ISRAEL ASSOCIATION OF ACTUARIES (ILAA)
Data Science Training Program

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1 Our Approach

2 Intervention team

3 Sia Partners presentation

Synthesis of Sia Partners Proposition

Context

- The Israeli Association of Actuaries (ILAA) is constantly aiming at the promotion of the professional skills of its members. We would like to propose the Association to offer its members a training aiming at giving a basic knowledge on data science, and the capacity to start developing actuarial models with these new technologies.

- The participants are expected to attend a theoretical presentation and to improve their computing skills on R software. At the end of the training they should be in a position to understand the principal main concepts at stake; in addition, they should be able to manage Data Science projects by themselves.

- The main topics covered by the training are detailed below.
    - Theoretical background: introduction to machine learning methods and algorithms;
    - Computing skills: introduction to R programming language and the relevant associated tools, implementation of selected algorithms.

Planning

1st day — **Introduction to R (basics)**
R environment, data manipulation and basics of programming

2nd day — **Predictive models on R**
Machine learning models for classification and prediction & practical cases

3rd day — **Predictive models on R (extension)**
Machine learning models for classification and prediction & practical cases

Our strenghts

- Expertise in Data Science
- Daily use of R in Machine Learning projects by our consultants
- Sia Partners is a State-acknowledged training institute in France, used to provide professional trainings to insurance companies.
- Our lecturers are actuaries and data scientists. They have a strong experience in data science applied to insurance

Team

Data Scientist / Actuary Senior Manager	Lecture | 3 days full time
2 Data Scientists / Actuaries Consultant	Lecture | 3 days full time

Planning

- 3-days training (including a half a day lecture)
- Intervention in June 2018

Day 1: Data science applications in insurance

Goals

1. What are data science applications
2. Several examples
3. Exercises

Support of the lecture

1. Slides

Key points

1. No specific computing knowledge on R is needed
2. The presentation includes many examples and practical applications
3. Each participant is expected to have a computer

Our approach

1 Introduction to data science applications in insurance

- **Data sciences projects in insurance**
  - What is data science applications
  - Concepts & principles
  - Open data
  - Data manipulation
- **Example**
  - Type & characteristics
  - Basic operators
  - Use of variables

2 Introduction to R programming

- **Introduction to R environment**
  - Development interface *(Rstudio)*
  - User-created packages
  - Concepts & principles of R programming language
- **Variables & operators**
  - Type & characteristics of the variables
  - Basic operators
  - Use of variables

Day 2 & 3: Predictive models for insurance modelling

Goals

1. Practical use of machine learning methods for insurance
2. Implementation with R
3. Optimization and model selection

Support of the formation

1. Slides
2. R scripts

Key points

1. Advanced mathematical background needed
2. The presentation includes many examples and practical applications
3. Each participant is expected to have a computer

Our approach

1 Econometrics models

- **General models:**
  - GLM / GAM
  - Principles / Advantages / Limits / Applications
- **R implementation :**
  - Dedicated packages & functions
  - Optimization of computing time and memory management
- **Analysis of the results & model optimization:**
  - Residuals analysis and metric choice
  - Variables selection
  - Handling non-convex optimization problems
  - Handling interactions

2 Machine Learning Algorithms

- **Basis algorithms:**
  - CART / Random Forest / SVM / GBM / Neural network
  - Principles / Advantages / Limits / Applications
- **R implementation :**
  - Dedicated packages & functions
  - Optimization of computing time and memory management
- **Analysis of the results & model optimization:**
  - Variance analysis (residuals) and metric choice
  - Variables selection
  - Cross-validation

3 Selected practical applications

- **Home Insurance Pricing**
- **Line by line machine learning reserve**
- **Optical character recognition**

1 Our Approach

2 **Intervention team**

4 Sia Partners presentation

Intervention team

Sia Partners will send on the project 3 operational consultants with the following profiles:

- **Practical experience in Data Science**;
- **Members of the French institute of actuaries**;
- **Strong IT and programming skills**
- **Members of Sia Partners' training team**

