

**PID5815**/Integration of EU-wide cardiovascular datasets *Adriano Barbosa da Silva, QMUL* 

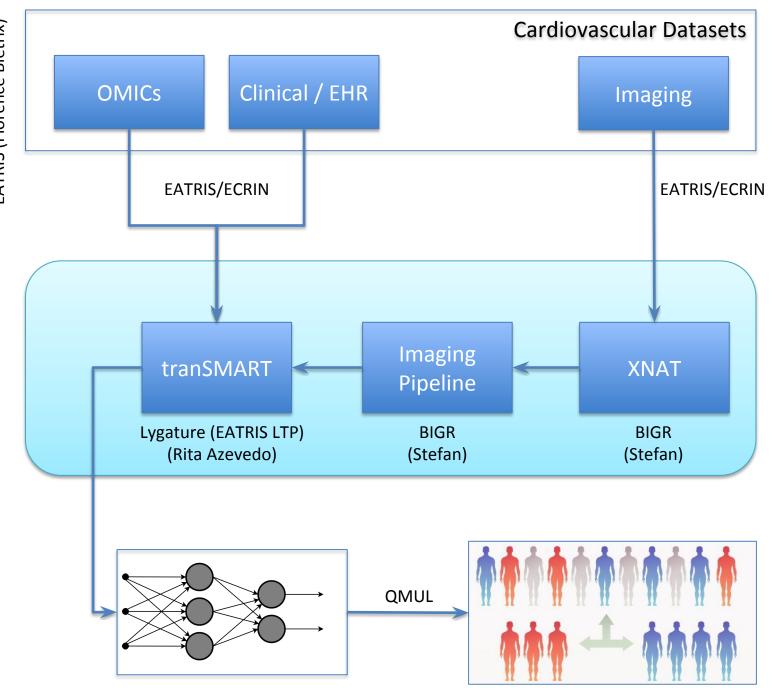
RI 1: BBMRI-ERIC, Petr Holub

RI 2: EATRIS, Florence Bietrix

RI 3: EATRIS LTP, Rita Azevedo

RI 4: EurobioImaging, Stefan Klein (EPI2)



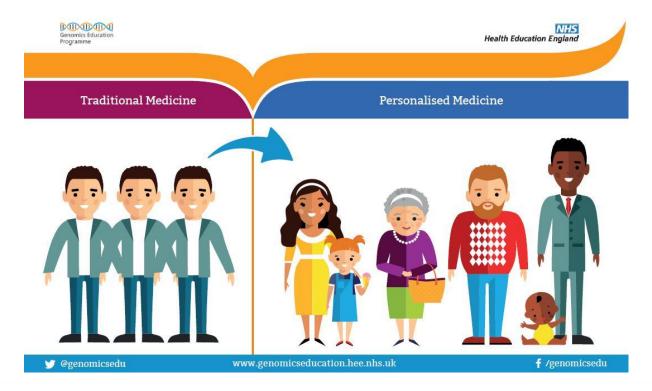








# In the future the NHS should treat the Patients and not the Diseases, the main postulate of **Precision Medicine**

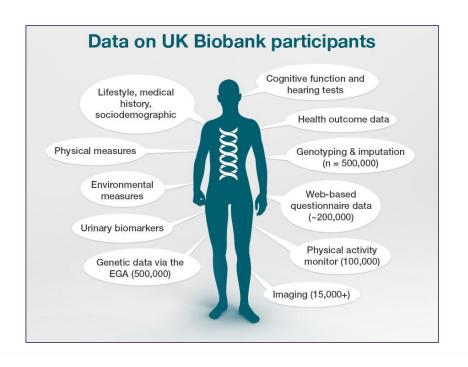


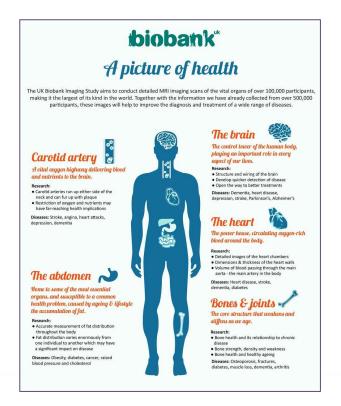




#### Need for data collection

 Projects Like the UK Biobank aims to collect a wide range of patient's data







## Cardiac Biomarkers

Table 6
The list of the cardiac landmarks being included in the model

Landmark name	Mean model to landmark distance (mm)				
Ostium left coronary artery	5.2				
Ostium right coronary artery	6.3				
Apex	7.1				
Aortic valve center	4.2				
Mitral valve center	5.3				
Tricuspid valve center	5.5				
Pulmonary valve center	4.2				
Ostium coronary sinus	7.7				
Ostium vena cava superior	5.0				
Ostium vena cava inferior	8.1				
Ostium left inferior pulmonary vein	7.6				
Ostium left superior pulmonary vein	7.9				
Ostium right inferior pulmonary vein	7.8				
Ostium right superior pulmonary vein	6.7				
Center left ventricle	4.1				
Center right ventricle	6.2				
Center left atrium	4.9				
Center right atrium	6.9				
Heart center	6.9				
Bifurcation point LAD-LCX	4.7				
Center left atrial appendage	6.9				
Center right atrial appendage	7.9				
Center LV anterior papillary muscle	5.1				
Center LV posterior papillary muscle	6.8				
Center RV anterior papillary muscle	7.4				

Using the transformations  $T_i$  resulting from the procrustes analysis of the surface model, mean landmark positions have been calculated (see Section 5.3). The right column shows the residual mean distances between mean model and landmark samples (see Eq. (14)).

