AI based industry applications
A journey from cancer detection to market abuse detection

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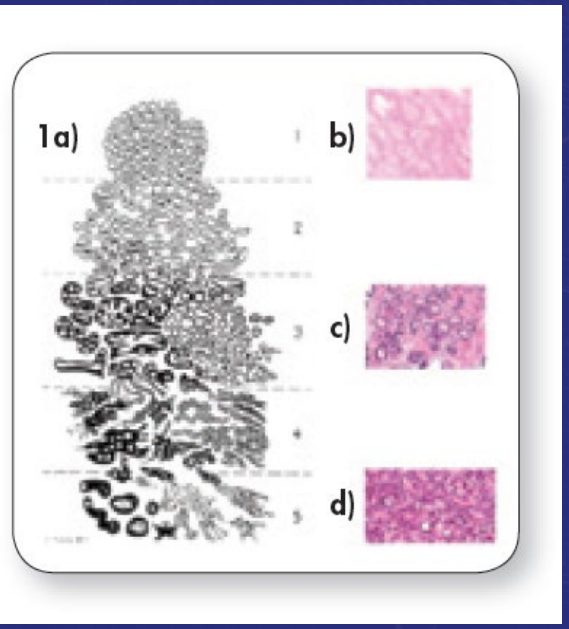
Introduction

- Graduated from Faculty of Automatic Control & Computer Science, UPB, Bucharest
- Teaching assistant
- PhD in Applied Sciences - Delft Univ. of Technology, The Netherlands
- Research scientist - Phillips Applied Technologies, The Netherlands
- Senior researcher and team lead - Advanced Medical Diagnostics, Belgium
- Co-founder & CEO - Features Analytics, Belgium

Cancer Detection in Ultrasound Imaging

- Urologists are equipped with UltraSound (US) machines that are non-invasive devices
- MRI examination is more accurate than US
- MRI is expensive and the patient is sent to an MRI outside facility
- While US imaging can be used for large scale screening, MRI cannot

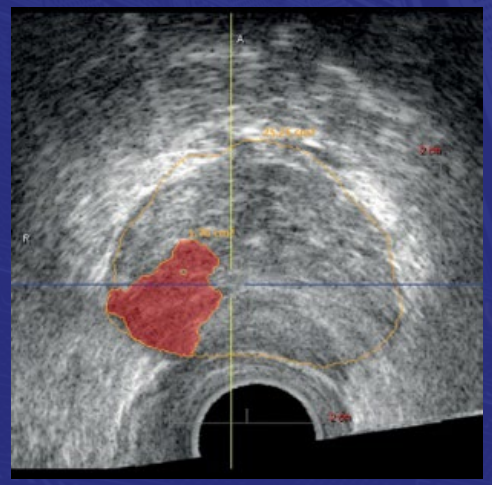


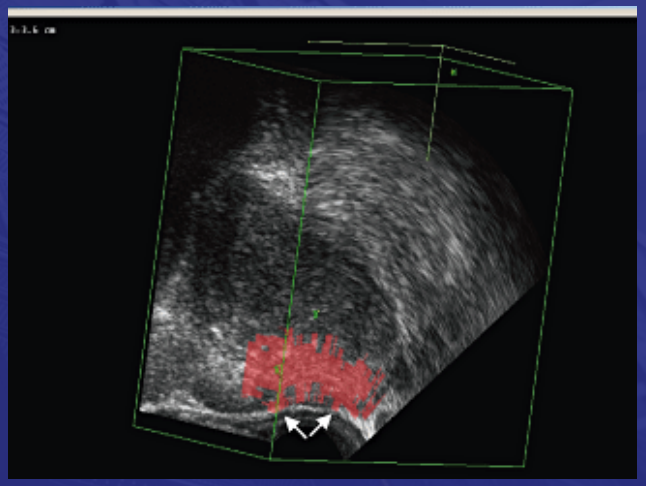
- Prostate cancer tissue microscopically differs from healthy tissue
- The backscattered (RF) data contains more information than the B-mode image

- Can we synthetize in the RF data the signature of healthy tissue vs. malignant tissue?

