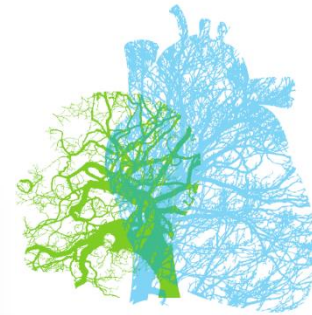


VICOMTECH

eSalud, big data, imagen y dispositivos médicos

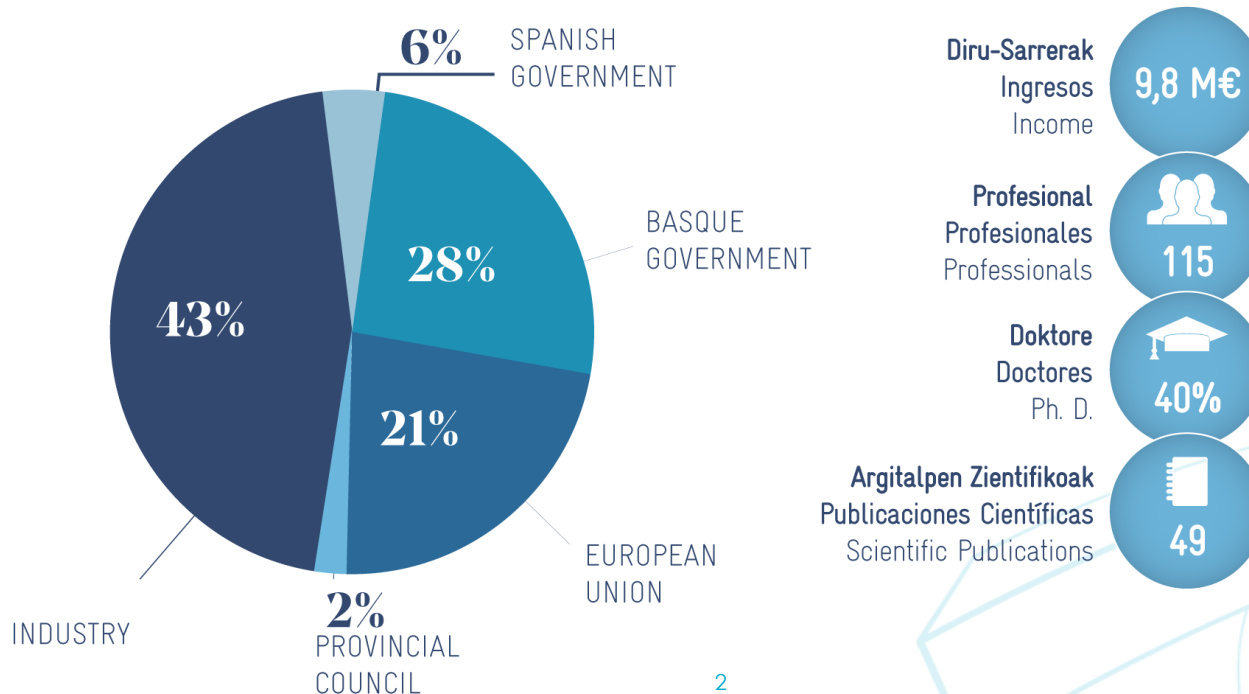


Alba Garin-Muga PhD
agarin@vicomtech.org

eHealth & Biomedical Applications
Vicomtech

Vicomtech

- Applied Research Centre in **Information Technologies**, founded in 2001, specialized in Computer Graphics & Computer Vision, Data Analytics & Intelligence, Interactive Digital Media & Language Technologies



Vicomtech



Industria y Fabricación
Avanzada



Sistemas de Transporte
Inteligentes e Ingeniería



eSalud y Aplicaciones
Biomédicas



Digital Media



Inteligencia de Datos
para Energía y Procesos
Industriales



Tecnologías del Habla y
del Lenguaje Natural

eSalud y Aplicaciones Biomédicas



Image, Visualisation and Simulation

- Biomedical image analysis: planning, quantification, biomarkers, CV
- Computer-aided Diagnostics: screening and cloud-based diagnosis platforms
- *In silico simulation*: Multi-scale personalised physiological simulation



Big Data and Personalised Medicine

- BD supporting Health, Social and Welfare Management, and Public Health policies
- Profile-based patient stratification (bioinformatics + image + DSS)
- Disease characterisation and predictive models



eHealth Solutions

- Clinical and Patient decision support systems
- Clinical and Personal electronic record
- Intelligent Data Collection (in the hospital, on the go...)



