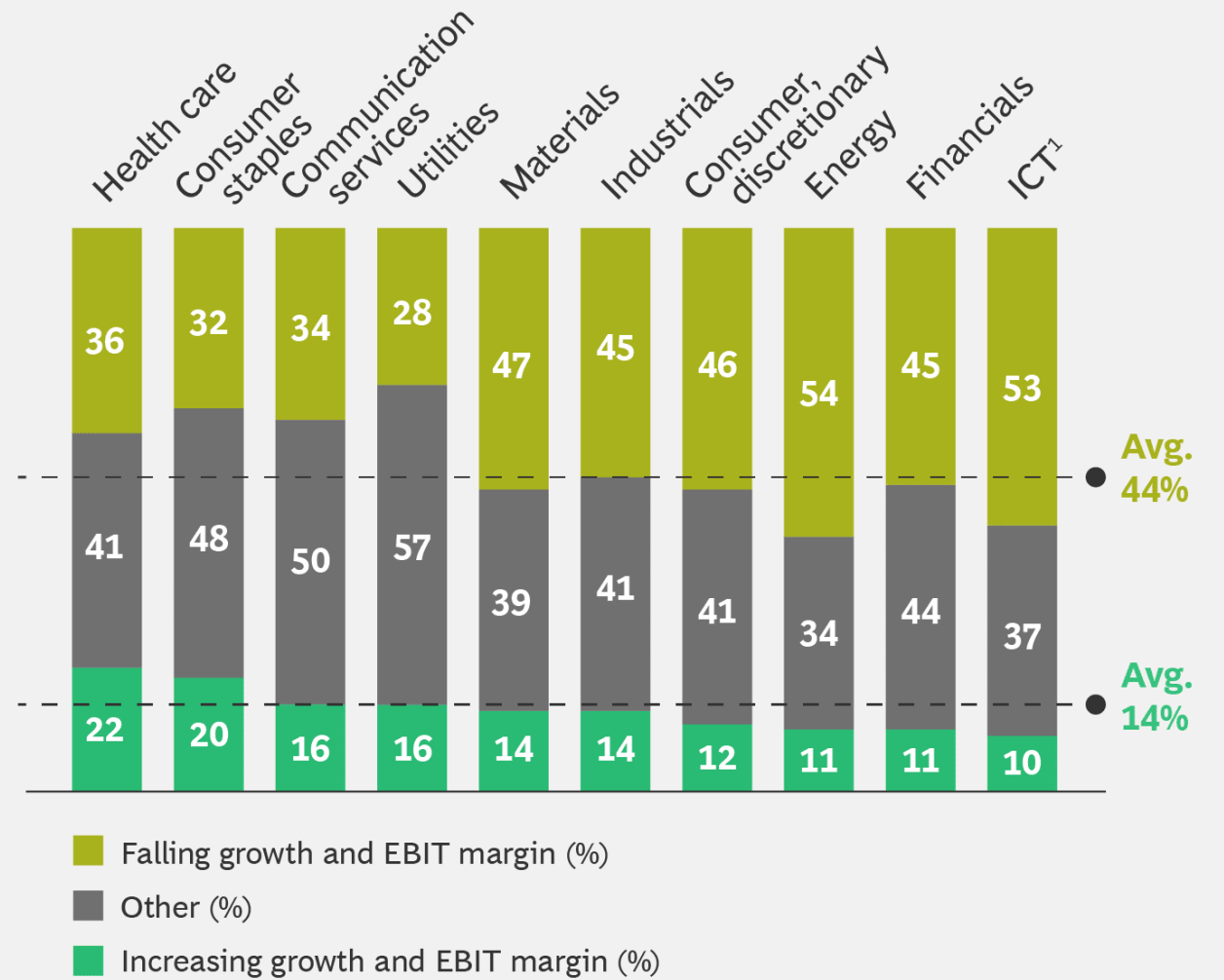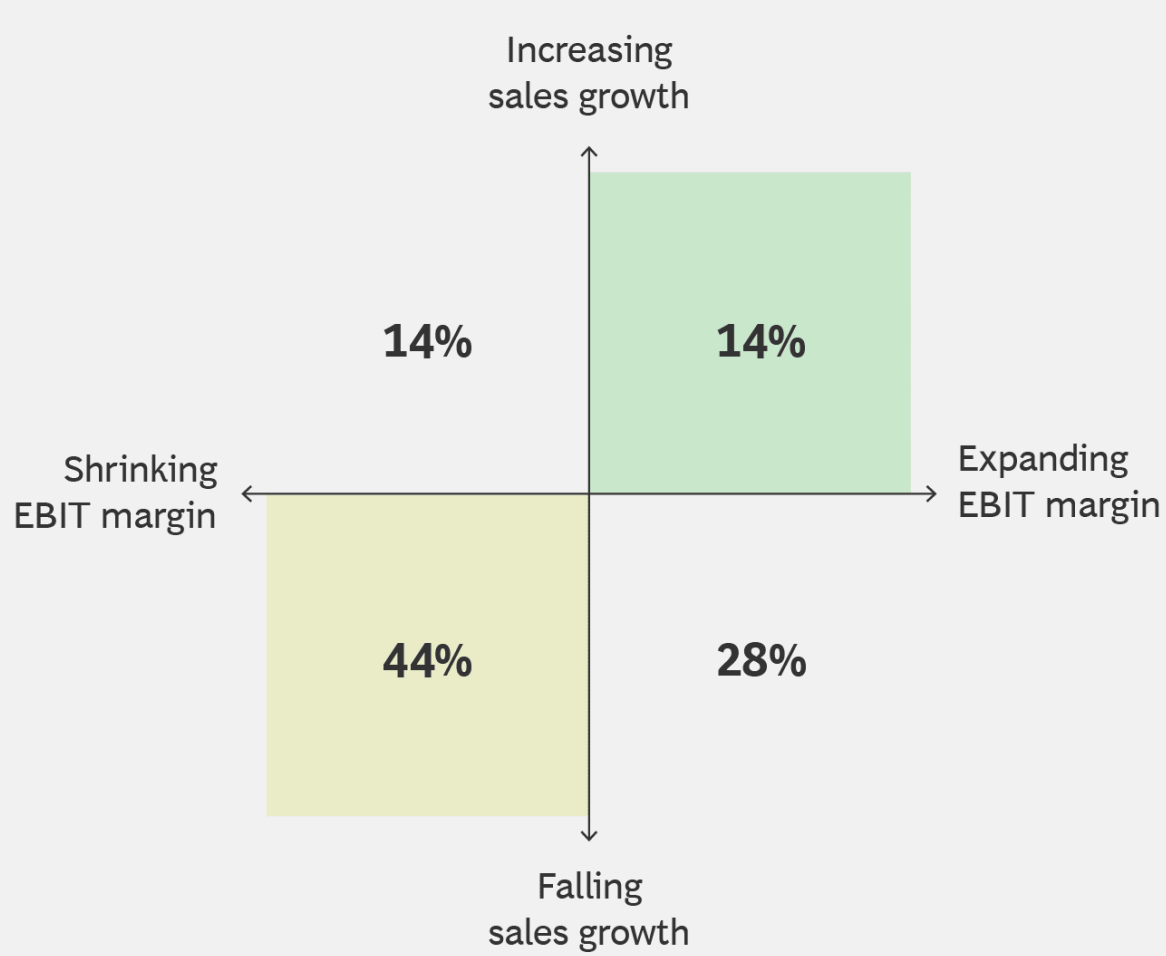# Artificial Intelligence in Finance
at
Hong Kong University of Science and Technology