The methodology of the clinical trial

- Prostate cancer (Pca) patients scheduled for Radical Prostatectomy (RP)
- Only patients with positive Biopsies (Bx positive) were sent to surgery
- Data collected from hospitals in Belgium, France, Germany, UK, Hungary, Czech Republic
- One day before RP, the 3D US raw data was acquired from each patient
- Agreement with BK Medical (Denmark) to acquire RF US data from the machine
- After surgery, the organ was sent to histopathology lab for analysis
- The lab sent us the results for each specimen (analysis of sections obtained from cuts every 3 mm)





How we developed the technology

The Data

- Results from histopathology lab
- RF 3D US data
- Prostate delineation (automatic segmentation + manual review)
- Location and volume annotation of cancer foci
  - Automatic procedure (mapping lab annotation in the RF US data)
  - Manual verification

The ML technology

- We developed signal processing algorithms to enhance the original RF data with additional **Features** to better distinguish between malignant and normal tissue
- We applied **Supervised Machine Learning** techniques to train and develop the models
- Based on the model accuracy obtained we had several iterations in the model desgin

Volume threshold	Sensitivity	Specificity	PPV	NPV
Foci ≥ 0.50 mL	100% (12/12)	81% (13/16)	80% (12/15)	100% (13/13)

Volume threshold	Sensitivity	Specificity	PPV	NPV
Foci ≥ 0.50 mL	90% (79/88)	70% (35/50)	84% (79/94)	80% (35/44)
Foci ≥ 0.20 mL	90% (87/97)	72% (47/65)	83% (87/105)	82% (47/57)

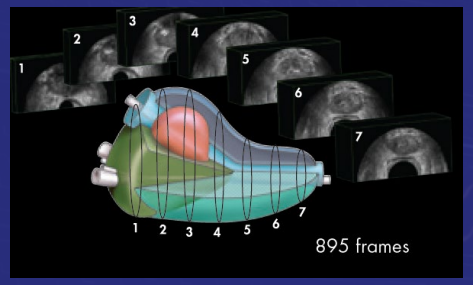
Acquisition of RF 3D US data

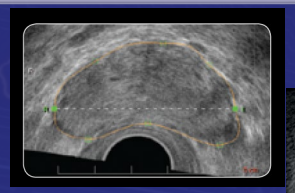
Prostate Delineation
Cancer Foci Annotation
Location & Volume

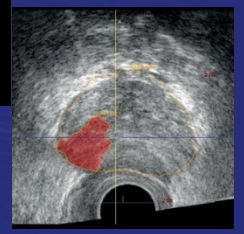
Data enhancement with Features

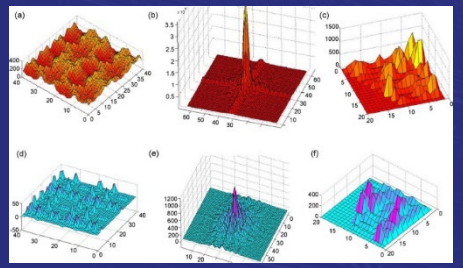
Training supervised Machine Learning models on labeled data