	Data Scientist / Actuary **Consultant Senior Manager** **9 years experience**	**Teacher (Leading)**	**Full time**	• Chief Data Science Officer at Sia Partners • Strong experience on numerous projects • Deep knowledge of market methods
	Data Scientist / Actuary **Consultant** **2 years experience**	**Teacher (Assisting)**	**Full time**	• Strong programming and IT skills • Applied experience on numerous projects
	Data Scientist / Actuary **Consultant** **2 years experience**	**Teacher (Assisting)**	**Full time**	• Strong programming and IT skills • Applied experience on numerous projects

Senior Manager Actuarial Science / Data Science

Pierre-Antoine MERLE

Actuary Senior Manager
Paris

- 9 years experience
- Data Science chief at Sia Partners
- French, English

Academic

- Actuary, member of the French institute of actuaries
- EURIA – MS in actuarial science

Sectorial skills

- **Reserving**:
  - *Classic and advanced model*
  - *Piloting strategy*
- **Pricing**:
  - *Models*
  - *Construction of area and car dictionaries*
  - *Portfolio optimization*
- **Data Science**:
  - *Web Scraping*
  - *Data Quality and Management*
  - *Model selection*
- **Reinsurance**:
  - *Modelling and pricing*
  - *Optimization*

Language skills

- Professional English

Computer skills

- SQL / BO
- R / SAS / VBA
- IBNRS / ERMS/ Actupricing

Consultant in the Actuarial Science team at Sia Partners, Pierre-Antoine is specialized in problematics regarding non-life insurance and Data Science. He currently supervises all the Data Science projects concerning Banking and Insurance at Sia Partners.

Projects selection

Area risk mapping for auto insurance & Data Capture

An entity willing to change its pricing model for auto insurance concerning the area could not do it because of a too small and too undiversified portfolio. The innovative solution developed by Sia Partners was to combine their internal data with market data retrieved through web scrapping.

- **Data Capture**
  - Selection of market prices and areas to target (relevant market actor / similar offer);
  - Price extraction through web scrapping;
  - Reconstruction of market area dictionaries through Reverse Engineering.
- **Mixt Area Model**
  - Bayesian approach: theoretical law: geographic market coefficients / credibility: internal entity data;
  - Specification and calibration of the model: theoretical distribution / observations distribution;
  - Construction of a mixt area model by computing the ex post law on every postal code;
  - Development and implementation of a zoning tool according to this Bayesian model allowing a regular update of the mixt model.

Pricing models & Data Capture

Sia Partners developed a new innovative approach in order to include competitors' prices in the explaining variables of a pricing model in order to explicitly measure the influence of a prices augmentation on the clients fidelity.

- **Data Capture**
  - Selection of market prices and areas to target (relevant market actor / similar offer);
  - Price extraction through web scrapping;
  - Creation of relevant variables (rank / relative difference with best offer / absolute difference with best offer).
- **Cancelation modelling**
  - Variable selection (commercial data, pricing data);
  - Benchmark GLM modelling & Random Forest (non linear effects and interactions)
  - Identification of sensibility to the price on each profile (threshold function)

Other relevant projects

- **AUTO : New product pricing: Model frequency-cost by guarantee and area dictionary construction**
- **Data Science: Residuals analysis on auto insurance pricing by areas**
- **Vehicle liability: Model of extreme claims occurrence (> 70 K€)**

Arnaud BUZZI – Actuary Consultant

Arnaud BUZZI

Actuarial consultant, Paris

2 years experience

- French
- English

Academic

- Ecole Centrale Paris - Engineer title in financial mathematics
- University Paris Dauphine - MS in Actuarial Science

Sectorial skills

- **Financial skills**
  - Asset Liability Management
  - Quantitative analysis
  - Economic scenario generators
  - Financial Risk modelling and monitoring
  - Asset pricing
- **Actuarial skills:**
  - Best Estimate of Liabilities in Life Insurance
  - Life insurance modeling
  - Solvency Capital Requirement
  - Pricing and reserving in Non-Life Insurance
- **Data Science:**
  - Data Capture and Data Mining.
  - Optimization techniques
  - Model calibration

Computer skills

- **Programming:** R, Python, C/C++/C#, Matlab, SQL, VBA.
- **Publication:** Latex, HTML&CSS, Markdown, Office.