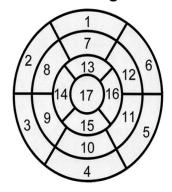




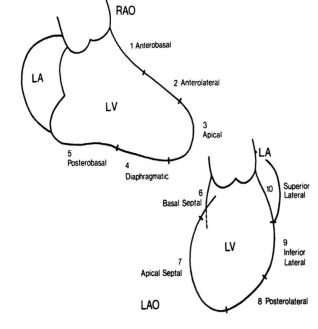


## Cardiac **Biomarkers**

#### **Left Ventricular Segmentation**



- 1. basal anterior
- 2. basal anteroseptal
- 3. basal inferoseptal
- 4. basal inferior
- 5. basal inferolateral
- 6. basal anterolateral
- 7. mid anterior
- 8. mid anteroseptal
- 9. mid inferoseptal
- 10. mid inferior
- 11. mid inferolateral
- 12. mid anterolateral
- 13. apical anterior
- 14. apical septal
- 15. apical inferior 16. apical lateral
- 17. apex

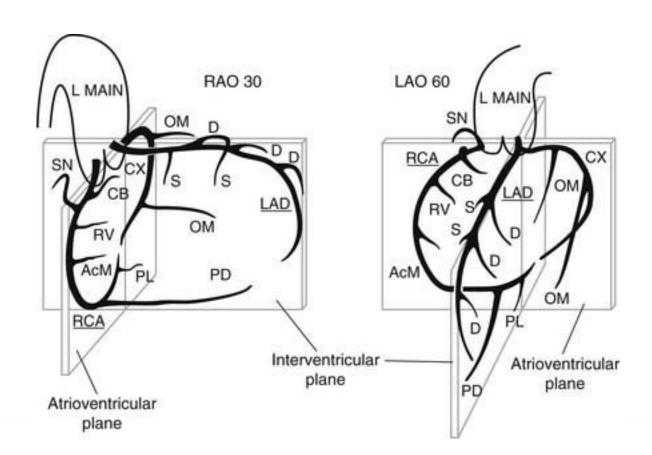






## Cardiac Biomarkers

Coronary Angiography: Valve and Hemodynamic Assessment





## Queen Mary University of London

## Data Tsunami





## Queen Mary University of London

## Data Tsunami





## Solutions based on open source software



CORRECTED PROOF

Presenting and sharing clinical data using the eTRIKS Standards Master Tree for tranSMART 3

Adriano Barbosa-Silva , Dorina Bratfalean, Wei Gu, Venkata Satagopam, Paul Houston, Lauren B Becnel, Serge Eifes, Fabien Richard, Andreas Tielmann, Sascha Herzinger, ... Show more

Bioinformatics, bty809, https://doi.org/10.1093/bioinformatics/bty809

Published: 26 September 2018 Article history ▼

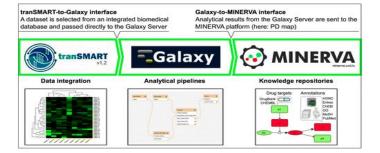
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Big Data, Vol. 4, No. 2 | Original Articles

Open Access | CC

## Integration and Visualization of Translational Medicine Data for Better Understanding of Human Diseases

Venkata Satagopam 🖂, Wei Gu, Serge Eifes, Piotr Gawron, Marek Ostaszewski, Stephan Gebel, Adriano Barbosa-Silva, Rudi Balling, and Reinhard Schneider



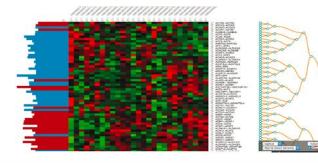
## SmartR: an open-source platform for interactive visual analytics for translational research data 3

Sascha Herzinger, Wei Gu, Venkata Satagopam, Serge Eifes, Kavita Rege, Adriano Barbosa-Silva, Reinhard Schneider ™, eTRIKS Consortium

Bioinformatics, Volume 33, Issue 14, 15 July 2017, Pages 2229–2231,

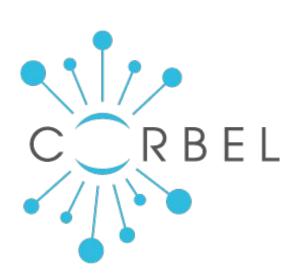
https://doi.org/10.1093/bioinformatics/btx137