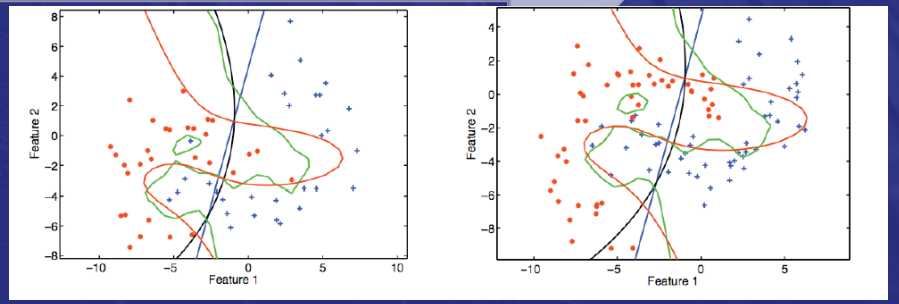
Evaluate model accuracy on unseen data



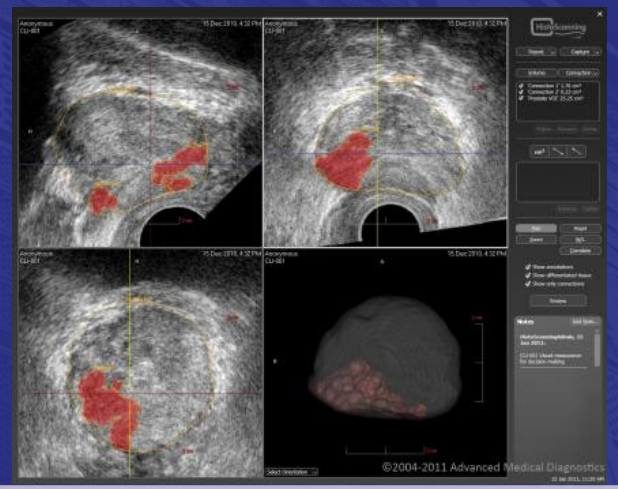


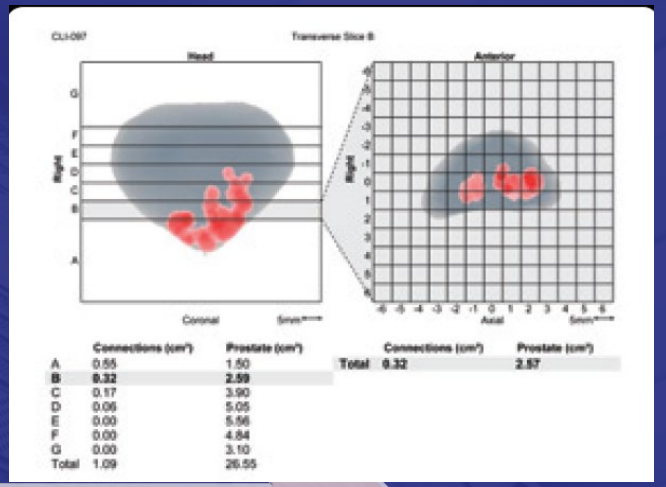






The medical device product in use





Live acquisition of 3D US data

Semi-automatic prostate delineation

Automatic processing with Feature enhancement and ML algs

Clinical interpretation

Report and plan next steps

Market Abuse Detection

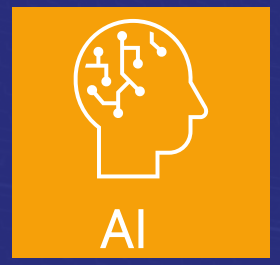
- Headquartered in Belgium (Nivelles), office in London and remote team in Romania
- Selected by M12 (MSFT Ventures) in top 10 women lead start-ups in enterprise tech
- Graduated London MSFT accelerator and PwC Fintech Scaleup program
- Initial projects with Tier 1 US investment banks
- Product released Q1 2022 - **Next-generation Trade Surveillance Platform for Market Abuse detection in trading in Capital Markets** (Equities, Fixed Income , FX, Commodities, Derivatives, Cryptos, …)
- Clients: banks & exchanges in US and Europe

Industry Issues

Majority of the organizations not satisfied with their current trade surveillance solutions
+$33 B Global Regulatory Fines 2012-2022

Parameter-based systems generate massive number of alerts: 99%+ False Positives!!
Time consuming and need frequent parameter re-calibration
What is going undetected?

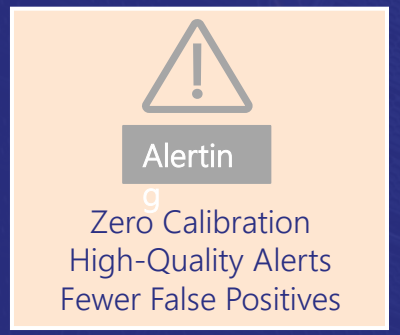
Current systems siloed by asset class or region
How to support additional markets and products (ex. Cryptos)?
How to manage ever changing large volumes of complex data?



How do deal with volatility?
How to keep surveillance teams in full control?
Regulators want transparency, not a “black box” approach

Features Analytics Unique Technology

eyeDES® is the Next-Generation Solution for Market Abuse Detection that effectively reduces the cost and the risk



Zero-Parameter Building Blocks Tech

- ✓ Describes behaviors and actions by Shape
- ✓ No calibration or model training required
- ✓ Adapts to market conditions and volatility

AI Driven Proactive Surveillance

- ✓ Scenario configuration optimization
- ✓ Unveils new emerging patterns of abuse (Scenario X)

Standardized Surveillance Across All Asset Classes

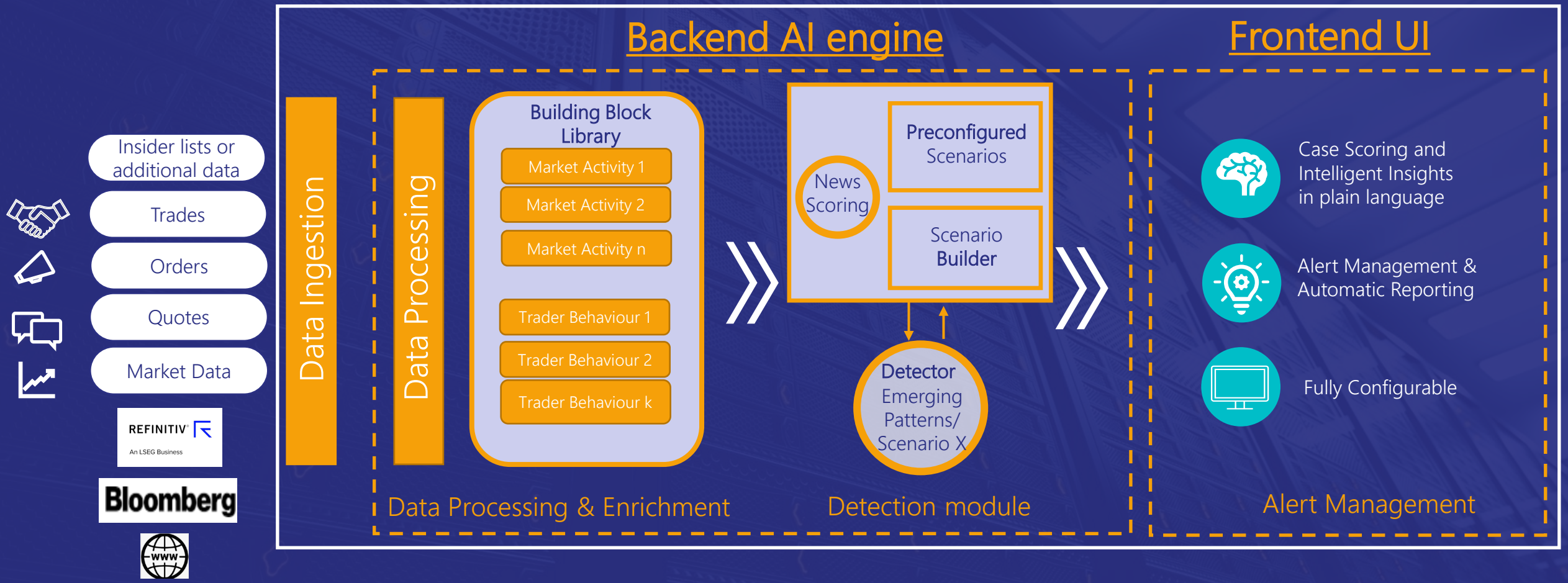
- ✓ Single consistent solution across all asset classes: *FX, Equities, Derivatives, Fixed Income, Commodities, Cryptos,…*