Arnaud Buzzi works as an actuary consultant within the Actuarial Unit of Sia Partners.

He participated in various projects in the fields of ALM modeling, Economic Scenario Generators, Data Science, and financial modeling.

In addition to all those experiences, Arnaud participates in various working groups within Sia Partners and with the French Institute of Actuaries, whose goals are to develop financial models for insurance applications.

Projects overview

- **Asset Liability Management, Life Insurance and Financial Modeling**
  - **Regulatory reporting automation in Moody's Risk Integrity**:
    - Redaction of the functional documentation,
    - Gap analysis to determine the missing data and specification of the new data model,
    - Creation of the reporting matrices.
  - **Development of an Economic Scenario Generator**:
    - Choice and implementation of financial models for rates, actions, and real estate,
    - Calibration of the models in a market-consistent way in a risk-neutral world,
    - Development of a user-friendly web interface for the generation of the financial trajectories,
    - Application to an Asset Liability Management model.
  - **Actuarial Audit**:
    - Analysis and validation of the financial modeling tools and methods of a major life insurer for regulatory purpose.
  - **Credit Risk Modeling**:
    - Audit of a credit risk model for a european bank and proposition of a new model.
- **Data Science and Data Capture**
  - **Reverse Engineering of the pricing models of car insurers**:
    - Data retrieval from the online quote service by using web robots,
    - Determination of the relevant factors influencing the quote and reverse engineering of the pricing model,
    - Implementation of a web API for results communication.
  - **Capture of interest rates given by banks' online simulators for loans**
    - Retrieving of the data from the online service through web robots,
    - Implementation of a web interface for results visualization and communication.
- **Fundamental research in physical modeling**
  - **University of California Irvine – Earth System Science:**
    - Development of a physical model for ice sheet systems,
    - Coding of a C++ optimization tool for model calibration.

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Clément BILLORÉ –Actuary consultant

Clément BILLORÉ

Actuarial consultant, Paris
2 year experience

• French
• English

Academic

- EURIA (Brest) – MS in Actuarial Science
- Actuary, member of the French institute of actuaries

Sectorial skills

- **Data Science :**
  - *Data Mining*
  - *Optimization techniques*
  - *Model calibration*
- **Pricing**:
  - *Pricing Model*
  - *Portfolio Optimization*
- **Banking actuarial :**
  - *Modelization banking yield*
  - *Profit testing*
  - *Bale II*
- **Reserving** :
  - *Classic Model*
  - *Stratégie de pilotage*

Computer skills

- Programming : R, SAS, SQL, VBA
- Publication : Latex, HTML&CSS, Office, JavaScript

Clément Billoré works as a actuary consultant within the Actuarial and data science Unit of Sia Partners. He participated in various projects in the actuarial and data science fields. He has a specific knowledge of Data Mining techniques and programming.

Work experiences

Insurance Non-Life Modelization and data science

Sia Partners has developed Risk measuring tools based on data science technics.

- **Pricing HOI**
  - Framing specifications
    - Identifying needs
    - Product perimeter
    - Identifying data sources
  - Development R model
    - Implementation of calculation
    - Outputs validation
  - Development and implementation tool
    - Development user interface
    - Tool documentation
    - Handover to internal staff

- **Nuclear risk modeling for credit insurance**
  - Development of a monitoring tool to localize buyers and nuclear power plants
  - Calculation of exposure by nuclear power plants
  - Calculation of maximal loss of the insurer

Personal insurance

The entity developpe and use his own asset liability model in life insurance. The liability is developed with his own prospective table.