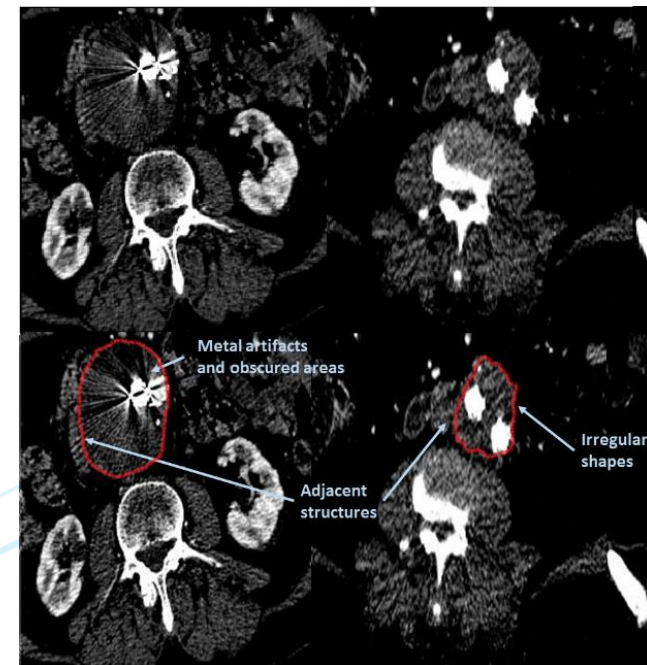
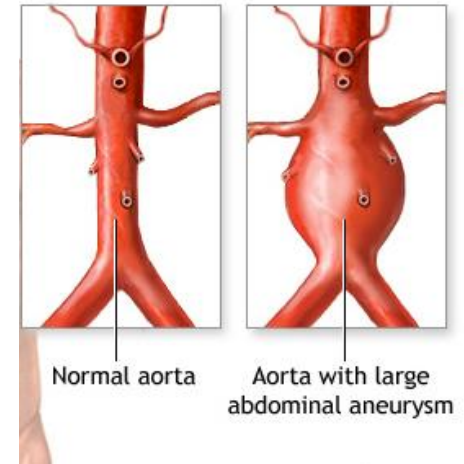
Interaction and Medical devices

- Computer- assisted surgery, image-guided, robotics, simulation, VR/AR...
- Assistive technologies (mmechatronics, cyber physical systems, robotic)
- POC devices, implantable, Nano devices

Deep Learning

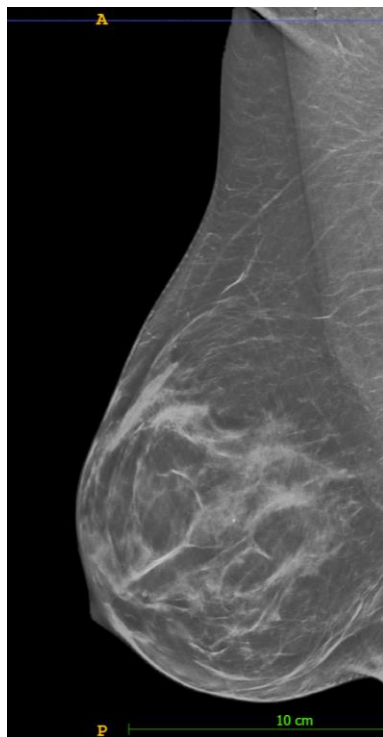
DELEGA: Aneurysm segmentation from CTA images using Deep Learning