Published: 09 March 2017 Article history ▼



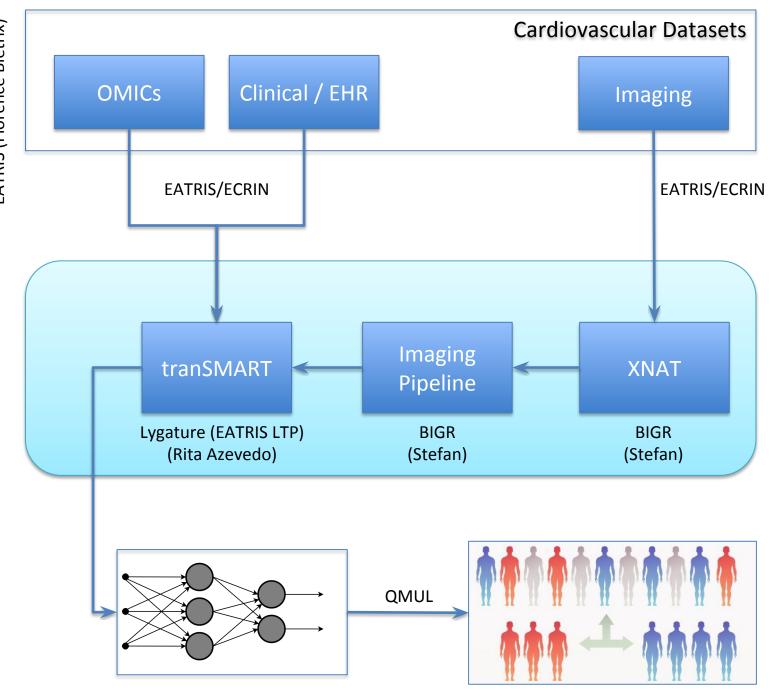
















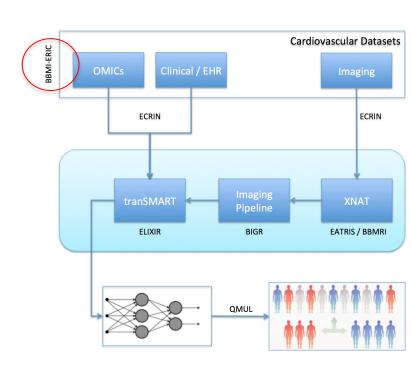


**EATRIS: Florence Bietrix** 

**Aim:** identify EU datasets for cardiovascular research that could be used as input of the *data capture system*.

#### **CORBEL Services:**

- To identify biobanks that have relevant biological material, associated **data** and services
- To access biological samples and associated data

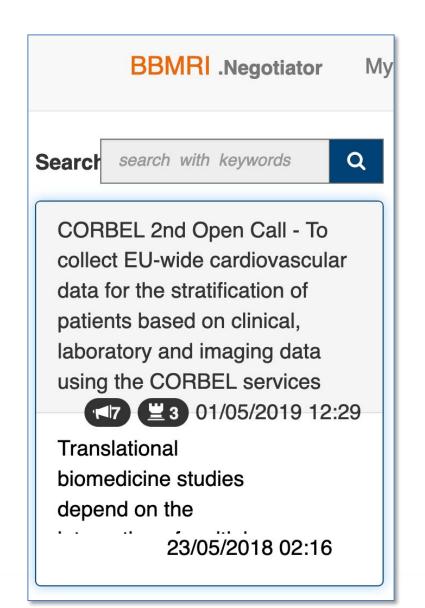






#### **Actions**

- Added QMUL as a registered institution;
- Helped to create a descriptive query for my request;
- Increased query limits from 100 to 500+ biobanks at once;

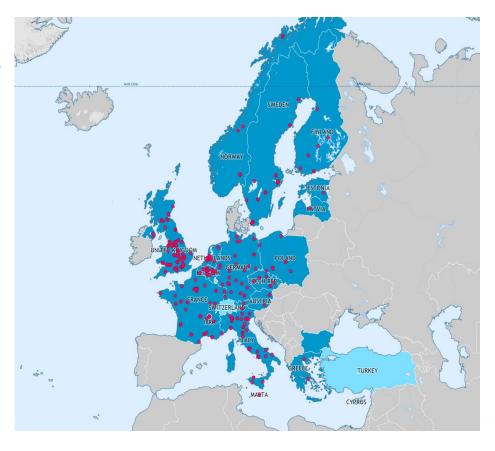






- □ Directory 5.0
- □702 biobanks
- ☐ 603 biobanks with collections
  - 1487 collections
- □ Estimated
  - >100,000,000 samples and associated data









#### Results

Query sent to the system



#### Request:

Identify EU-wide cardiovascular research/medical datasets including

- DICOM data (CT/MRI)
- Clinical data (Electronic Health Record)
- Omics data





#### Results

465 matches



#### **Matching Biobanks:**

465 (330 Collections reachable, 1150 Collections unreachable) Show matching Biobanks

- Medical University of Lodz Clinical Biobank
- Biobank Graz
- Biobank Innsbruck
- MedUni Wien Biobank
- VetBioBank
- Biobank @ UZ Brussel
- University Biobank Limburg
- Biobank@UZA
- Bimetra Biobank @ UZ Gent



