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IFoA GIRO Conference 2024

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Boosting sustainability agenda with data science

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Assoc. Prof. George Tzougas, Shubham Mehta

IFoA GIRO Conference 2024

Agenda

- Speakers
- Background
- Revamping classics
- New dimensions and products
- Challenges
- IFoA Data Science

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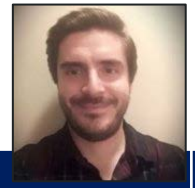
Speakers

Speaker introductions

	 Dr. Alexey Mashechkin	 Debashish Dey FIA	 Assoc. Prof. George Tzougas	 Shubham Mehta
Volunteering with IFoA	✓	✓	✓	✓
- Role	Lifelong Learning Pillar Chair	Sustainability & Climate Change Working Party Co-chair (practitioners)	Sustainability & Climate Change Working Party Co-chair (academics)	Sustainability & Climate Change Working Party Member
Background				
Business	✓	✓		✓
- Actuarial traditional	✓	✓		✓
- Actuarial non-traditional				✓
- Data science	✓			
Academic focus			✓	

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Background

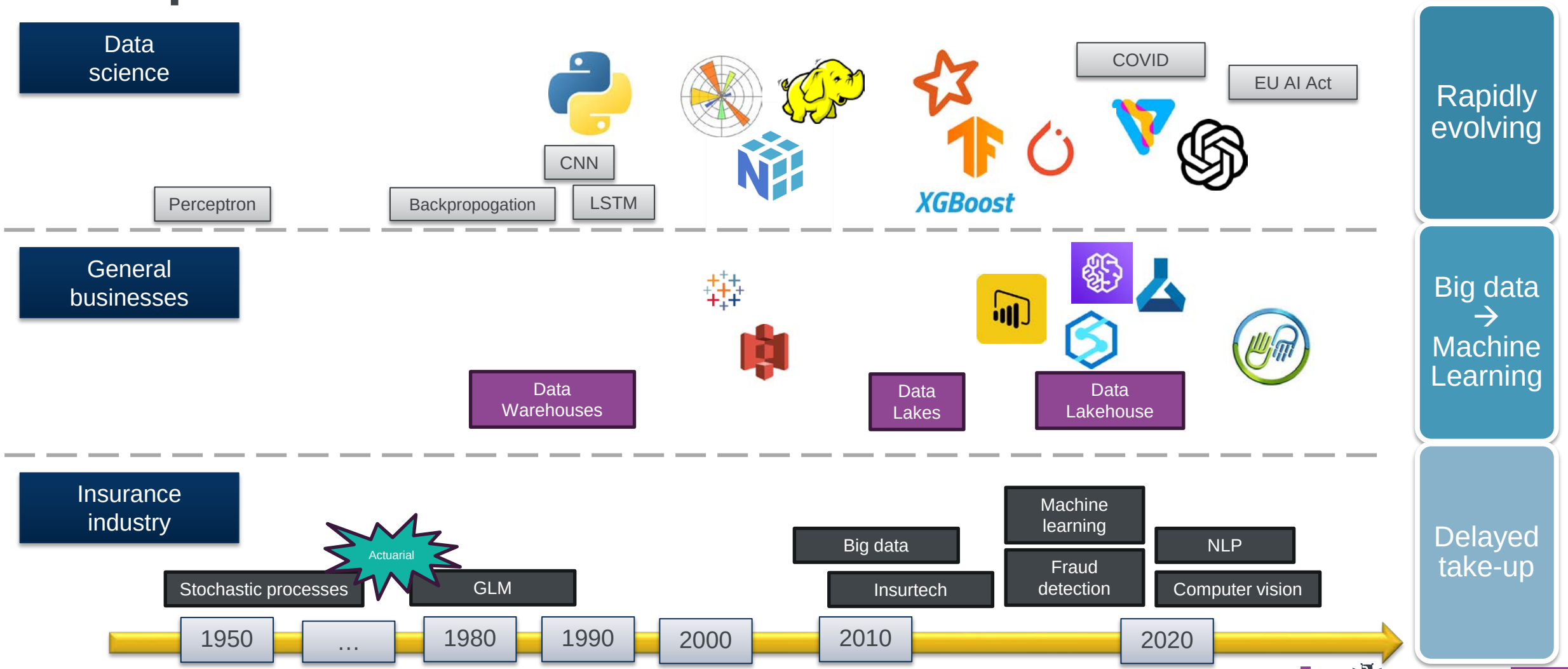
Sustainability agenda

GOVERNMENTS

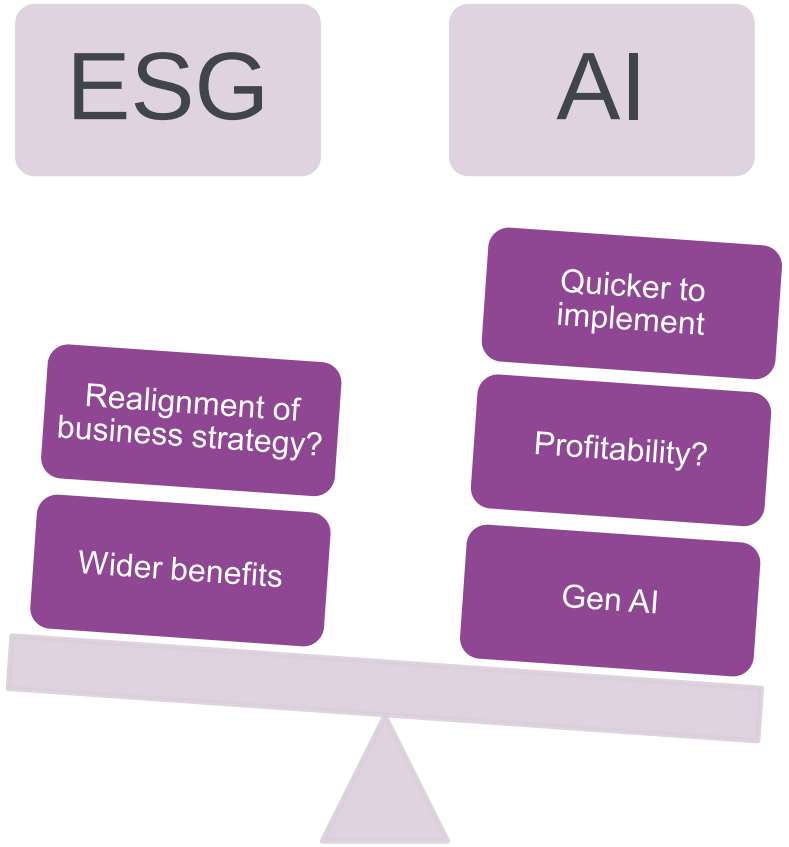
BUSINESSES

Sources: https://iucn.org/our-work/informing-policy/international-policy/un-sustainable-development-goals,; https://www.synergy-cmc.com/esg/

Adoption of data science across industries



Conflicting goals for businesses?



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Revamping classics

Use cases within general insurance industry