- **Risk department : Update of liabilities implementation**
  - Statistical studies of portfolio
  - Study models used
  - Construction of a prospective table
    - Projection of structural lapses
    - Projection of cyclical lapses
    - Projection of mortality
  - Back-testing
  - Calculation SCR impact

1 Synthesis of our proposition

2 Our approach

3 Intervention team

4 Planning & Pricing

5 **Sia Partners presentation**

Sia Partners, a management consulting firm with a global reach

155
M$ Revenue in 2016

1999
Date created

x2
Doubled in growth over the last 3 years

20
Offices worldwide

870
Consultants

25+
Nationalities

> A team with an unparalleled expertise able to deliver superior value and tangible results for our clients

15%
Strategy

70%
Business Transformation

15%
IT & Digital Strategy

10 Sector teams and 11 Service teams

Our teams are fully integrated with a global reach

> A culture of excellence and high standards for our clients and our team

#7
in Vault Top 10 Consulting APAC list and #18 in Europe

Key clients include
20%
of Fortune 500 companies trust us

40,000+
Followers on LinkedIn

7,000
Assignments since our creation

Sia Partners is **independent** from IT companies and financial audit firms

Our project culture is strongly oriented towards **expertise** and delivering **results**

We have a **global reach** with integrated teams **based in financial centers across the U.S., Europe and Asia**

10 industries and just as many cross-industry teams

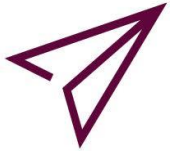
SECTORS

Banking

Retail

Government

Telecommunications


Transportation

Insurance

Pharmaceuticals

Manufacturing

Healthcare

Energy

SERVICES

CIO Advisory

Human Resources

Actuarial & Data sciences

Change Management

Procurement and Sourcing

Operational Excellence

CFO Advisory

Digital Transformation

CRM

Corporate Strategy

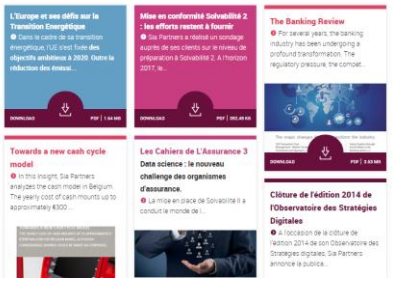
Our publications

Our website

Visit us at http://showroom-actuariat.sia-partners.com/ for an overview of our work on data science

Regular communication to the market

Sia Partners Blog



The insurance booklets *(quarterly)*

Lectures & training

Lectures

USP

Digitalization

ESG

Emerging risks

ORSA

Impact IT

ALM

Data Science

Trainings

Foyer Assurances - Prévoyance - Patrimoine

Les Echos FORMATION

BANK OF ENGLAND PRUDENTIAL REGULATION AUTHORITY

IFE International Faculty for Executives BENELUX

Sia Partners assets : A practical experience in Data Science applied to insurance

Our expertise

P&C Pricing

- Sia Partners has realized many P&C pricing projects with prestigious clients
- A dedicated team to P&C pricing issues
- Our consultants are experts on models for motor insurance and property insurance

Data Science

- Our consultants are familiar with the different data science methods used in predictive models
- Our data scientists back every Sia Partners' interventions on technical and computational aspects
- A team is specially dedicated to Data Science

Data Capture

- A unique technology to access automatically to a wide range of (public) competitive prices
- Data Science team in charge of the Data Capture Project at Sia Partners
- A pioneer project to integrate market data in internal pricing models

Examples of project driven by Sia Partners

Carrefour Banque, thélem, La médicale, SMABTP, Crédit Agricole Assurances

- Revision of the pricing – Car Insurance
- Revision of the policy – Home Insurance
- Cost model for extreme claims in civil liabilities
- Revision of multi-risk climatic pricing
- Audit of home and car insurance pricing
- Construction of a risk assessment cartography based on internal data and market data – Car & Home Insurance

ingenico GROUP, Générale, SNCF, EDF, Club Med

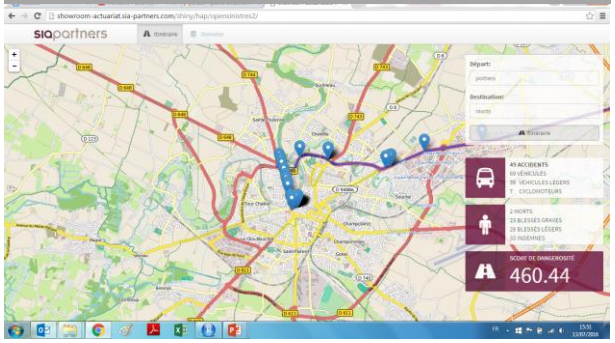
- Predictive maintenance model
- Customer segmentation model – Loan insurance
- Yield management model
- Electric meter Linky project
- Dashboarding

