New challenges for CISO: Artificial Intelligence, emerging technologies and regulations

COMMISSION
DE SURVEILLANCE
DU SECTEUR
FINANCIER

The regulator's viewpoint

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Agenda

1. INTRODUCTION
2. AI OPPORTUNITIES
3. RISKS AND RECOMMENDATIONS
4. CONCLUSION & QUESTIONS

INTRODUCTION – WHAT IS AI?

- What is AI?
  - “The theory and development of computer systems able to perform tasks that traditionally have required human intelligence.”

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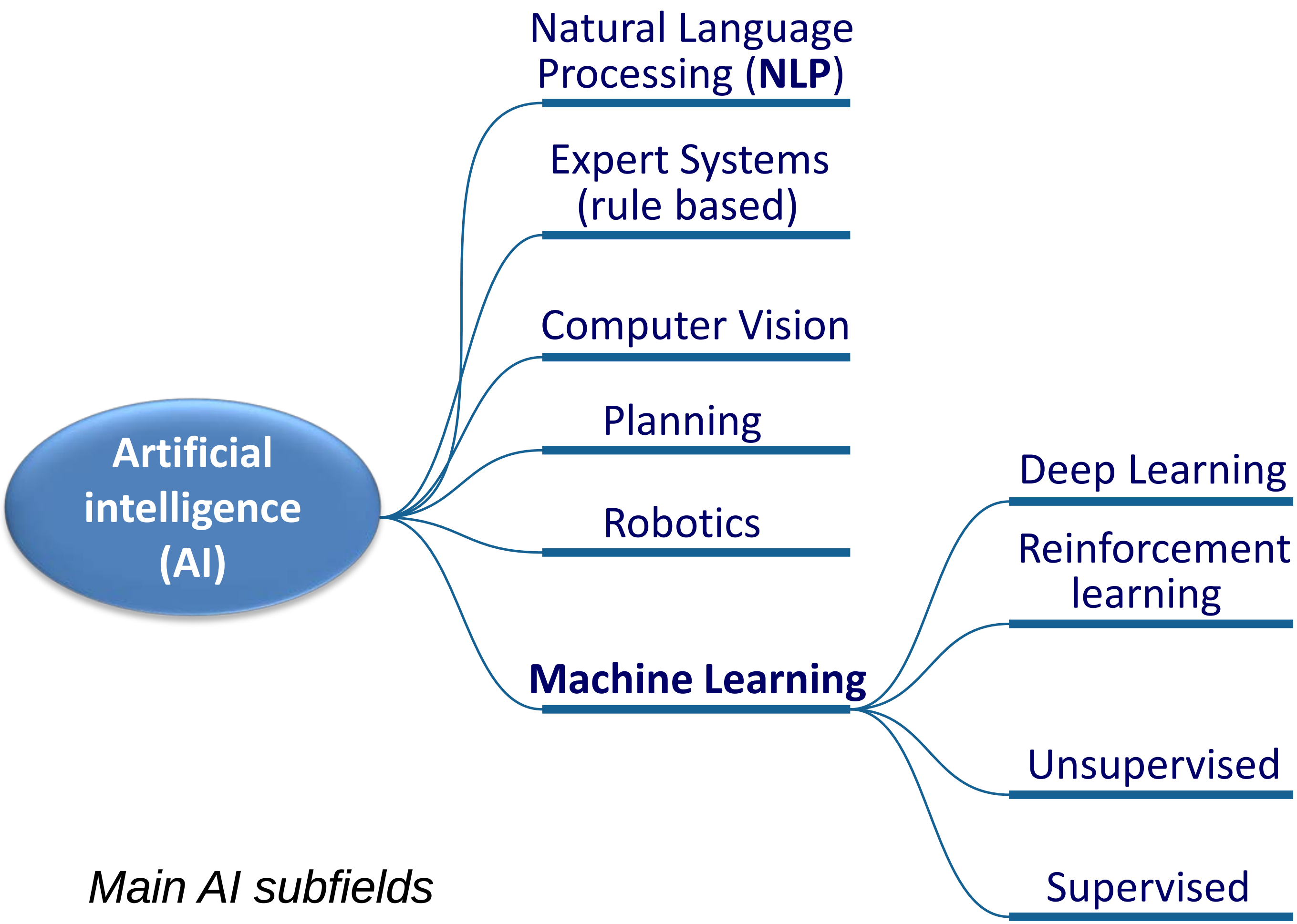
  - Intelligent tasks:
    - Reasoning / Problem solving
    - Learning
    - Planning
    - Ability to understand language and speech
    - Ability to manipulate and move objects
    - etc...