Business area	Risk/Opportunities	Solutions/Techniques	Data science-ready?
Pricing	• **Real-time** claims & quotes • **Usage-based** and more precise tariffication • **NatCat** risks • **ESG-metrics** • Data **bias risk**	• Utilisation of **satellite images** • Climate-models • Integrated IT solutions • Big and/or **external** data	✓
Reserving	• Revamped **portfolio** segmentation • **NatCat** risks	• **Individual** reserving • **Big** data	✓
Capital modelling	• More **complex** & **accurate** modelling required	• Enhanced predictive models	✓
Governance, Infrastructure	• ORSA / better internal **compliance** • Streamlined **IT services** and connected internal **databases**	• Real-time statistics • Cloud solutions • **Enhanced models** • **Management statistics**	✓
Reporting	• **ESG** reporting • **Efficient** reporting e.g. Solvency 2 templates	• Data scraping techniques • **Large language models** • **Real-time** management information	✓

Use case: Climate-related hazards on claim frequency prediction in motor insurance

Existing models are not directly applicable to incomplete records of weather hazards and claims.

Key contribution to addressing this gap

- ✓ **Novel** class of predictive compound frequency models**.**
- ✓ Study looks at **Greek motor insurance data set**, documenting climate events and storm-triggered motor claims.
- ✓ The proposed modelling framework uncovers the combined distribution of storms and claims **despite incomplete data**.
- ✓ **Geospatial covariates**

Key finding

- ✓ **Negative intrinsic dependence** between actual storms and claim frequencies per storm.