- Aneurysm: dilation of the aorta that can rupture, causing death
- Endovascular aneurysm repair: minimally-invasive surgery to exclude the aneurysm from blood flow using a stent
- Requires lifelong surveillance based on CTA images where the rate of aneurysm growth is evaluated
 - Currently measuring axial diameter manually

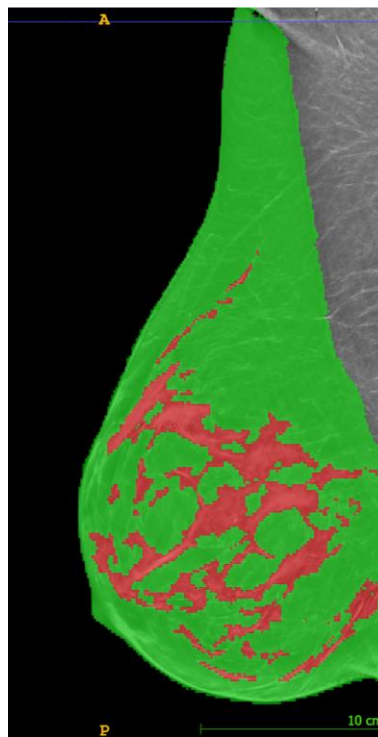


Deep Learning

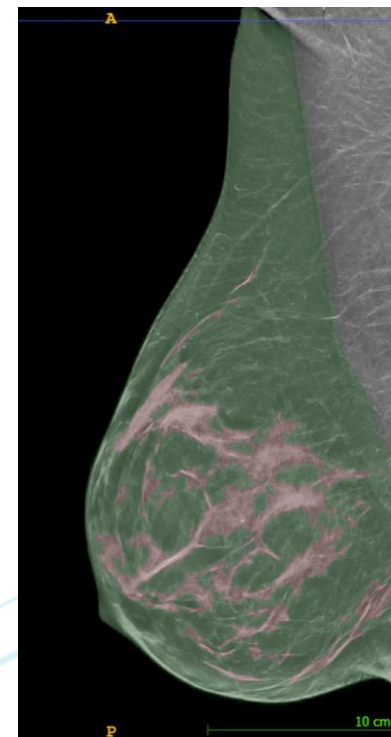
- Tissue segmentation using Deep Learning in % fibro-glandular vs fatty using 700+ images
- Automatic BI RADS density classification (I,II,III,IV) from relative density estimations



Source



Segmented



Overlay

Deep Learning

- Microaneurysm detection

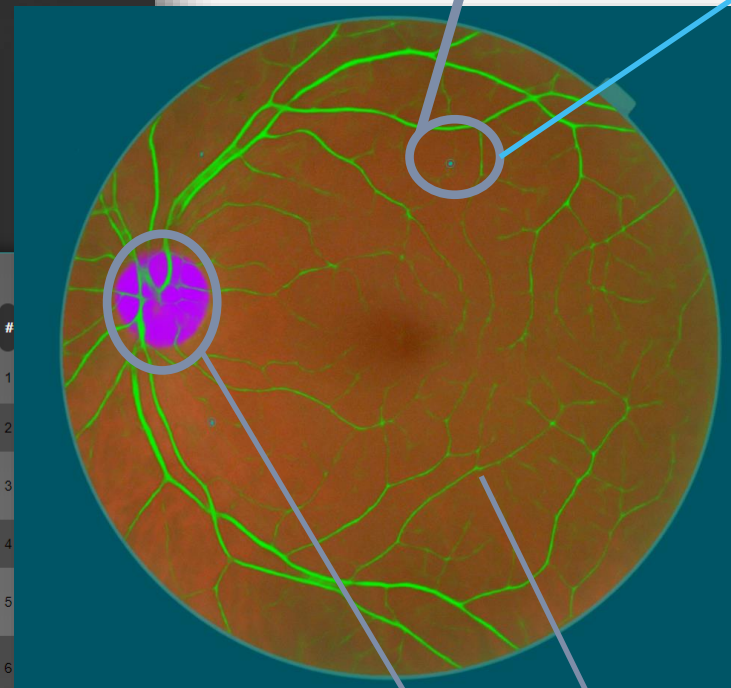
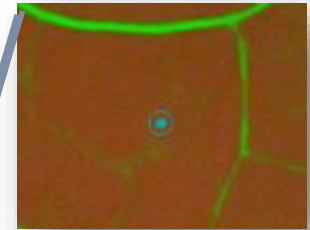
Retinal Cloud Processing