INTRODUCTION – WHAT IS AI?



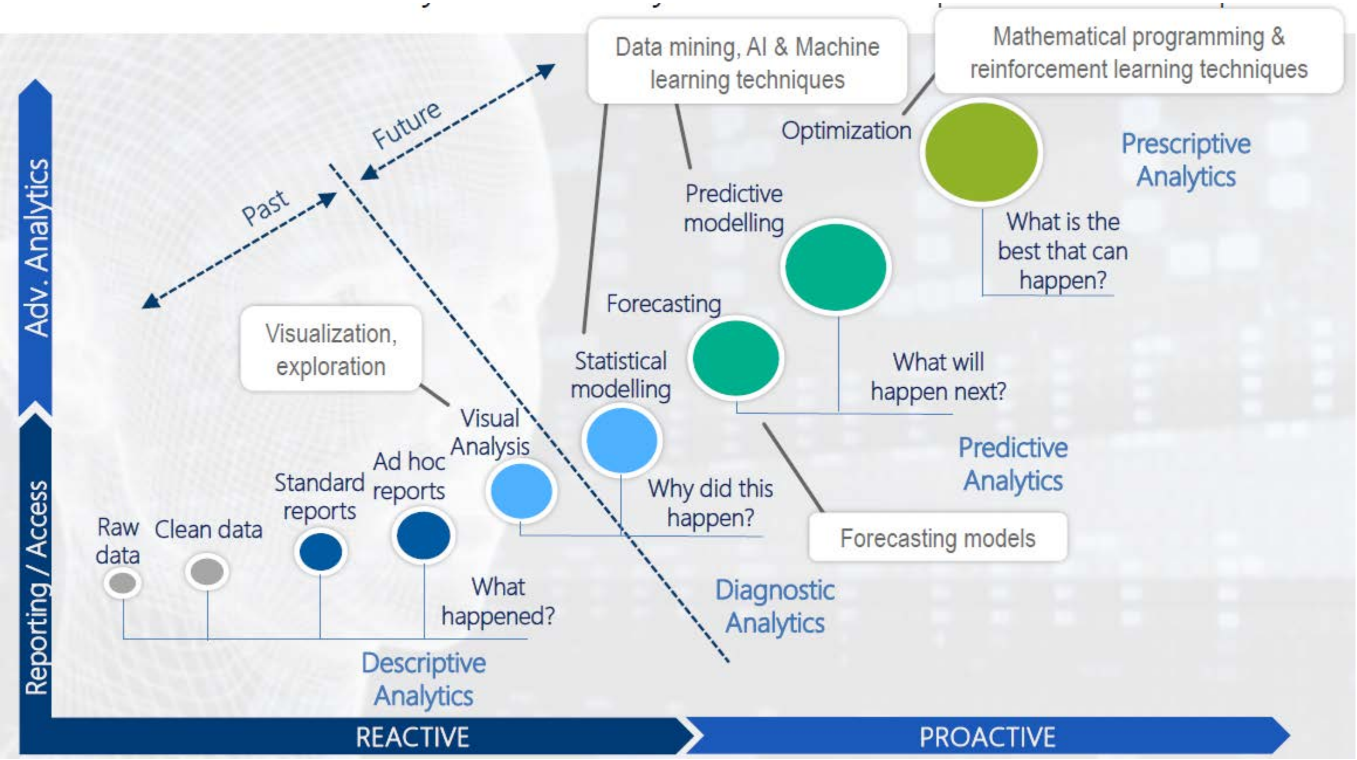
Main AI subfields

GOVERNANCE EXPECTATIONS ON AI FOR SUPERVISED ENTITIES

- The common principle underlying the supervised machine learning algorithms is:
  - Machine learning algorithms are described as learning a target function (f) that best maps input variables (X) to an output variable (Y): Y = f(X)
  - In other words, the goal is to learn the mapping Y = f(X) in order to be able to make predictions of Y for a new X. This is called **predictive modeling** or **predictive analytics**.