#### **EATRIS-ERIC**



## Search across EATRIS member institutions (90+)



5 institutions identified:

## Matchmaking Report

Client: Corbel Open Call - Adriano Barbosa da Silva

**Project Title:** PID5815 - Integrating EU-wide cardiovascular research

datasets

**EATRIS Project ID:** 20181017-1400



#### **EATRIS:**



#### Results

- 5 Negotiations started:
  - ☐ Instituto Ramón y Cajal de Investigación Sanitaria (IRYCIS, Spain)
  - ☐ University Hospital Bellvitge (IDIBELL, Spain)
  - Clinical Research Centre of Tartu University and Tartu University Clinics (Estonia)
  - ☐ Fondazione Ri.MED (Italy)



- St. Anne's University Hospital in
- ☐ Brno (Czech Republic)

European infrastructure for translational medicine

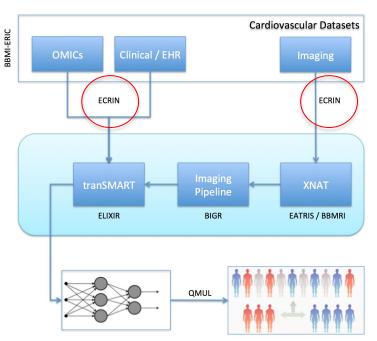


#### **EATRIS:**



#### **CORBEL Services:**

- Regulatory and ethical context
- Data sharing/reuse(prospective and retrospective data)



#### **Actions:**

Contacted the relevant partners at the hospitals with compatible data;



European infrastructure for translational medicine





#### Results



- 2 Negotiations followed:
  - ☐ Fondazione Ri.MED (Italy);
    - Collaboration possible via ISMETT
       (Mediterranean Institute for Transplantation and Advanced Specialized Therapies);
    - Needs a Data Processing Agreement.

European infrastructure for translational medicine





#### Results



2 Negotiations followed:

### Fondazione Ri.MED (Italy);

#### Data Processing Agreement (DPA)

by and between

**ISTITUTO MEDITERRANEO PER I TRAPIANTI E TERAPIE AD ALTA SPECIALIZZAZIONE S.r.l.**, with registered office in Palermo (Italy), at Via Discesa dei Giudici, 4 (hereinafter referred to as "**ISMETT**")

and

**UPMC ITALY S.r.l.**, with registered office in Palermo (Italy), at Via Discesa dei Giudici, 4 (hereinafter referred to as "**UPMCI**")

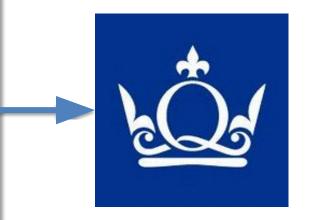
 $\circ \quad \text{Jointly referred to as the "Joint-Controllers"}$ 

and

Queen Mary University of London of Mile End Road, London, E1 4NS, United Kingdom

hereinafter referred to as "QMUL"

DPO, JMRO







#### Results







#### Results

2 Negotiations followed:



- St. Anne's University Hospital in Brno (Czech Republic)
  - Collaboration possible
  - We want to use UKBIOBANK mapping as a way to aggregate value to the hospital's data;
  - Needs a MoU for Collaboration
     Agreement between the universities prior to deliver data;





2 Negotiations followed:



St. Anne's University Hospital in Brno (Czech Republic)

International Cooperation Office









insert the logo of the partner institution here xxxxxxxxx

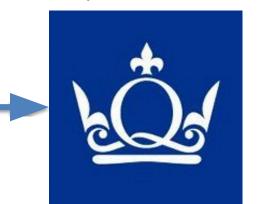
Číslo dohody FNUSA: Číslo dohody Partnera:

#### DOHODA O SPOLUPRÁCI

uzavřená dle § 1746, zákona č. 89/2012 Sb., občanský zákoník, ve znění pozdějších předpisů (dále jen "občanský zákoník") FNUSA's agreement number: Partner's agreement number:

#### COLLABORATION AGREEMENT

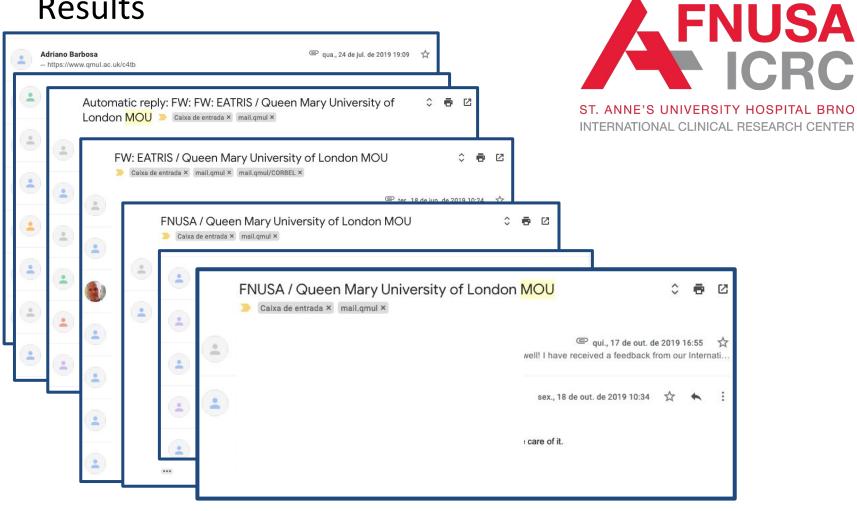
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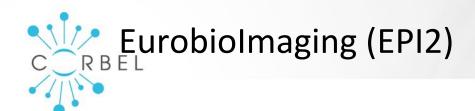