Exhibit 1 | Across Industries, Some Companies Thrive During Crises

During downturns, 14% of companies improve both growth and margins during crises...

Increasing
sales growth

14%	14%

Shrinking
EBIT margin

Expanding
EBIT margin

44%	28%

Falling
sales growth

... and that holds true across industries

	Health care	Consumer staples	Communication services	Utilities	Materials	Industrials	Consumer, discretionary	Energy	Financials	ICT[1]
Falling growth and EBIT margin (%)	36	32	34	28	47	45	46	54	45	53
Other (%)	41	48	50	57	39	41	41	34	44	37
Increasing growth and EBIT margin (%)	22	20	16	16	14	14	12	11	11	10

Avg. 44%

Avg. 14%

■ Falling growth and EBIT margin (%)
■ Other (%)
■ Increasing growth and EBIT margin (%)

Exhibit 2 | How AI Can Support Companies

Challenge	How AI can help	Use case example
Uncertain and variable supply and demand	• Update forecasts in real time • Accelerate decision making	• Digital control towers and decision support
Operations and supply disruption	• Flexibly reallocate resources • Improve cost efficiency	• Real-time value chain optimization
Suboptimal workforce allocation	• Optimize remote offerings • Reallocate workforce	• Labor allocation analytics
Changing consumer confidence and priorities	• Rapid response to new behavior	• Real-time product customization

Exhibit 3 | The COVID-19 Crisis Is Accelerating the Shift to a New Reality

New reality	How AI can help
• Uncertainty requires redundancy, which inevitably means increased costs	• AI enables the greater scale and scope needed to build redundancy while minimizing cost
• Consumption patterns are moving toward e-commerce and other digital models • Consumers may increasingly distinguish essential from luxury items	• AI optimizes detection of new consumption patterns and allows for hyperpersonalization • AI can improve R&D, innovation, and new-product development
• Remote ways of working are becoming the new normal • On-demand labor is becoming more important	• AI-based companies are equipped for new ways of working • AI enables on-demand labor through more precise sales and supplier predictions

X-37 Announces $14.5 Million Series A

November 14, 2019 09:00 AM Eastern Standard Time

SOUTH SAN FRANCISCO, Calif.--(BUSINESS WIRE)--X-37, LLC, an artificial intelligence-enabled drug discovery company, announced today that it has closed a $14.5 million Series A financing. The funding round was led by DCVC Bio and was joined by Alpha Intelligence Capital and Hemi Ventures. The Series A funding will be used to expand the number of drug development programs at X-37 and to advance identified drug leads through laboratory and preclinical testing, with the goal of beginning human clinical trials by 2022. X-37's development programs encompass novel therapeutics modulating important drug targets to address unmet clinical needs, including ZAP-70 for autoimmune disease, PIM3 and SHP2 for cancer, and Factor XIIa for anticoagulation.

"With this financing, we have the ability to progress multiple discovery and development programs. Our investors have been a huge help in the genesis of X-37, and we look forward to working closely with them going forward."

Tweet this

X-37 was cofounded by Atomwise Inc. and a team of experienced pharmaceutical developers from Velocity Pharmaceutical Development. In addition to the above development programs, the team at X-37 will identify additional high-value drug targets, generate novel drug leads against these targets using Atomwise's world-class AI platform for structure-based drug design, and develop each of these drug programs to a medically-relevant inflection point, where it can be acquired by or partnered with a major pharmaceutical company to be brought to market.

X-37 makes use of an LLC structure permitting each drug development program to be housed in a separate virtual company under the parent LLC. This structure is tax efficient and flexible, in that it allows X-37 to divest individual drug development programs, while maintaining the parent company and team. X-37 began operation in 2018 and has already generated promising novel hit molecules against several targets of high interest to the pharmaceutical industry.

"We are thrilled with the progress we have made to date and we are looking forward to moving a set of important new drugs into development," said David Collier, M.D., CEO and cofounder of X-37. "With this financing, we have the ability to progress multiple discovery and development programs. Our investors have been a huge help in the genesis of X-37, and we look forward to working closely with them going forward."