Our Trade Surveillance Platform

Our technology enriches data with signals called "Building Blocks".
They measure and describe trading behaviour & market actions in terms of Shape and not scale.

eyeDES®

Available on-prem or cloud



Market Abuse Scenarios covered

Pre-configured Scenarios provided to support regulations from SEC, MAR, FCA, …
Builder Users can build/amend specific scenarios using the Building Blocks library
Detector Scenario X reveals emerging patterns of abuse and below the line cases

Case Studies

European Regulator

- Looking to replace parameter-driven solution
- Analysis of Cash equities and related options positions
- **Results – 98% reduction in FP + unveiling new cases**
  - Layering cases (~30), Insider Trading (~20) (vs. approx. 2000's alerts currently)
  - Unveiled previously undetected cases of abuse

European Bank

- Need to automate monitoring OTC positions and detect Insider Trading
- Current solution cannot analyse OTC positions
- On 1 month of data eyeDES triggered < 10 high-quality alerts / day (vs. 30-40 / day produced by existing solution)
- **Results: 85 % reduction in FP + minimized risk exposure**

Canadian Bank

- Need to improve current surveillance solution for detection of Ramping in Fixed Income
- FA analysed 3 months of client trade activity + Bloomberg market data
- eyeDES results: immediate improvement vs. existing solution that required 18+ months calibration efforts

Our clients

Banks
Broker-Dealers
Exchanges (+ Crypto)
Asset Managers
Hedge Funds
Regulators

Overlay to client existing solutions and surveillance programs

Standalone to leapfrog client surveillance programs

Instrument ID: 8505114 | **Account: act_1** | **From: 2018-05-28 08:27:55.256857** | **To: 2018-05-28 08:28:23.954481**

The alert involves account act_1 and security 8505114 on 2018-05-28.
The action lasts approximately 28 seconds and 697 milliseconds and begins at around 08:27:55.
The account enters on the Bid side (this is the alleged intended side) order 8505114/1/1527496075256861753 at the third level of the Bid book with an entry size of 50.00. This order represents the 8.50% of the book volume at this price level.
At around 08:28:15, or approximately 20 seconds and 111 milliseconds after the introduction of the order 8505114/1/1527496075256861753 the account enters 10 orders on the Ask side (including order 8505114/2/1527496095368720040) with a minimal depth of 2 and total size, at entry time, of 91 shares.
The introduction of these larger, more aggressive orders on the top of the Ask book is followed by a market reaction that leads order 8505114/1/1527496075256861753 to be traded at 08:28:21 (50 of the initial 50 shares in order 8505114/1/1527496075256861753 get traded).
Just a short time after the execution of the trades on the intended side, account act_1 starts cancelling all the orders on the unintended side, finishing later and leaving the book at 08:28:23.
This is a suspicious case for the Layering scenario, where the orders on the unintented side are not deleted right away to avoid detection.
This explains why orders on the unintended side are deleted in a relatively long time span of 1 second and 291 milliseconds (i.e., not instantaneously).
This time lapse is short enough to avoid execution given the prevailing market conditions at the time of the action.
None of the orders on the Ask side got executed once.
Throughout the day account act_1 is a net buyer of security 8505114.

Scenario: Layering (Alerted as: Layering) **Context information**