Practical impact

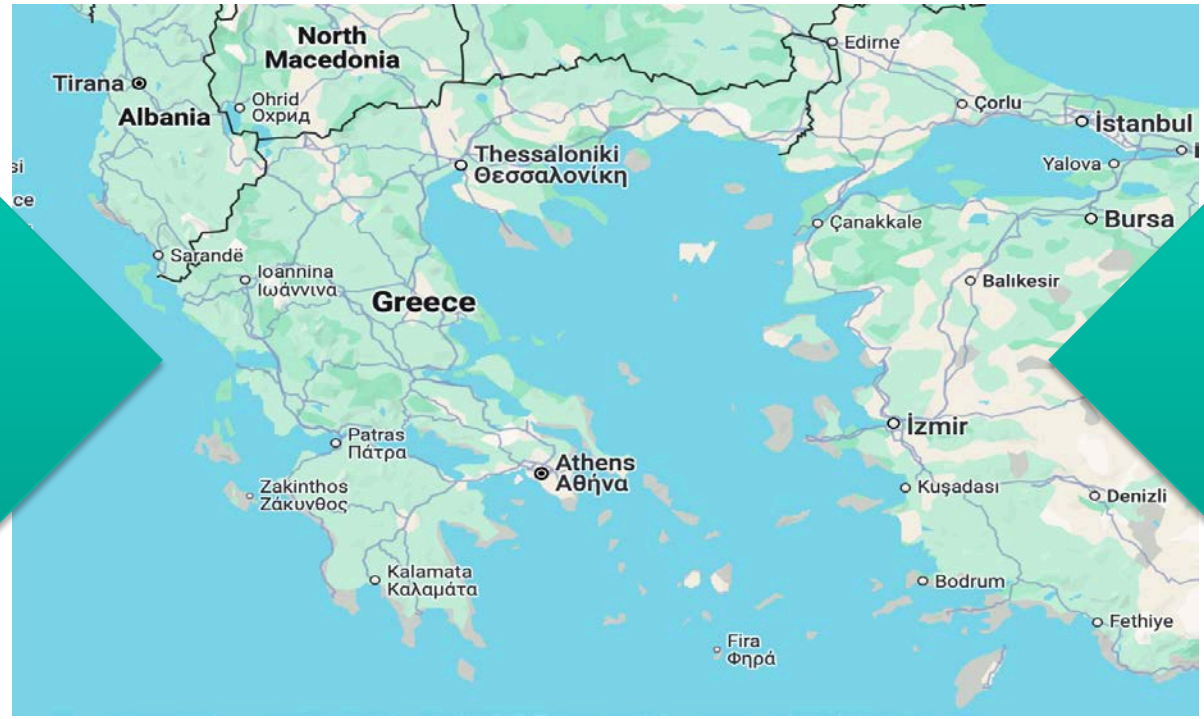
- ✓ **Offers valuable insights** for the insurance sector, especially with Greece's new law mandating natural disaster vehicle insurance from 1 January 2025.

Use case: Climate-related hazards on claim frequency prediction in motor insurance

The study analyses a **Greek motor insurance dataset,** documenting **storm events and storm-triggered claim counts across various regions of Greece over time.**

Geospatial features

- ✓ Vulnerability
- ✓ Coast ratio
- ✓ Log alt mean
- ✓ Residential
- ✓ Industrial
- ✓ Agricultural
- ✓ Wetlands



Exposure

- ✓ Motorcycle
- ✓ Cars
- ✓ Trucks

Use case: Climate-related hazards on claim frequency prediction in motor insurance

Goal: **Derive the joint distribution of (*M, N*)** , based on **geospatial features x** in a region over a year, **using complete data ($\tilde{M}$, $\tilde{N}$)**. $\tilde{M}$ is **actual number of storms** $\tilde{N} = (\tilde{N}_1, \tilde{N}_2, \ldots \tilde{N}_{\tilde{M}})$ Is the **number of claims triggered per storm**.

GENERAL MODEL

$$f_{\tilde{M},\tilde{N}}(\tilde{m},\tilde{n};x) = f_{\tilde{M}}(\tilde{m};x)\prod_{t=1}^{\tilde{m}} f_{\tilde{N}_t|\tilde{M}}(\tilde{n}_t;\tilde{m},x)$$

CASE 1: INDEPENDENT

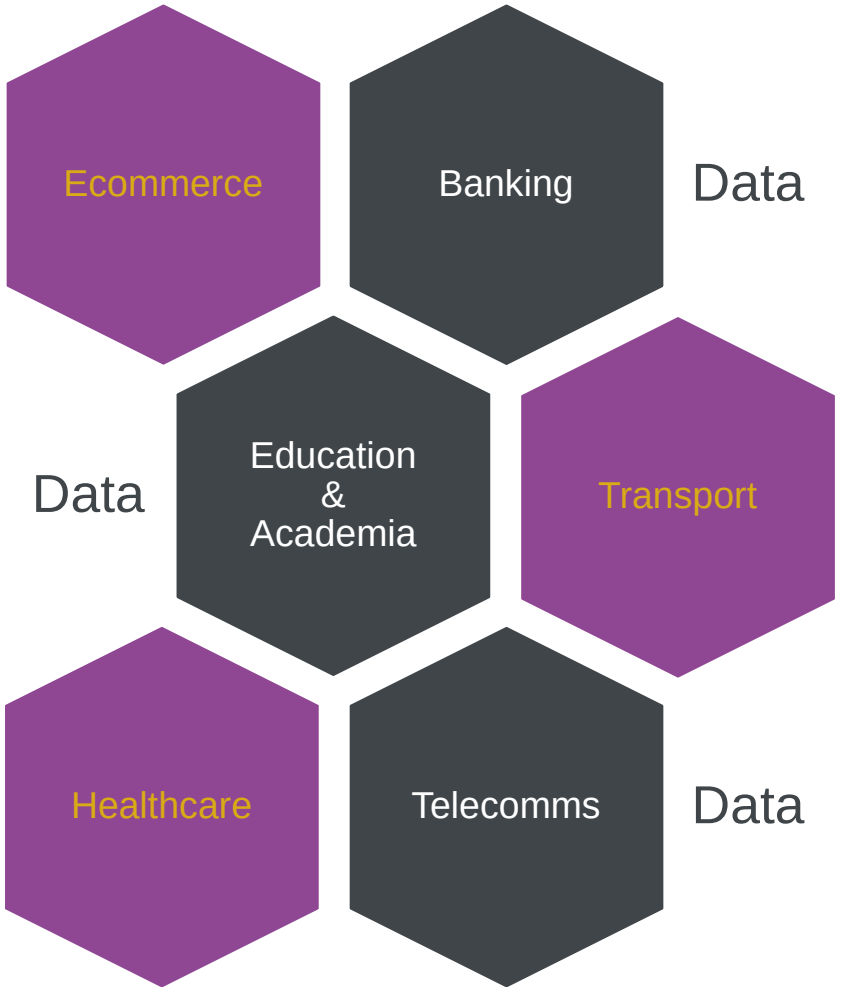
$$f_{M,N}(m,n;x) = \sum_{\tilde{m}\geq m}\binom{\tilde{m}}{m} f_{\tilde{M}}(\tilde{m},x)\left(f_{\tilde{N}_t}(0;x)\right)^{\tilde{m}-m}\left(1-f_{\tilde{N}_t}(0;x)\right)^{m} \times \sum_{\tilde{n}\in C_n}\left(\frac{f_{\tilde{N}_t}(\tilde{n}_t;x)}{1-f_{\tilde{N}_t}(0;x)}\right)^{m}$$