Annotations Admin site

DRS Upload New File Logout (admin)

Image	DRS Status	Proc. Started	Proc. Finished	Result	Computed DRS	PDF	Delete	#
8536_right		March 13, 2018, 2:04 p.m.	March 13, 2018, 2:07 p.m.	Healthy	Processed Image			1
7958_right		March 13, 2018, 2:01 p.m.	March 13, 2018, 2:04 p.m.	Healthy	Processed Image			2
0429527_OI_4		Feb. 13, 2018, 3:42 p.m.	Feb. 13, 2018, 3:45 p.m.	Mild NPDR (8 MA)	Processed Image			3
SI_6791_20160602092313		Feb. 12, 2018, 3:21 p.m.	Feb. 12, 2018, 3:23 p.m.	Healthy	Processed Image			4
SI_6791_20160602092313		Jan. 26, 2018, 3:59 p.m.	Jan. 26, 2018, 4:12 p.m.	Mild NPDR (1 MA)	Processed Image			5
SI_6785_20160316124237		Jan. 26, 2018, 3:59 p.m.	Jan. 26, 2018, 4:09 p.m.	Mild NPDR (1 MA)	Processed Image			6
SI_6674_20161014101304		Jan. 26, 2018, 3:59 p.m.	Jan. 26, 2018, 4:07 p.m.	Mild NPDR (2 MA)	Processed Image			7