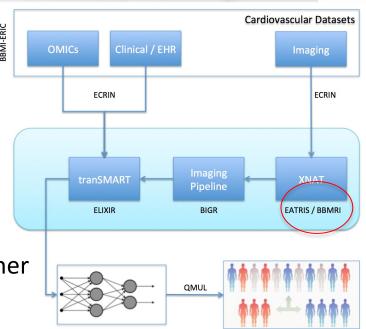




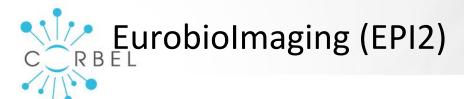
#### Stefan Klein

**Aim:** Promote the integration of the imaging datasets within the data capture system **CORBEL Service:** 

- Deploy XNAT.bmia.nl imaging archive (together with EATRIS/BBMRI)







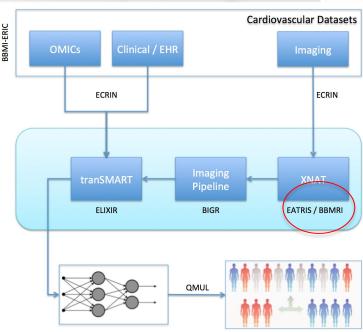


#### Stefan Klein

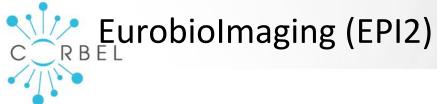
**Aim:** Promote the integration of the imaging datasets within the data capture system

#### **CORBEL Service:**

- Deploy XNAT.bmia.nl imaging archive (togetl EATRIS/BBMRI)



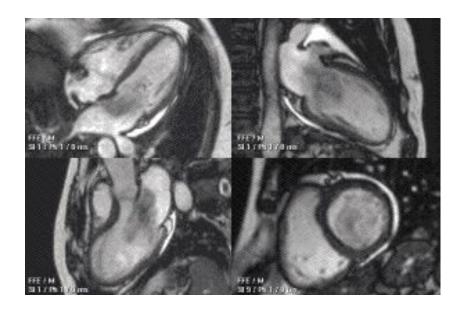




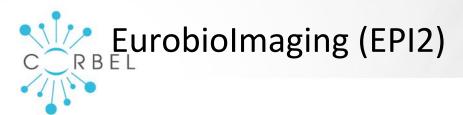
## Queen Mary University of London

### Stefan Klein

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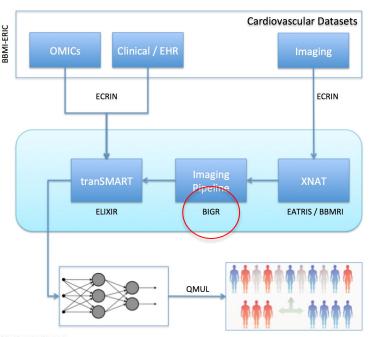


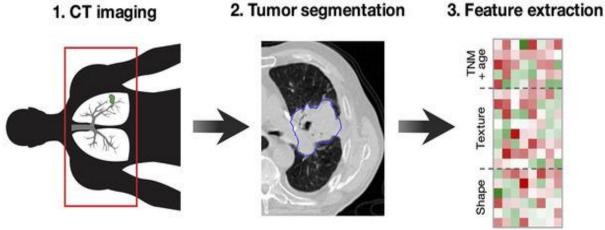


## Stefan Klein

#### **Future actions**

Collaborate with the Radiomics pipeline to extract imaging features from the raw data





DOI: 10.18632/oncotarget.22251



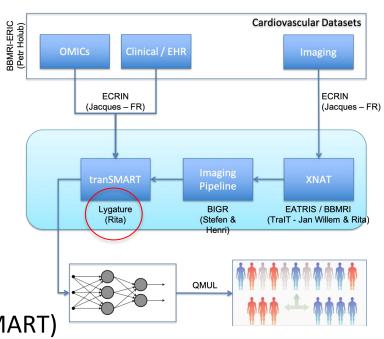


#### Rita Azevedo

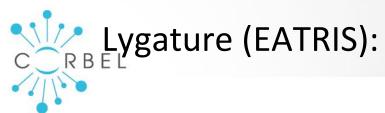
**Aim:** Extract biomarkers from the acquired images

#### **CORBEL Service:**

 a) Provide services and tools to deposit store and access their data (tranSMART)