CASE 2: DEPENDENT

$$f_{mix}(m,n;x,\Phi_{mix,k}) = \sum_{b=1}^{B}\pi_b(x)\, f_{M,N}(m,n;x)$$

Outcome: Fitted compound Poisson-Poisson (PP), Negative Binomial-Negative Binomial (NN) and Negative Binomial-Poisson (NP) models. Mixture models with components were also fitted leading to 42 total models. Cross-validation used to assess predictive performance and computational burden - best-performing model being 5NN.

Take-up in other industries



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New dimensions and products

Global view - positive impact of data science/AI on SDGs

General use cases around the world

Geospatial

Smart cities

Education

Healthcare

Banking

Predicted quantifiable impacts

- 97m new jobs in 26 countries
- Africa +$400m GDP by 2030
- +40% healthcare delivery
- Global +$15.7tr GDP by 2030

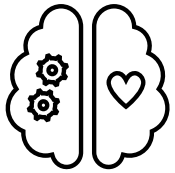
Sources: The Economist, Medium, ORF, PWC, WEF

Sustainable data science solutions

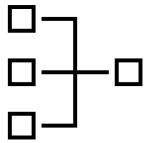
Green AI (vs Red AI)

Sustainable Solutions

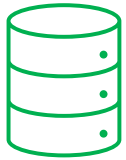
Green cloud
/ Cloud sustainability solutions