Microaneurysm

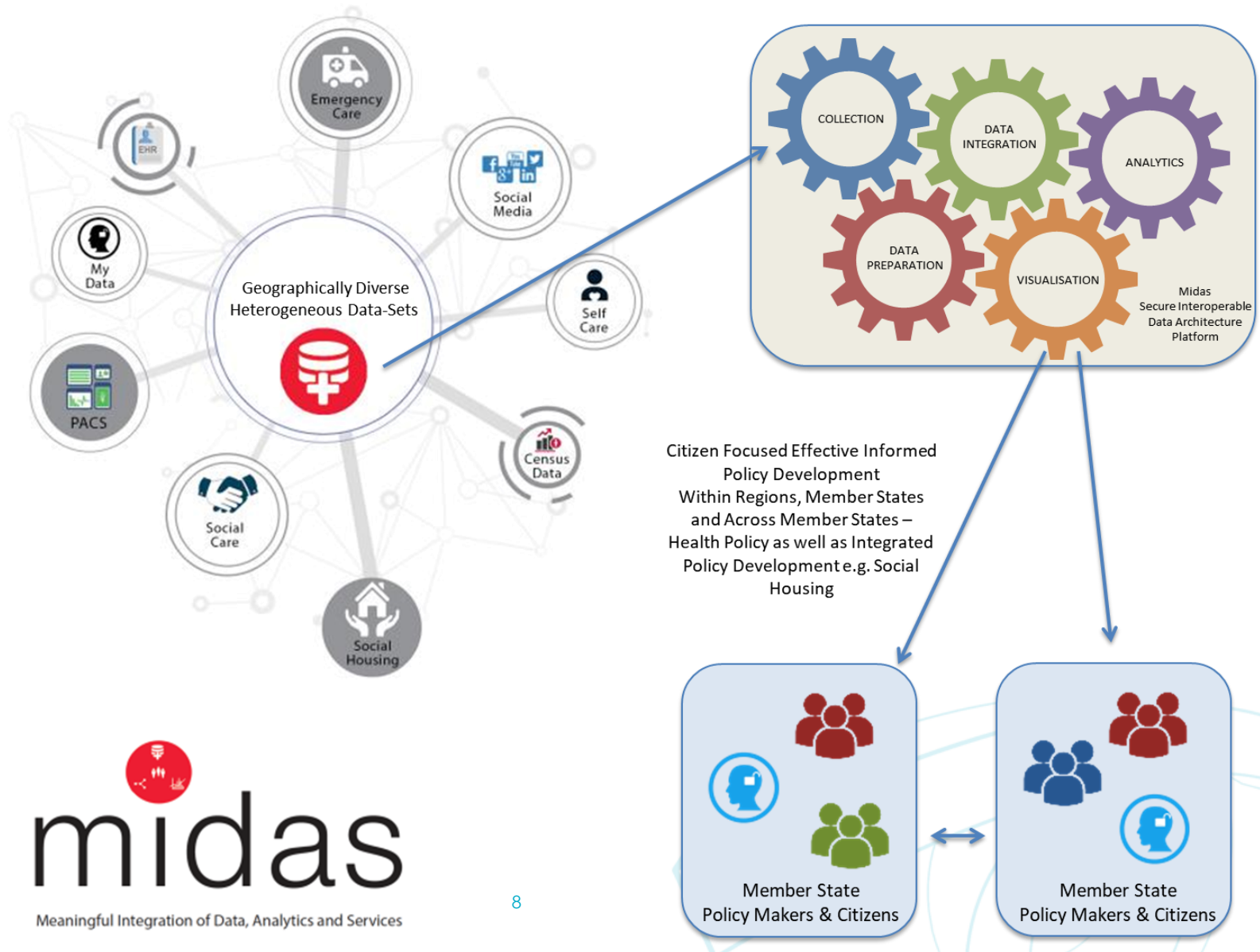


Screening results

Optical disc

Blood vessels

Big Data in Health



Heterogeneous data collection & preparation

M MIDAS General Stats Missing Values Correlations

WORKING DATASET: udalmap.ssv

OVERVIEW


FEATURES TYPES

Number of values / samples / features 1126488 / 5522 / 204

Number of unnamed columns


MISSING VALUES

VALUES



688288

SAMPLES with



0

	var_1	var_2	var_3	var_4
var_1	4016 missing values (72.73%)			
var_2		4267 missing values (77.27%)		
var_3			4016 missing values (72.73%)	
var_4				4267 missing values (77.27%)

Number of values / samples / features

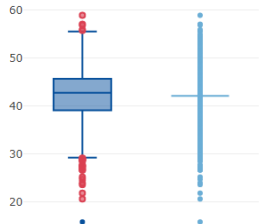


Choose a feature and an imputation method

Only shown those features with numeric type that have missing values.

▾

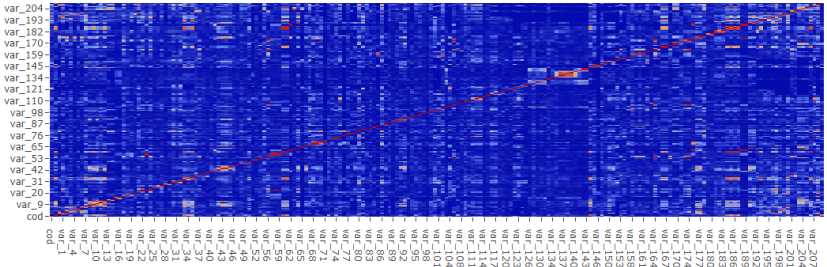
▾



■ var_9

■ var_9 imputed by i

CORRELATIONS > OVERVIEW (udalmap.ssv)



CORRELATIONS > REFINE (threshold: 0.7)

- year is highly correlated with var_12 p = 0.7484
- year is highly correlated with var_33 p = 0.7862
- year is highly correlated with var_60 p = 0.8065

MISSING VALUES

FEATURES TYPES

Number of values / samples / features 1126488 / 5522 / 204

Number of unnamed columns

MISSING VALUES

VALUES



688288

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Number of values / samples / features



Choose a feature and an imputation method

Only shown those features with numeric type that have missing values.