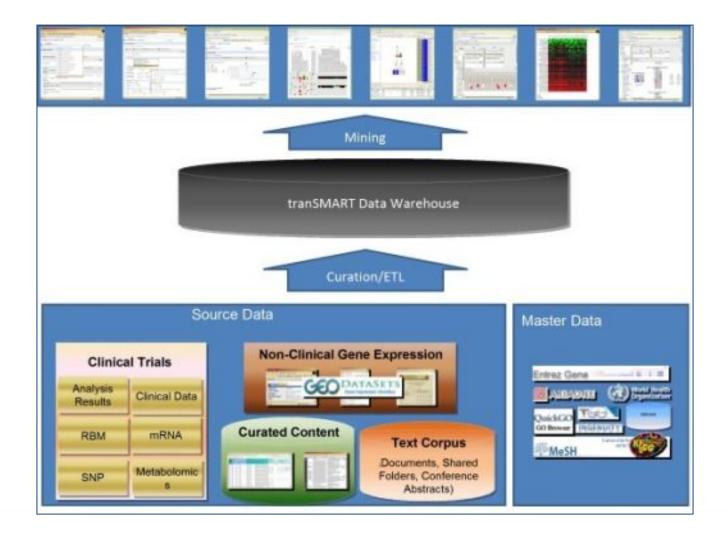








#### Rita Azevedo

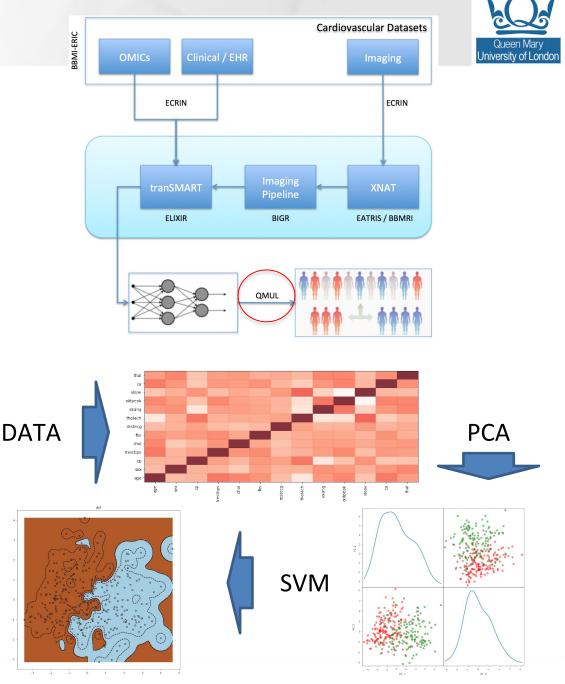




**Aim:** Apply machine learning methods to stratify cardiovascular patients based on machine learning

#### **Methods:**

- Dimensionality reduction:
   PCA
- Machine learning classifiers:
  - a) Supervised
  - b) Un-supervised
- Tree based-methods:
  - a) Random forests
  - b) Gradient boost
- Deep learning







- i2b2 categorization of UKBB data
  - ☐ 11,870 variables

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biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Impedance_of_arm	4674		bio.impedance.of.armleft0.baseline
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Impedance_of_arm	4675		bio.impedance.of.armleft0.calibration
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Impedance_of_arm	4676		bio.impedance.of.armleft0.imaging
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Arm_fat_percentage	4693		bio.arm.fat.percentageright0.baseline
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Arm_fat_percentage	4694		bio.arm.fat.percentageright0.calibration
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Arm_fat_percentage	4701		bio.arm.fat.percentageleft0.baseline
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Arm_fat_percentage	4702		bio.arm.fat.percentageleft0.calibration
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Spirometry+Smoked_cigarette_or_pipe_within_last_hour	6255		bio.smoked.cigarette.or.pipe.within.last.hour.0.baseline
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Spirometry+Smoked_cigarette_or_pipe_within_last_hour	6256		bio.smoked.cigarette.or.pipe.within.last.hour.0.calibration
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Spirometry+Smoked_cigarette_or_pipe_within_last_hour	6257		bio.smoked.cigarette.or.pipe.within.last.hour.0.imaging
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Arterial_stiffness+Arterial_pulse_wave_stiffness_device_ID	7209		bio.arterial.pulse.wave.stiffness.device.id.0.baseline
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Arterial_stiffness+Arterial_pulse_wave_stiffness_device_ID	7210		bio.arterial.pulse.wave.stiffness.device.id.0.calibration
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Arterial_stiffness+Arterial_pulse_wave_stiffness_device_ID	7211		bio.arterial.pulse.wave.stiffness.device.id.0.imaging
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Impedance_device_ID	8390		bio.impedance.device.id.0.baseline
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Impedance_device_ID	8391		bio.impedance.device.id.0.calibration
biobank_decoded_decoded_r8a.list.csv	Physical_measures+Anthropometry+Impedance_measures+Impedance_device_ID	8392		bio.impedance.device.id.0.imaging
biobank_decoded_decoded_r8a.list.csv	Psychosocial_factors+Mental_health+Ever_highly_irritable_argumentative_for_2_days	8456		bio.ever.highly.irritable.argumentative.for.2.days.0.baseline
biobank_decoded_decoded_r8a.list.csv	Psychosocial_factors+Mental_health+Ever_highly_irritable_argumentative_for_2_days	8457		bio.ever.highly.irritable.argumentative.for.2.days.0.calibration
biobank_decoded_decoded_r8a.list.csv	Psychosocial_factors+Mental_health+Ever_highly_irritable_argumentative_for_2_days	8458		bio.ever.highly.irritable.argumentative.for.2.days.0.imaging