20W



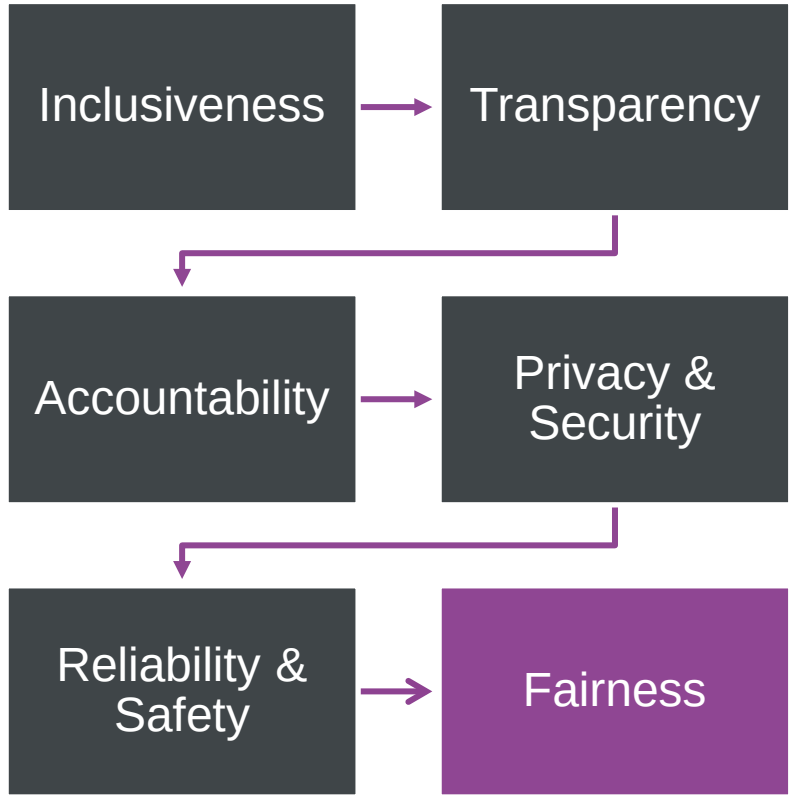
Spiking Neural Networks



Green
data centres

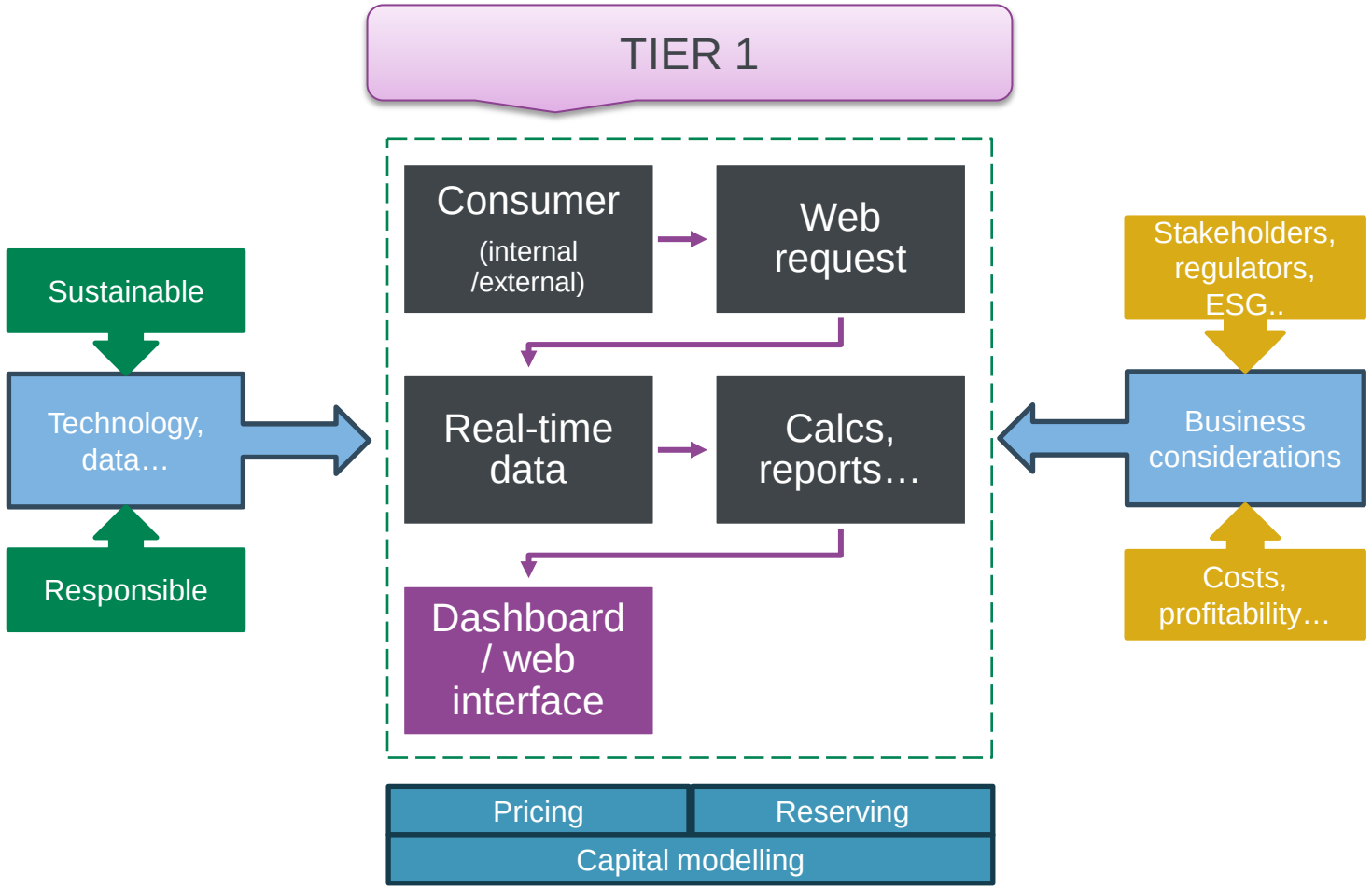
Responsible data science solutions

Responsible solutions



Source: Microsoft

Insurance as a service (IAAS)



BENEFITS

Customer

- ✓**Real-time** quotes
- ✓**Cheaper** quotes
- ✓**Secondary** benefits

Insurer

- ✓**Efficiency** & **profitability**
- ✓**Real-time** management information
- ✓**Modern** solution
- ✓Better **integration**
- ✓Ability to **scale up**
- ✓Improved customer **satisfaction**
- ✓Improved **data quality and coverage**

