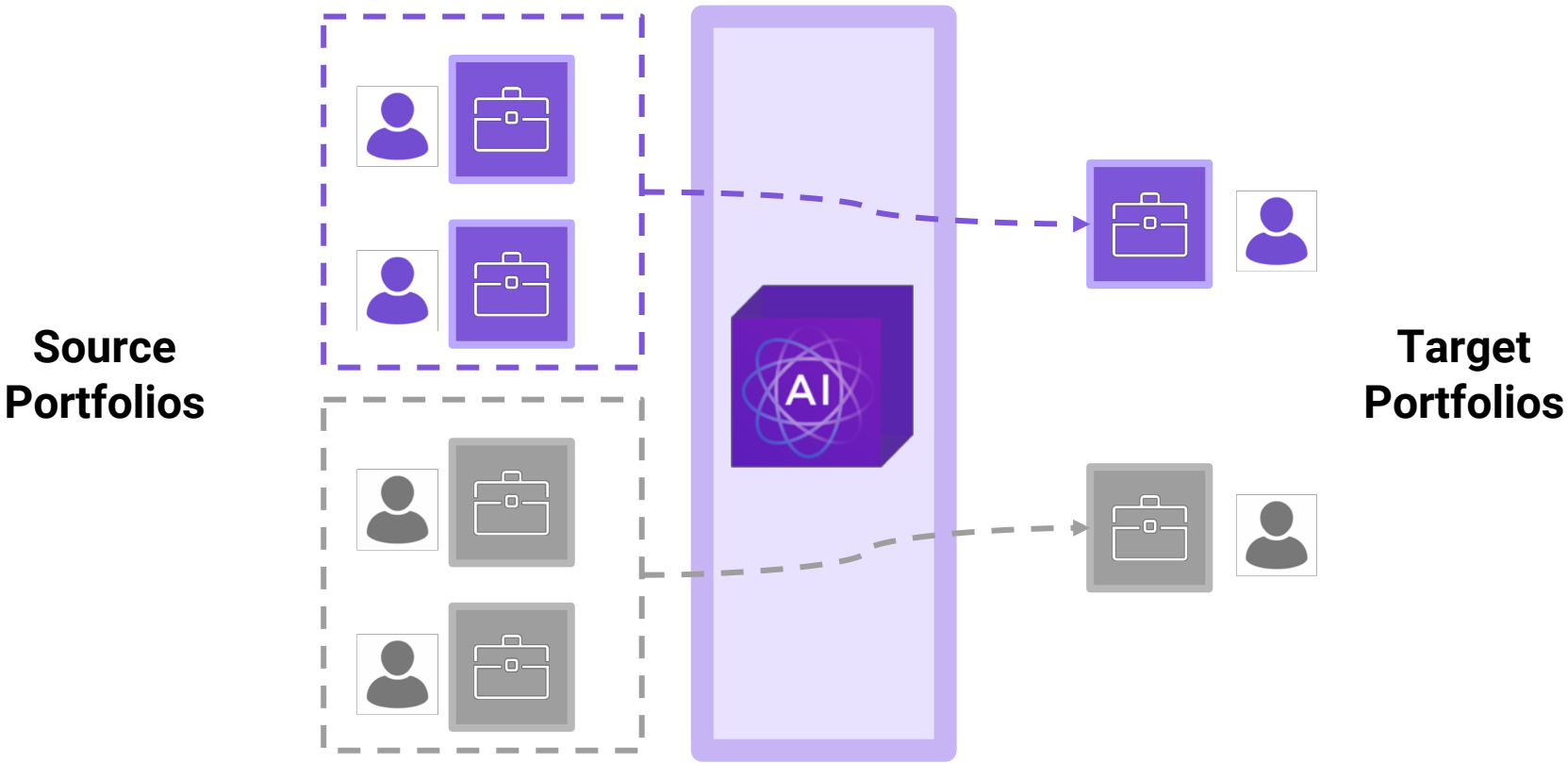
Element AI | Copyright © 2019 | Strictly Confidential

Understanding of client-specific situation



Element AI | Copyright © 2019 | Strictly Confidential

Design of client-specific portfolios



Element AI | Copyright © 2019 | Strictly Confidential

Personalized Product Conversations

Thank you!

element_ai

elementai

elementai

elementai

ivan@elementai.com

Element AI | Copyright © 2019 | Strictly Confidential