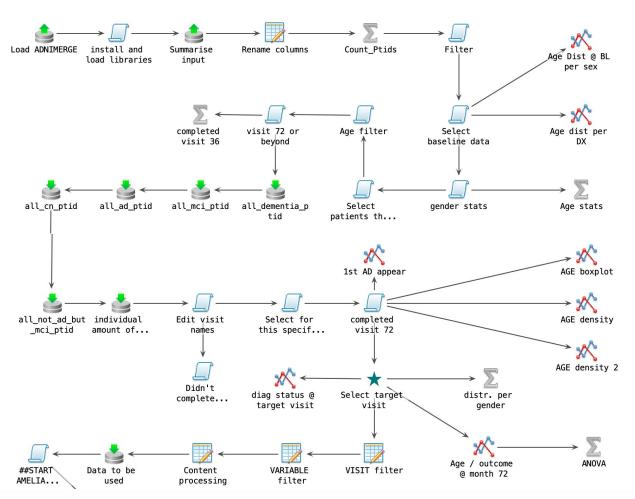




- i2b2 categorization of UKBB data
   11,870 variables
- Dataset Explorer i 127.0.0.1:8080/transmart/datasetExplorer/inde All Active Filters and or Filter Clear **Navigate Terms** abc Across Trials ☐ ☐ QMUL ■ ■ UKBB (1) Additional exposures Biological samples Biological sampling ■ Cognitive function ■ □ Early life factors **⊞ [ Employment** ■ □ Family history ■ ☐ Genomics ⊞ ☐ Health and medical history ■ ☐ Imaging <u>→ □ Lifestyle and environment</u> ■ ○ Medical conditions ■ ○ Online follow up Operations ■ □ Physical measures ■ □ Population characteristics ■ □ Psychosocial factors ■ ☐ Recruitment ■ ☐ Sex specific factors ■ ☐ Sociodemographics