Regulator

- ✓Improved **governance**
- ✓**Access** to information

Insurance as a service (IAAS)

TIER 2

Insurer-driven solutions

- ✓ Customer-centric
  - ✓ Health trackers
- ✓ ESG-metrics
- ✓ Consulting as a part of insurance products
- ✓ Protection gap reduction

Market-driven solutions

- ✓ Direct/Indirect sustainability-aligned
  - ✓ Coral reef insurance
  - ✓ Solar panel minimum annual power output insurance
- ✓ Increasing ESG regs
- ✓ Competitor pressures
- ✓ Customer and employee needs
  - ✓ Generational challenges

BENEFITS

Individual

- ✓Better and healthier **day-to-day**
- ✓**Inclusive** work environment

Society

- ✓**Healthier behaviours** for both individuals and corporates
- ✓**Sustainable** society
- ✓Promotion of **ESG-aligned** practices and projects

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Challenges

Challenges of ESG integration & looking ahead

Alignment with business strategy?

Increased **regulations**

Rapidly evolving space – **risk & opportunity**

Increased **complexity** and lack of **understanding** of models

ADOPTION

75%

More **underwriters** considering ESG factors (Marsh)

25%

Group-wide approach for ESG integration for underwriters (Marsh)

GOVERNANCE

58%

Chief sustainability officer retains responsibility (Deloitte)

39%

Different teams working as **internal silos** (KPMG)

CHALLENGES

45%

Insufficient resources and capacity (KPMG)

45%

Pressure from **ESG rating agencies** (Deloitte)

Insurance and actuarial perspective

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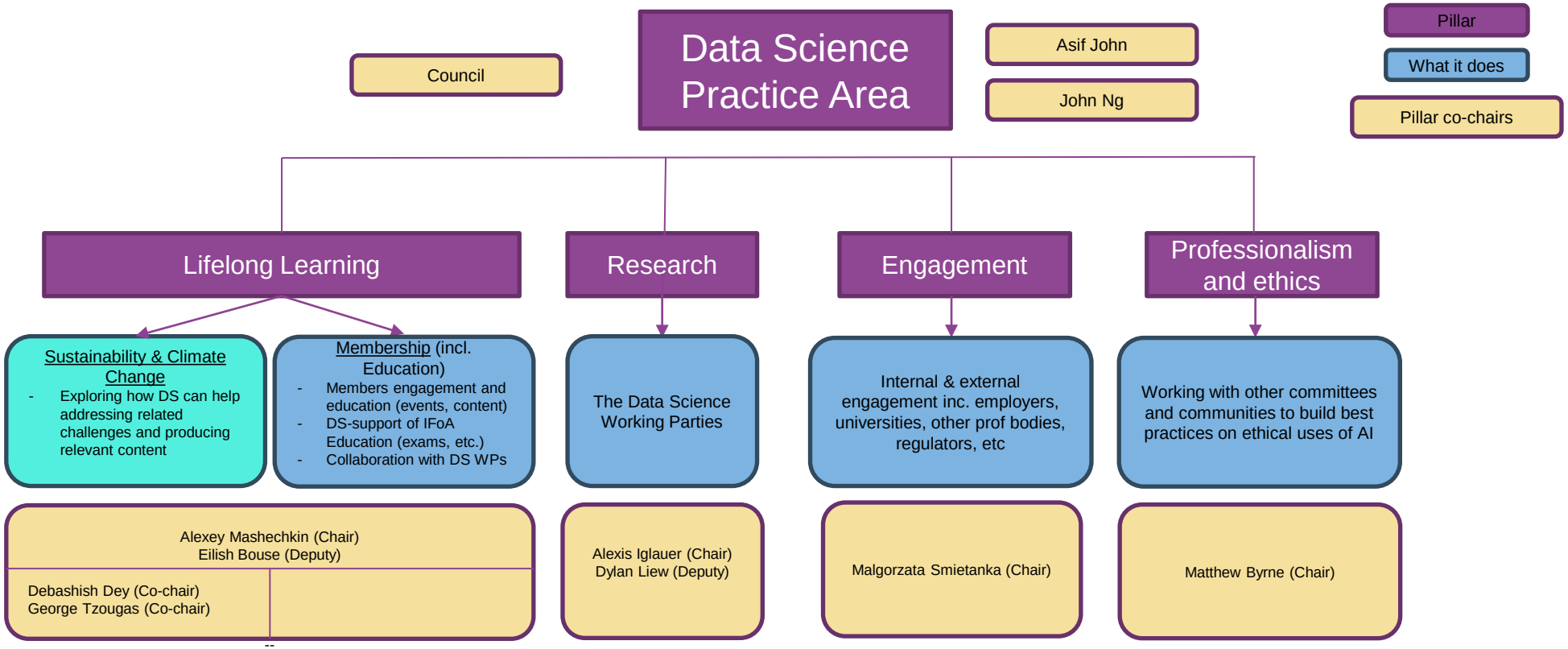
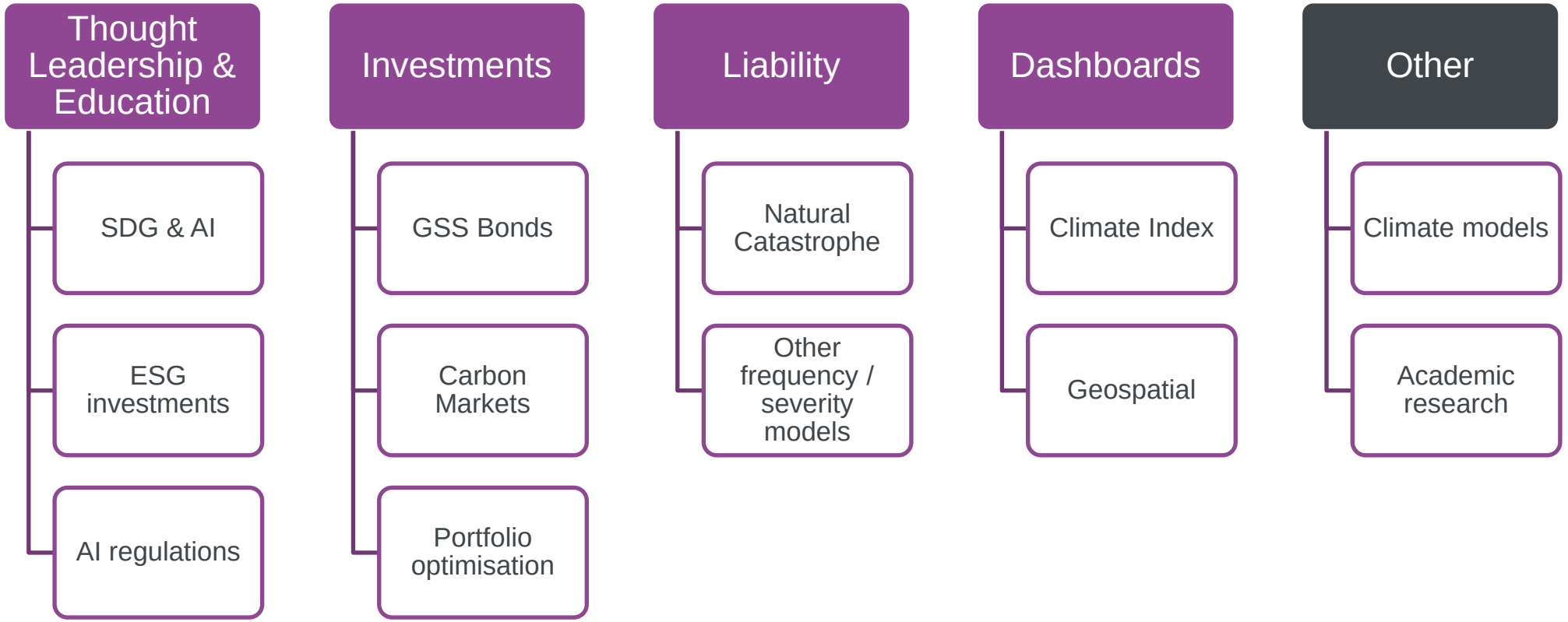
IFoA Data Science