Confidential

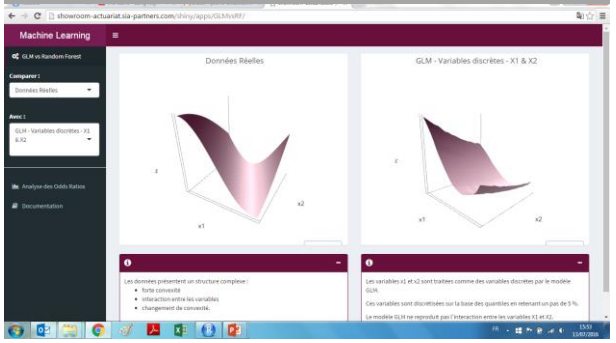
- Benchmark of pricing models – car insurance
- Construction of risk evaluation maps based on internal data and market data – Car Insurance
- Elasticity price model with integration of competition prices – Home Insurance
- Analysis of the competitive strength – Home Insurance

Sia Partners assets – Some of our applications

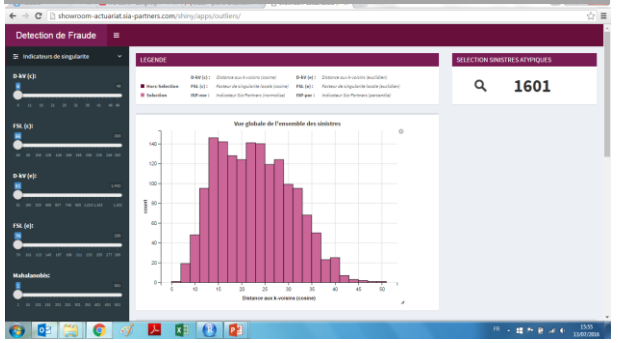
Pay As You Drive tool



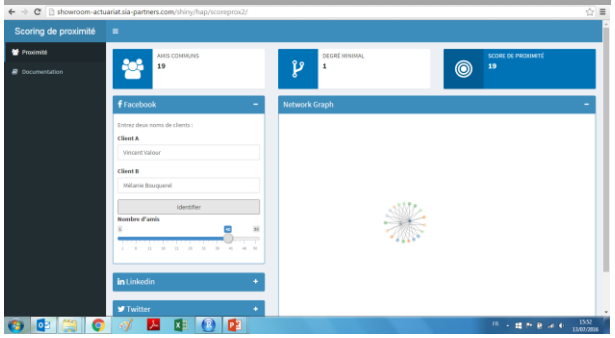
Machine Learning models visualization



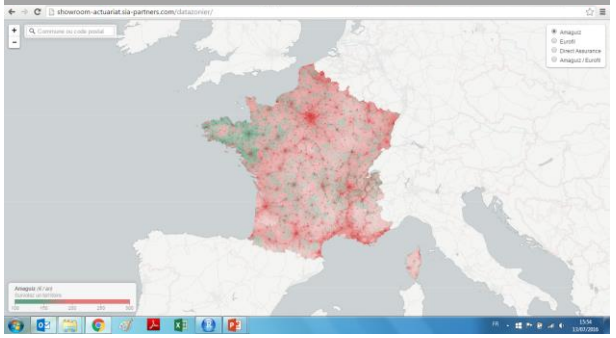
Fraud detection via non-supervised methods