INTRODUCTION – WHAT IS AI?

- Data Analytics



Source: SAS (AI Luxembourg Summit 2018)

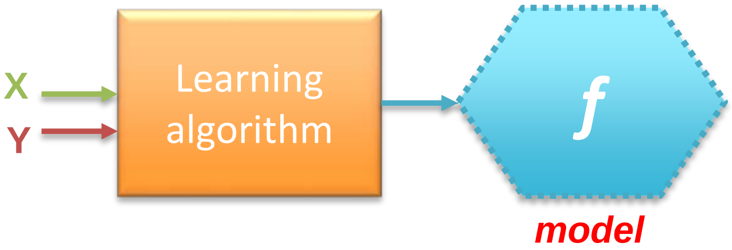
INTRODUCTION – WHAT IS AI?

Traditional programming

- The program (***f***) will , given some input x, calculate the output y (y= ***f***(x))

Machine Learning (ML)

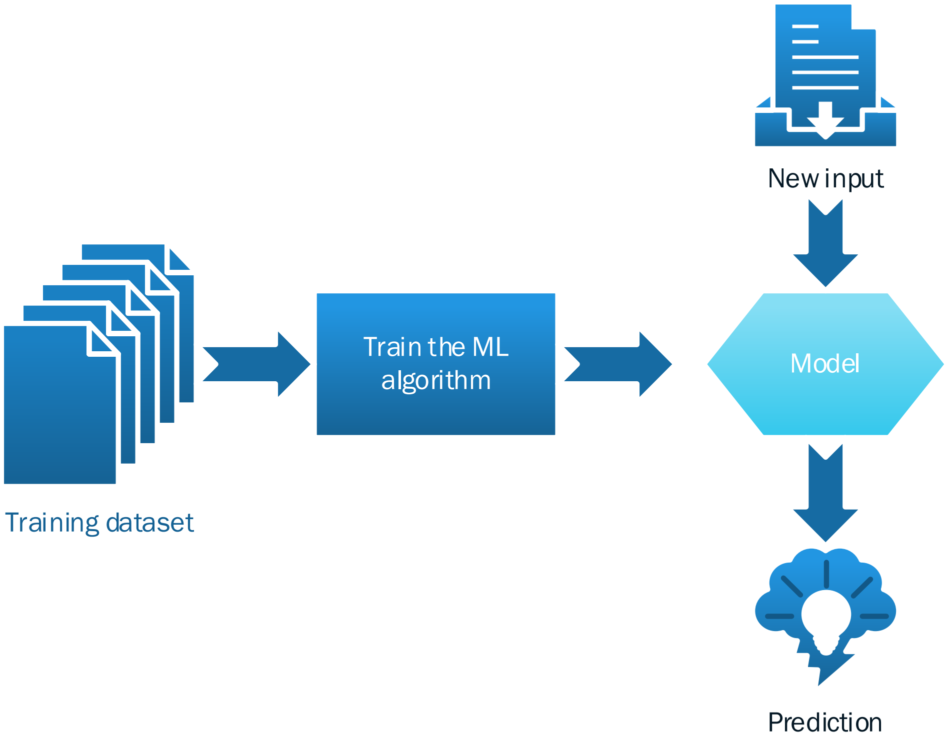
- The "program" (i.e. the function ***f*** mapping x into y) is "learnt" by the algorithm