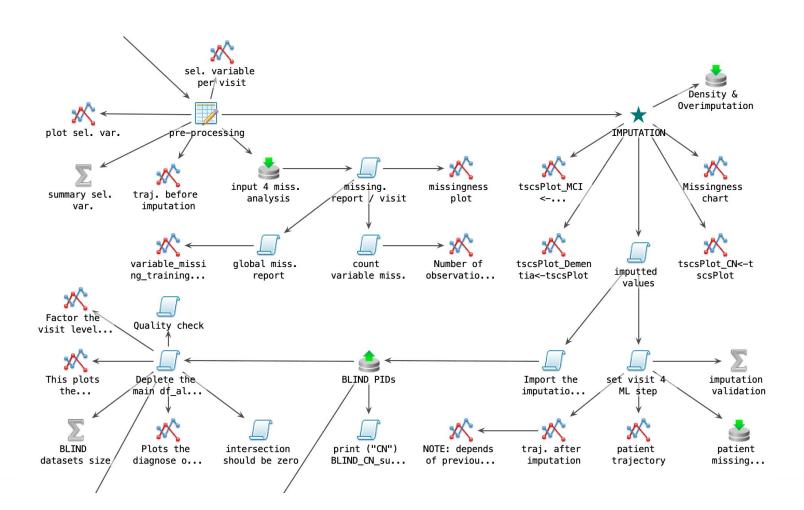






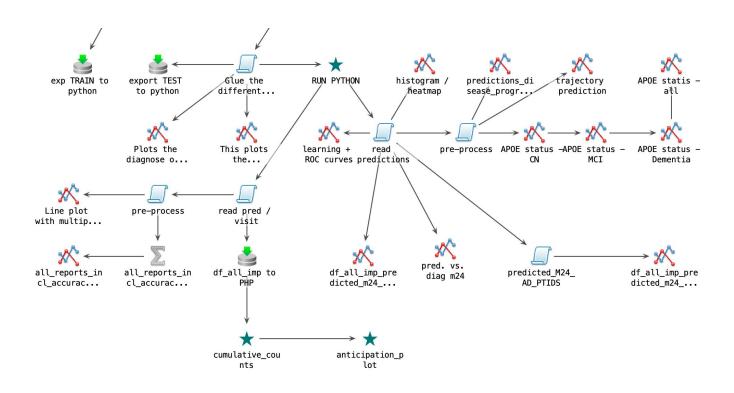








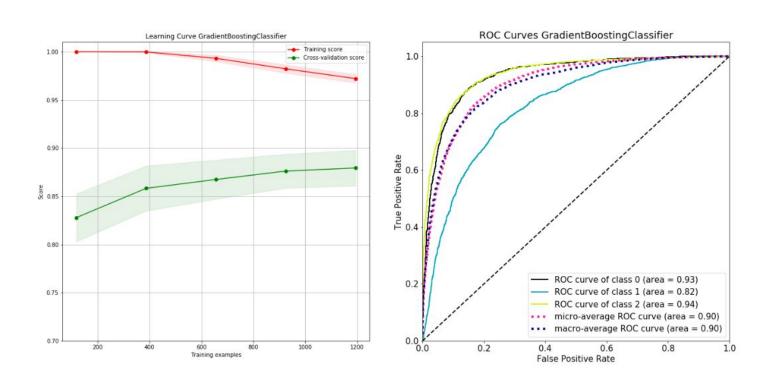






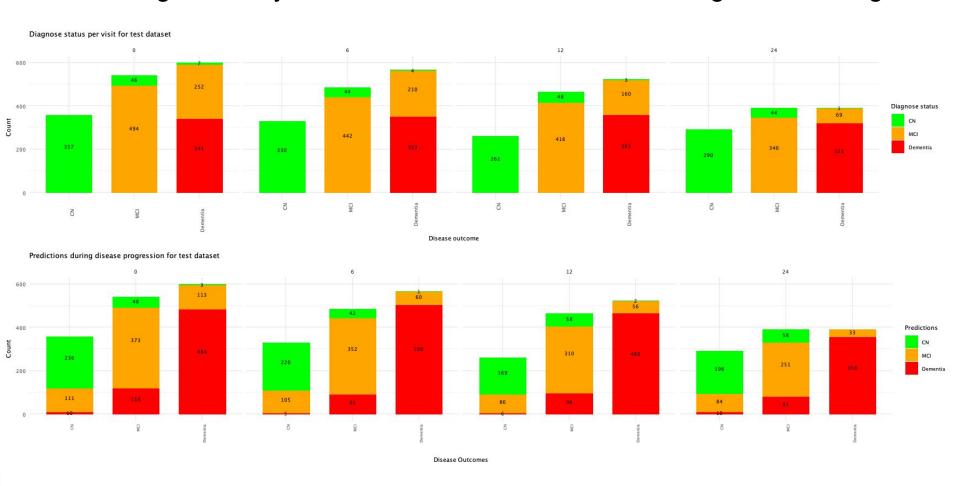


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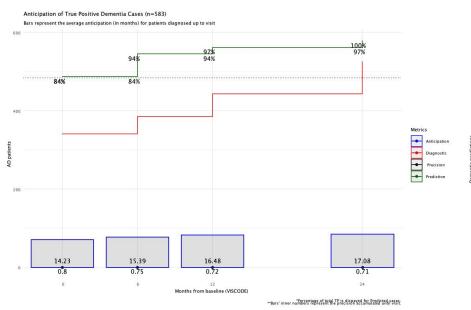


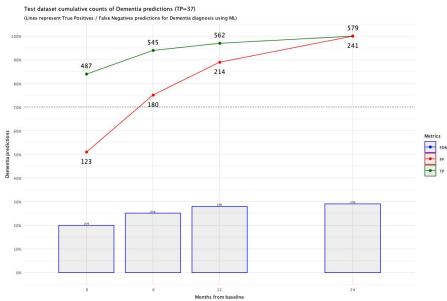














## Overall evaluation and feedback

What did we appreciate?

Quick V.I.P. treatment and support.

What went wrong? Was there anything missing?

Need to fund a position to extract data from the hospitals.

How could one improve in future projects?

Be very specific on what you need.

Beyond CORBEL: what is needed to maintain common access provision across RIs?

Continued funding.





- We used R.I. offered by CORBEL to identify 2 potentially used Cardiovascular Datasets (Petr Holub);
- We're setting up the legal framework to re-use this data (Florence Bietrix);
- We received training at the EPI2-EMC to use XNAT as platform for imaging integration (Stefan Klein);
- We received consulting from Lygature to compare our modelling to their i2b2-tranSMART mapping (Rita Azevedo);
- We are developing data structures using UKB for tranSMART, and ML modules with ADNI data while waiting.









What matters most to you? From beachcombing to backpacking, surfing the internet to saving the world, living in the European Union provides endless opportunities to do what you love – wherever that may lead. As a young citizen, the EU can give you all the tools you need to unlock your potential and ignite your inspiration. Whether you're an energetic entrepreneur, a digital devotee or a protector of the planet, it all comes down to #EUandME.

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Mike Barnes



Katriona Goldmann



Chris John



Sandra Ng



**David Watson** 



Claudia Cabrera & Evan Tzanis





















## THANK YOU!



Obrigado! Merci! Danke je wel! Danke schön! Děkuju!



biobanks



instruct Integrating

curated databases



chemistry

marine model organisms

EU-OPENSCREEN:\*\*



systems biology



 Plant phenotyping centres



ECRIN

· clinical trials

translational research



structural biology

mouse disease models



screening & medicinal

 biological/medical imaging



microorganisms



· Highly Pathogenic Agents



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