"X-37 represents an opportunity to bring new drugs to market very quickly, for challenging targets that have repeatedly stumped pharma and are in dire need of advancement," said Abraham Heifets, CEO and Founder of Atomwise, Inc. "We're thrilled to work alongside industry veterans who have a track record of efficiently delivering drug after drug for the past 25 years."

"We are very pleased to be investors in X-37," said Kiersten Stead of DCVC Bio. "We have watched with great excitement as Atomwise has refined its deep neural network and chemistry expertise. We identified the team of drug developers at Velocity Pharmaceutical

X-37, LLC

Release Summary

Cofounded by Atomwise and Velocity Pharmaceutical Development, X-37 combines a world-class AI platform and experienced pharmaceutical developers.

Convolution: 2D & 3D

Image

Convolved Feature

AtomNet: A Deep Convolutional Neural Network for Bioactivity Prediction in Structure-based Drug Discovery

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Abstract

Deep convolutional neural networks comprise a subclass of deep neural networks (DNN) with a constrained architecture that leverages the spatial and temporal structure of the domain they model. Convolutional networks achieve the best predictive performance in areas such as speech and image recognition by hierarchically composing simple local features into complex models. Although DNNs have been used in drug discovery for QSAR and ligand-based bioactivity predictions, none of these models have benefited from this powerful convolutional architecture. This paper introduces AtomNet, the first structure-based, deep convolutional neural network designed to predict the bioactivity of small molecules for drug discovery applications. We demonstrate how to apply the convolutional concepts of feature locality and hierarchical composition to the modeling of bioactivity and chemical interactions. In further contrast to existing DNN techniques, we show that AtomNet's application of local convolutional filters to structural target information successfully predicts new active molecules for targets with no previously known modulators. Finally, we show that AtomNet outperforms previous docking approaches on a diverse set of benchmarks by a large margin, achieving an AUC greater than 0.9 on 57.8% of the targets in the DUDE benchmark.

1 Introduction

A.I. Implementation Matrix

	Process A	Process B	Process C	Process D	Process E
Function & Nature	Strategic direction exploration	Sales lead management	Quality control	Risk management	Customer service (non-chatbot)
Data Availability					
AI Function & Role	Classification and Sentiment analysis	Facial recognition	Fault identification	Fraud detection and forecasting	Text to image processing
AI Data Type	Unstructured	Structured and clean	Structured and clean	Structured but sparse	Unstructured
AI Model	• Support Vector Machines (SVM) • Clustering • Recurrent Neural Networks (RNN)	• Convolutional Neural Networks (CNN)	• Support Vector Machines (SVM) • Clustering	• K-Nearest Neighbors (kNN) • Recurrent Neural Networks (RNN)	• Generative Adversarial Network (GAN)
AI Readiness	🔴	🟡	🟢	🔴	🟡
Schedule	TBD	Q4 2018	Q1 2018	TBD	Q2 2019

Management

A.I. Experts

A.I. Dashboard

Anthony Woo • Harvard Business School Asia-Pacific Research Center

Long Term: Strategic Approach

How relevant is A.I. to my company products and services?

	Peripheral	Central
Not ready	• Outsource A.I. functions • Explore open source A.I. capabilities	• Explore open source A.I. capabilities • Create in-house data-bases • Build ecosystem with partnerships and expert networks • Sandbox whenever possible, then scale
Ready	• In-house data scientist and management system • Regular open-source A.I. capabilities updates for senior management • Sandbox if needed	• *Everything else* • In-house A.I. research laboratory • Software: Explore deep reinforcement learning • Hardware: Explore High-Performance Computing (HPC)

How ready are we for A.I.?

Short Term: Tactical Approach

Management Perspective: How much of a pain point is this?