Overview of IFoA Data Science structure



Overview of Working Party projects



Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter(s).

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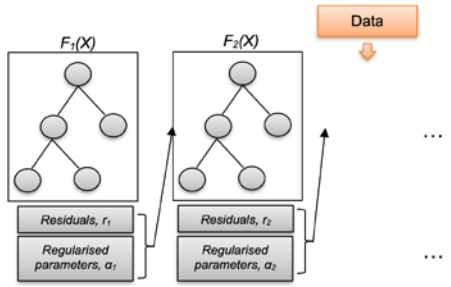
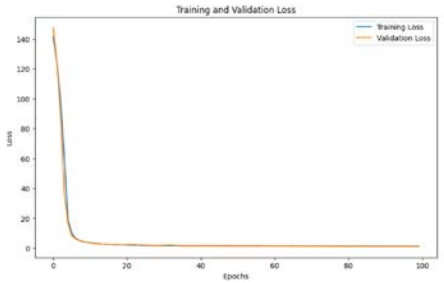
Appendix

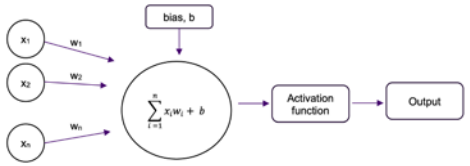
Appendix: IFoA Data Science – useful links