▾

▾



■ var_9

■ var_9 imputed by i

CORRELATIONS > OVERVIEW (udalmap.ssv)

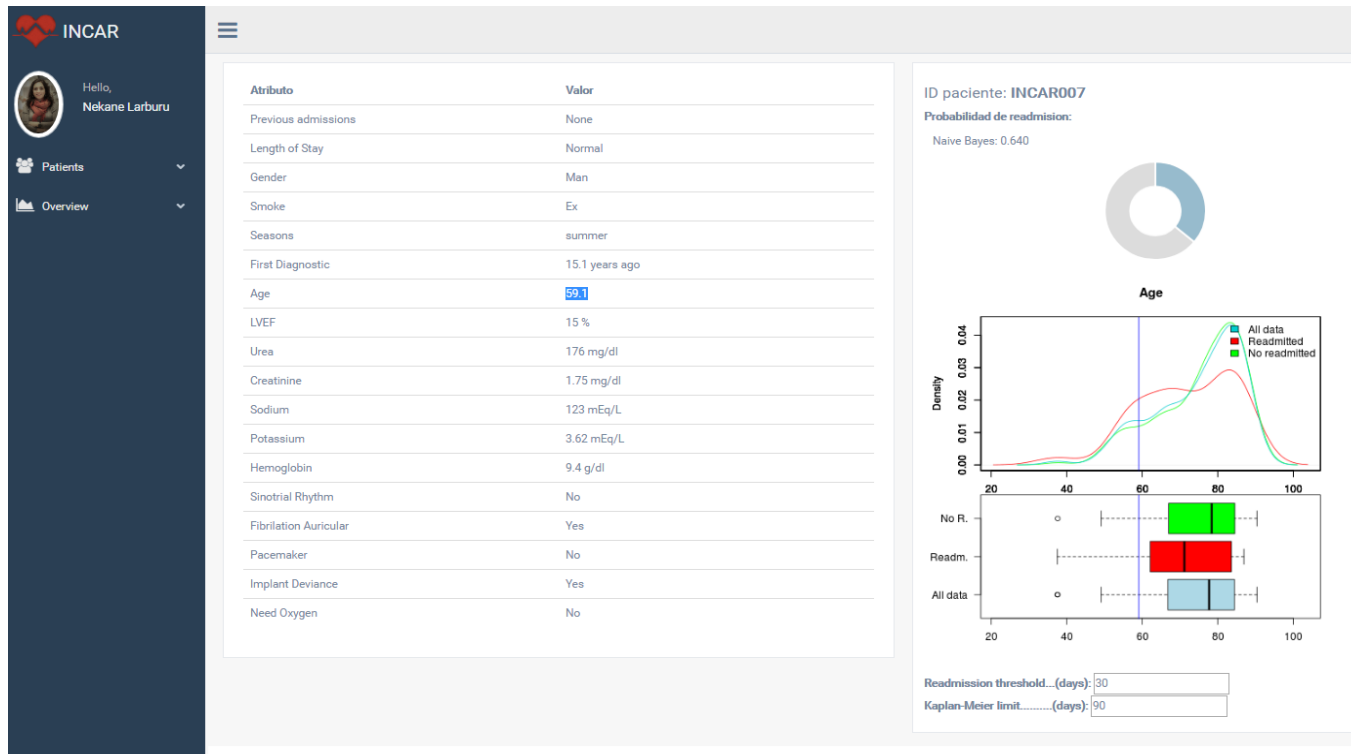


CORRELATIONS > REFINE (threshold: 0.7)

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Predictive models

INCAR: Monitoring and intelligent routing system for patients suffering from cardiac insufficiency



8:44

← Riesgo y Recomendaciones

¡¡Estás en ALTO riesgo!!

Necesitará seguir un plan de monitorización diaria (continuar or reforzar si antes se le pidieron 3 días por semana).

Se va a proceder a reforzar el programa de educación de insuficiencia cardíaca (planes de higiene y dietética) y se le ajustará el diurético en función de síntomas.

Y, por favor, llame a su profesional sanitario para la consulta o ajuste del tratamiento.