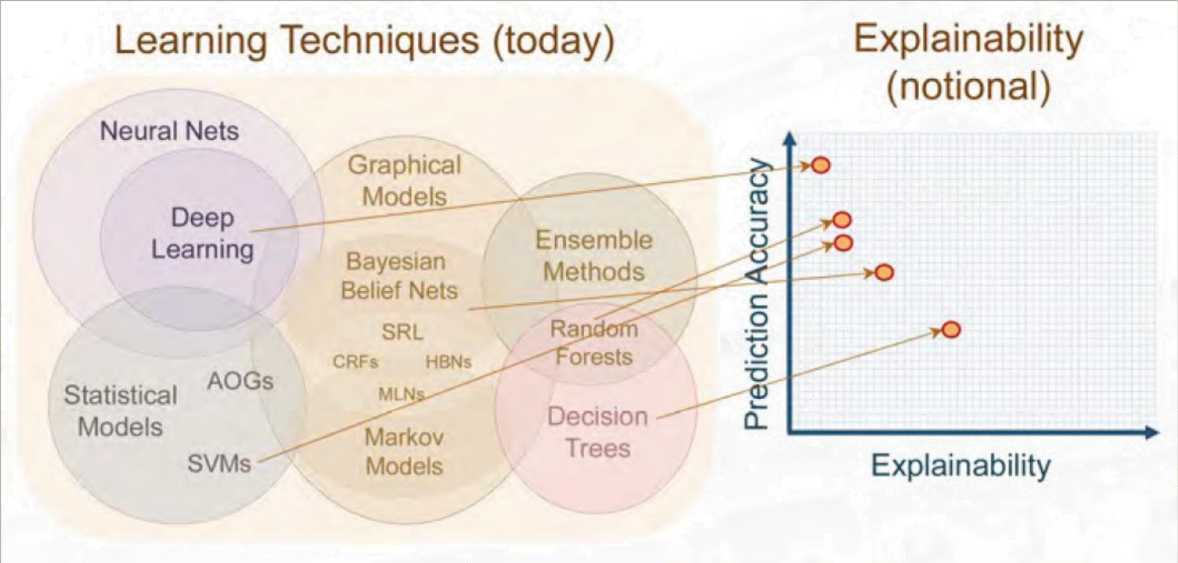|	"I can do this myself."	"I'll let A.I. do this."
Not ready	• Differentiate with personal touch • Utilize (customer) engagement and to create and reinforce sense of community • Monitor competition	• Explore A.I. capabilities (e.g. one-shot learning and transfer learning) • Accumulate data • Determine strategic importance in the long run
Ready	• More humanistic and creative • Deploy with *less* stringent fail-proof threshold • Decision making augmented by A.I. and big data analytics	• More mechanical and routine • Deploy with *more* stringent fail-proof threshold • Use A.I. as basis with human oversight

How ready are we for A.I.?

Explainability & Usability

Exhibit 6 | Relative explainability of learning algorithms

Learning Techniques (today)

Neural Nets
Deep Learning
Graphical Models
Bayesian Belief Nets
SRL
CRFs   HBNs
MLNs
Statistical Models
AOGs
SVMs
Markov Models
Ensemble Methods
Random Forests
Decision Trees

Explainability (notional)

Prediction Accuracy
Explainability

Source: DARPA

Exhibit 7 | Feature importances in investment product suitability

Suitability metre

Likely to be unusable   Likely to be usable

Top contributing factors

Factors	Contribution
1. Age	15.0
2. Risk profile	13.6
3. Annual income	10.5
4. Expenditure	9.0
5. Assets	3.4
6. Liabilities	3.0
7. Expected retirement age	3.0
8. Amount invested	2.1
9. Product sold	2.1
10. Channel	1.9