- The mapping function ***f*** constitutes the **model**

INTRODUCTION – MACHINE LEARNING

- A **model** is a representation of what the algorithm has learnt from the training data and is used to make prediction on new input data



AI OPPORTUNITIES

AI OPPORTUNITIES – AI DEMOCRATIZATION

- AI is not new, but is now more accessible due to several factors:
  - More powerful and dense processors (GPU)
  - Lower storage cost
  - Cloud computing
  - Big data: large data sets available for “learning”
  - AI tools and platforms (e.g. DataRobot, DataIKU, Microsoft, Google, Amazon, etc..)

AI OPPORTUNITIES – USE CASES

- RPA (Robotic Process Automation) and IPA (*Intelligent* Process Automation)
- Chatbots
- Robo-advisors
- **Fraud detection**
- Terrorism Financing detection
- Credit scoring
- Other (NLP/text mining, algorithmic trading, facial recognition in KYC processes, IT security, etc...)

RISKS AND RECOMMENDATIONS

RISKS AND RECOMMENDATIONS

- Key Risk areas:
  - Data
  - Governance
  - Ethics
  - Technology
  - External providers

RISKS AND RECOMMENDATIONS - DATA

Risks

- Difficult to find the right data
- **Data quality** issues
- External data not appropriate/ not reliable

Recommendations

- **Data governance**:
  - clear roles & responsabilities for data ownership;
  - data dictionaries,
  - data quality management,
  - etc...
- Involve business data owners
- Due diligence of data source providers
- Verify adequacy of data for the target context

RISKS AND RECOMMENDATIONS - GOVERNANCE

Risks	Recommendations
• No human in the loop / uncontrolled automated actions • Lack of AI specific skills (e.g. data scientists; AI auditor,…) or over-reliance on few key staff • Fear of change/ lack of adoption by business users • Lack of understanding of AI results	• Never leave a machine to decide on critical tasks alone (**human oversight** / dual validation) • Involve Internal Audit, Risk and Compliance functions in AI projects since the beginning (+ training) • Use external AI experts and ensure knowledge transfer • Involve business users from the start (key success factor)

RISKS AND RECOMMENDATIONS - ETHICS

Risks	Recommendations
• **Bias** (within training/validation datasets, algorithms,…) • **Discrimination** (e.g. populations not fairly represented in the training data) • **Personal data collected/processed without consent** (e.g. behavioral data) • **Accountability** of AI actions	• AI code of conduct (incl. fairness) • Identify and **remove bias** (during data preparation) • Active inclusion: seek for diversity in training / validation data • Create specific datasets to **test against discrimination** • Challenge the need for personal data/ **data privacy by design** • **Accountability cannot be delegated to a machine**: ultimate responsibility relies with senior management

RISKS AND RECOMMENDATIONS - ETHICS

Risks	Recommendations
• Lack of **explainability**/ «black box» models • Lack of **auditability**	• **Document the data preparation** process (model blueprint) • Document the choice of the algorithm; choose more **interpretable algorithms** (e.g. decision trees) depending on the criticality of the system • Use **explainable AI** techniques (e.g. interpreter) when required • Implement detailed **audit logs** • Implement technical means to **simulate the input data** into the AI to perform investigations in case of need

RISKS AND RECOMMENDATIONS - TECHNOLOGY

Risks

- Change management:
  - Lack of involvement of business users
  - **data leakage** (output information in input data)
  - Lack of documentation/ traceability
- Poor results/ **model not accurate**
- **Predictive power of ML is limited to what can be learnt from past observations: cannot predict something never seen before!**