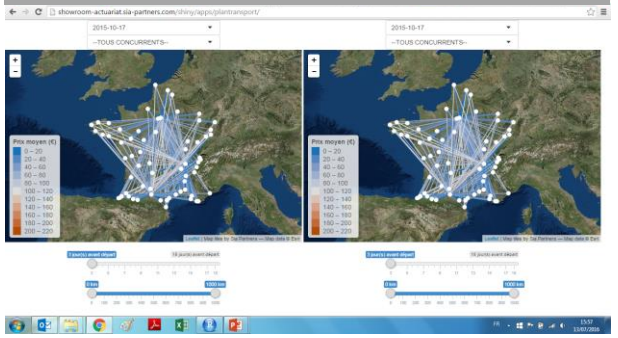
Fraud detection through social medias tool



Analysis of competitive prices



Means of transport analysis



Presentation of insurance & actuarial activities

Insurance & Actuarial services

Sia Partners Actuarial Team

Our Actuarial Services team was **created in 2011**. This team consolidates our actuarial resources previously deployed over a diverse range of activities into one dedicated Actuarial Services Unit

As of January 2016, the Sia Partners Actuarial Services department has:

- ✓ An expanding team – currently **40 actuarial consultants globally**
- ✓ An active involvement and contribution to **thought leadership**
- ✓ Expertise deployed over **four areas of competency:**

Core Actuarial Services

Actuarial Expertise

- Product documentation and product re-engineering following distribution regulations (GN16, IDD, PRIIPS)
- Audit/review of pricing methodologies
- Review of claims experience and reserve adequacy
- Review of models and hypotheses
- Optimisation of asset/liability management
- Embedded Value calculation (EEV, MCEV bases)
- …

Model Development, Calibration and documentation

- Development of risk management models (longevity, mortality, lapse)
- Development and calibration of Economic Scenario Generators (ESG)
- Valuation of options and complex financial guarantees
- Interim and full year balance sheet projections
- Aggregation and quantification of the impact of diversification
- …

YOUR CHALLENGES

Perform quantitative assessments through a coordinated and pragmatic approach

OUR SUPPORT

Our team has extensive knowledge on the mot advanced actuarial techniques.

Our firm offers global solutions by taking into account actuarial specificities and process implications.

Overview of our actuarial expertise, by competence center

Insurance & Actuarial services

General insurance

- Creation of new products / Pricing
- Reserving (SI, SII, IFRS)
- Reinsurance (pricing and creation of a program)

Life insurance

- Financial modeling
- KPIs production
- Audit and consulting

Health & Social protection

- Pricing
- Solvency II
- Support RFPs
- Analysis of regulatory impacts

Data Science

- Fraud detection models
- Data capture
- CRM
- Data Visualization

Transversal

Transformation
- Process optimization
- Project framing and management
- Change management

Regulatory compliance
- Support in implementing regulations
- Gap analysis
- Framework audit

Trainings
- Regulations
- Valuation
- ALM
- Tools

Our areas of support

	Insurance companies	Mutual Insurance companies	Banks
Actuarial	✓✓	✓✓	✓
Risk management	✓✓	✓✓	✓✓
Governance & Strategy	✓✓	✓✓	✓

They trust us

Our publications & regulatory watch

Practical guides

QRT Production

Standard Formula and USPs

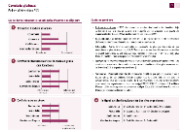
Compliance

Studies

Concentration of mutual insurance groups

Insurance and youngsters

In collaboration with Les Echos, study if the insurance companies strategy towards seniors



Benchmark on the risk management organization within the context of Solvency II

In collaboration with Les Echos, study on the evolution of business models within the insurance industry

Quarterly publication

Produced by the consultants from the insurance practice and proposing a regulatory watch along with a focus on a chosen theme.

N° 1 :
Focus on Solvency II work streams

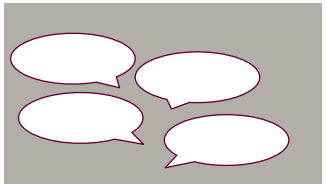
N°2 :
Digital / Responsible policies

N° 3 :
Big data

N° 4 :
Insurance for seniors

N° 5 :
Data for Insurance

Clubs



Operational Risks Club

Compliance Club

Breakfasts

ESG

ORSA

Data Science

Compliance

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Driving Excellence