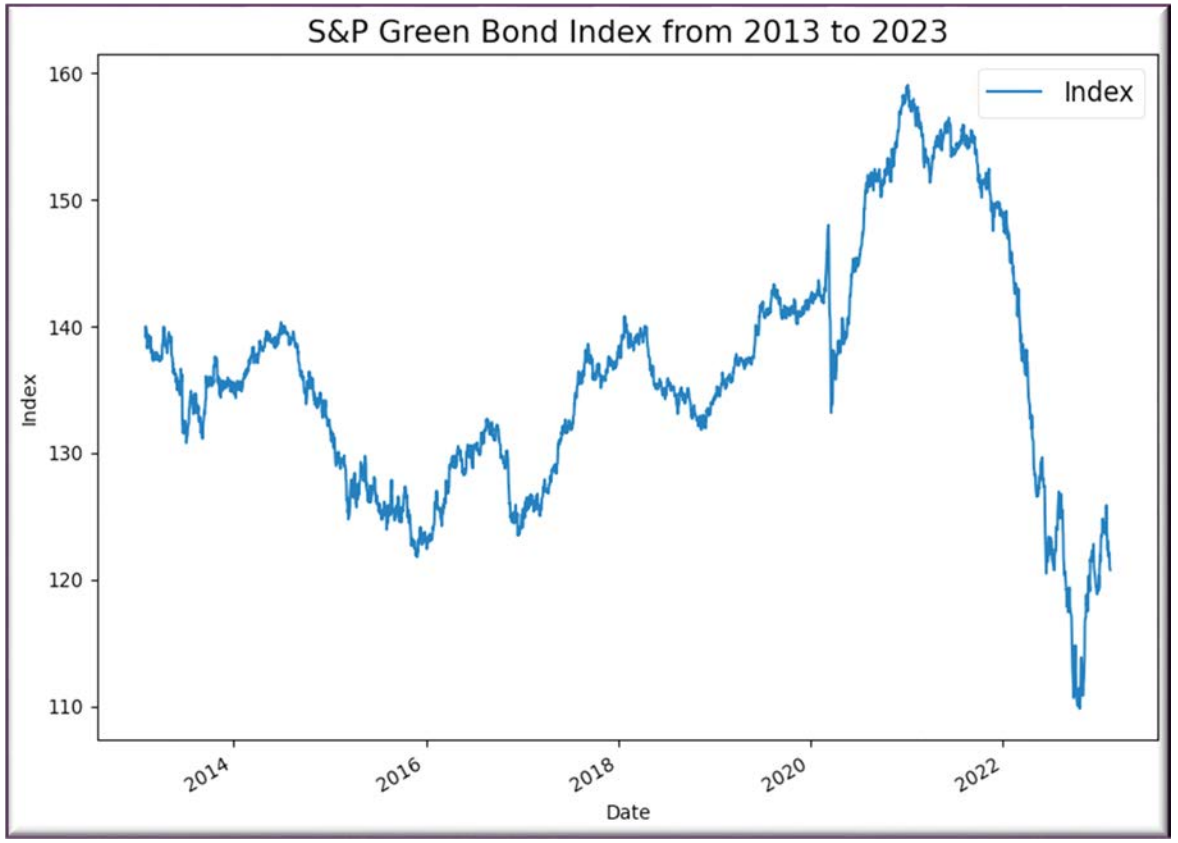
- IFoA VLE homepage
  - https://vle.actuaries.org.uk/course/view.php?id=1867
- IFoA blog posts
  - https://blog.actuaries.org.uk
- IFoA life-long learning homepage
  - https://actuaries.org.uk/learn/lifelong-learning/data-science/
- Other publications
  - https://researchportal.hw.ac.uk/en/persons/george-tzougas

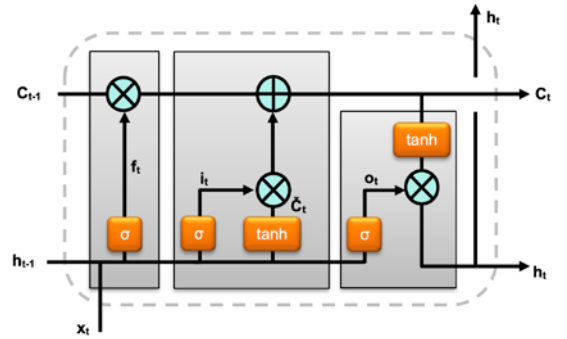
Appendix: Green bonds

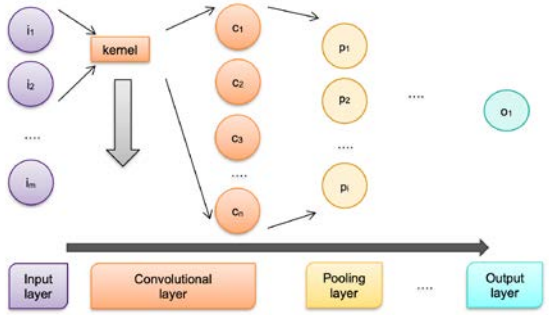












Appendix: Actuarial index