Recommendations

- **Document** the choices made at each step of the development process (e.g. feature selection, choice of algorithm,...)
- Prefer using integrated platforms
- Monitor model performance (via **accuracy** metrics and business KPIs, etc.) and **update the model** (re-training) when needed
- Perform **parallel runs** (old Vs new AI model)

RISKS AND RECOMMENDATIONS - TECHNOLOGY

Risks	Recommendations
• Insufficient error and incident management • Technical operational issues (e.g. interfaces with legacy systems) • Security vulnerabilities/ robustness to attacks	• Plan for **error and incident management** (e.g. RPA processes can generate frequent operational errors) • Apply **security by design** • Test **model robustness** • Perform independent security reviews according to the criticality of the system • **Technological watch**: monitor improvements in the attack and defense techniques (remember that **attackers are also using AI to improve their attacks!)**

RISKS AND RECOMMENDATIONS – EXTERNAL PROVIDERS

Risks	Recommendations
• **Dependency on few providers** • General outsourcing risks • **Systemic risks**: if the same model is used by many institutions, market movements and errors may be amplified	• Plan for the **maintenance** of the AI solution (e.g. have the right AI staff internally Vs SLA with external provider) • **Apply best practices** and regulatory recommendations on IT outsourcing (e.g. circular CSSF 12/552) • **Customize** the AI product • **Monitor systemic effects**

KEY SECURITY ISSUES

- Why should someone hack an AI?
  - To stop the service based on AI
  - To hijack the AI
    - For personal needs
      - To bypass the analysis (i.e. KYC/AML, biometrics)
      - To Influence the outcome in favor of the hacker (i.e. Asset management, credit scoring, political elections)
    - To harm the provider
      - To influence the outcome used by the provider (i.e. wrong investments)
      - To fuzz the results in an random way that it will lead to a loss of trust

KEY SECURITY ISSUES

- How could a hacker corrupt an AI?
  - By acting on the data
    - Initial data
    - Learning process
  - By acting on the model
    - Tuning parameters
    - Mathematical model substitution
    - Code modification
  - By acting on the explainability tools
    - Hiding the biais

RISKS AND RECOMMENDATIONS

Risks

- **Data quality** issues
- External data not appropriate/ not reliable
- No human in the loop / uncontrolled automated actions
- Lack of AI specific skills (e.g. data scientists; AI auditor,…) or over-reliance on few key staff
- **Bias** (within training/validation datasets, algorithms,…)

Threats

- Corruption of data
- Security threats on external data providers
- External data providers phishing (MITM, fake data provider by redirection)
- Undetected corruption (no human, no audit)
- Modified datasets, algorithms
- Traceability of AI actions

RISKS AND RECOMMENDATIONS

Risks

- **Discrimination**
- **Personal data collected**
- **Accountability** of AI actions
- Lack of **explainability**/ «black box» models
- Lack of **auditability**

Threats

- Corruption of data
- Security threats on external data providers
- External data providers phishing (MITM, fake data provider by redirection)
- Undetected corruption (no human, no audit)
- Modified datasets, algorithms
- Personal data leakage (also in AI output)
- Traceability of AI actions

RISKS AND RECOMMENDATIONS

Risks

- Change management:
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Threats

- Corruption of data
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CONCLUSION

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- Plan for **error and incident management**
- Apply **security by design**
- Test **model robustness**
- Perform **independent security reviews** according to the criticality of the system
- **Technological watch**: monitor improvements in the attack and defense techniques (remember that **attackers are also using AI to improve their attacks!**)
- **Use only the necessary data**

- Key controls: **data governance, human in the loop**
- Key challenges: **fairness, explainaibility, auditability**

CONCLUSION

Reference:

- CSSF whitepaper "Artificial Intelligence: opportunities, risks and recommendations for the financial sector" www.cssf.lu/fileadmin/files/Publications/Rapports_ponctuels/CSSF_White_Paper_Artificial_Intelligence_201218.pdf

QUESTIONS ?