Source: PwC

12
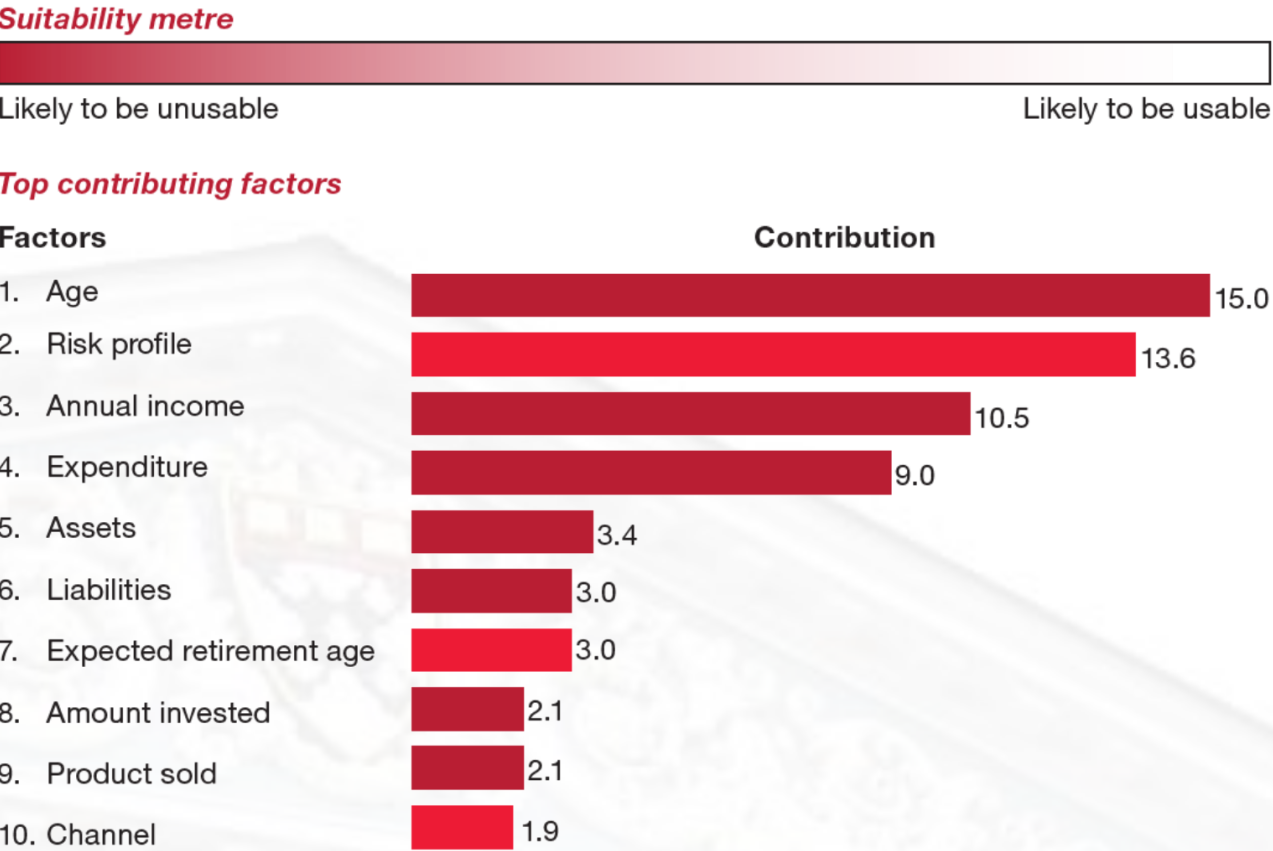
Beyond the Classroom

Topics of Interest
(n = 34)

Topic	Percentage
CV Writing & Interview Preparation	76%
Company Research: Bloomberg, McKinsey Insights, Zero2IPO	47%
LinkedIn & Networking	47%
Industry Primer: FinTech & VC/PE	35%
Industry Primer: Investment Banking	32%
PowerPoint Creation	24%
Certifications (CFA, CPA, FRM, CAIA…)	18%
Industry Primer: Management Consulting	15%