IR A INICIO

- Predictive Models to determine the risk of readmission and decompensation of heart failure patients for real time guidance using clinical data and telemonitored data

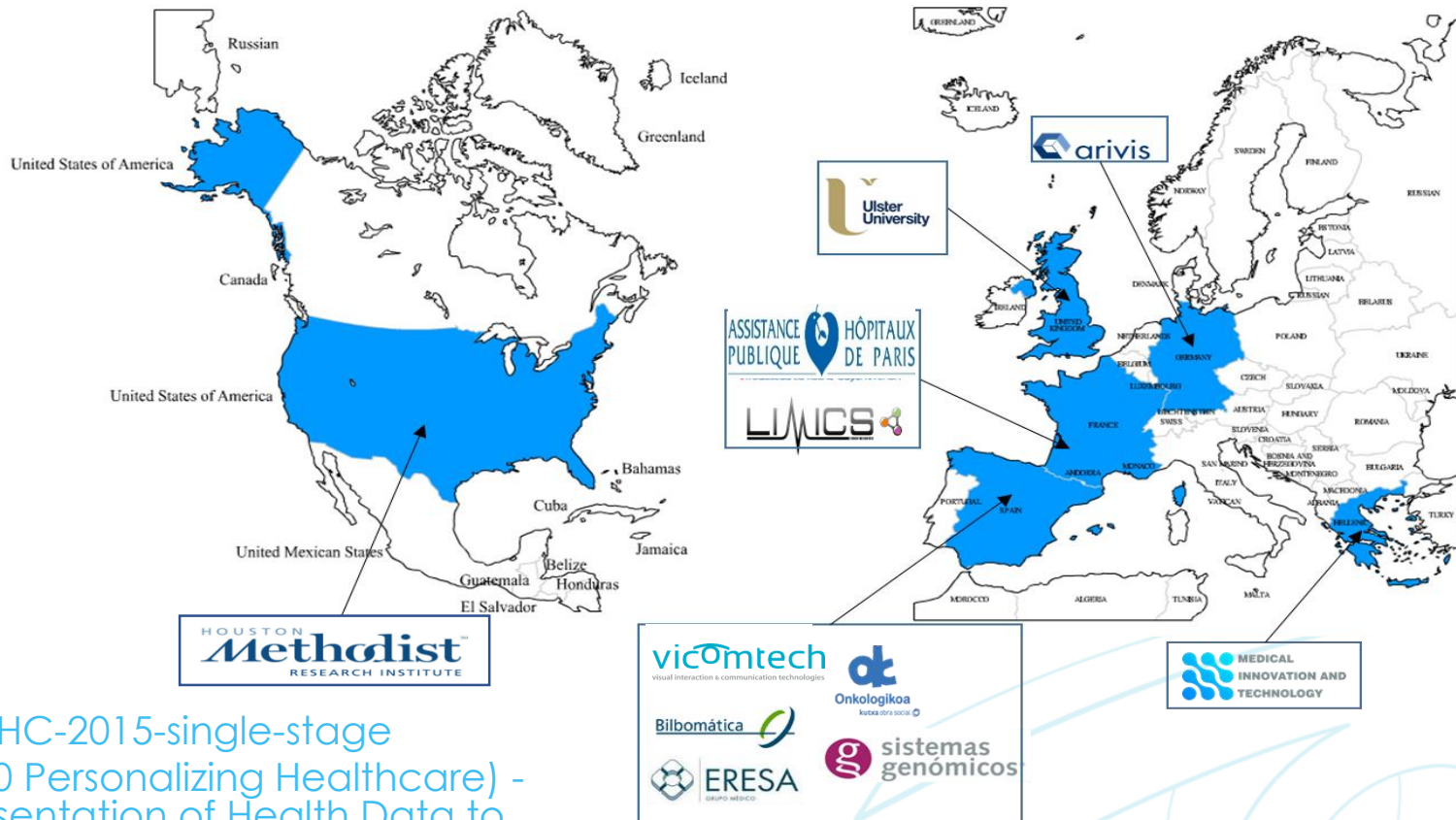
Clinical Decision Support Systems

@ desiree_project

desiree

DESIREE – Decision Support and Information System for Primary Breast Cancer

Funded by
the European Union



vicomtech visual interaction & communication technologies

Onkologikoa

Bilbomática

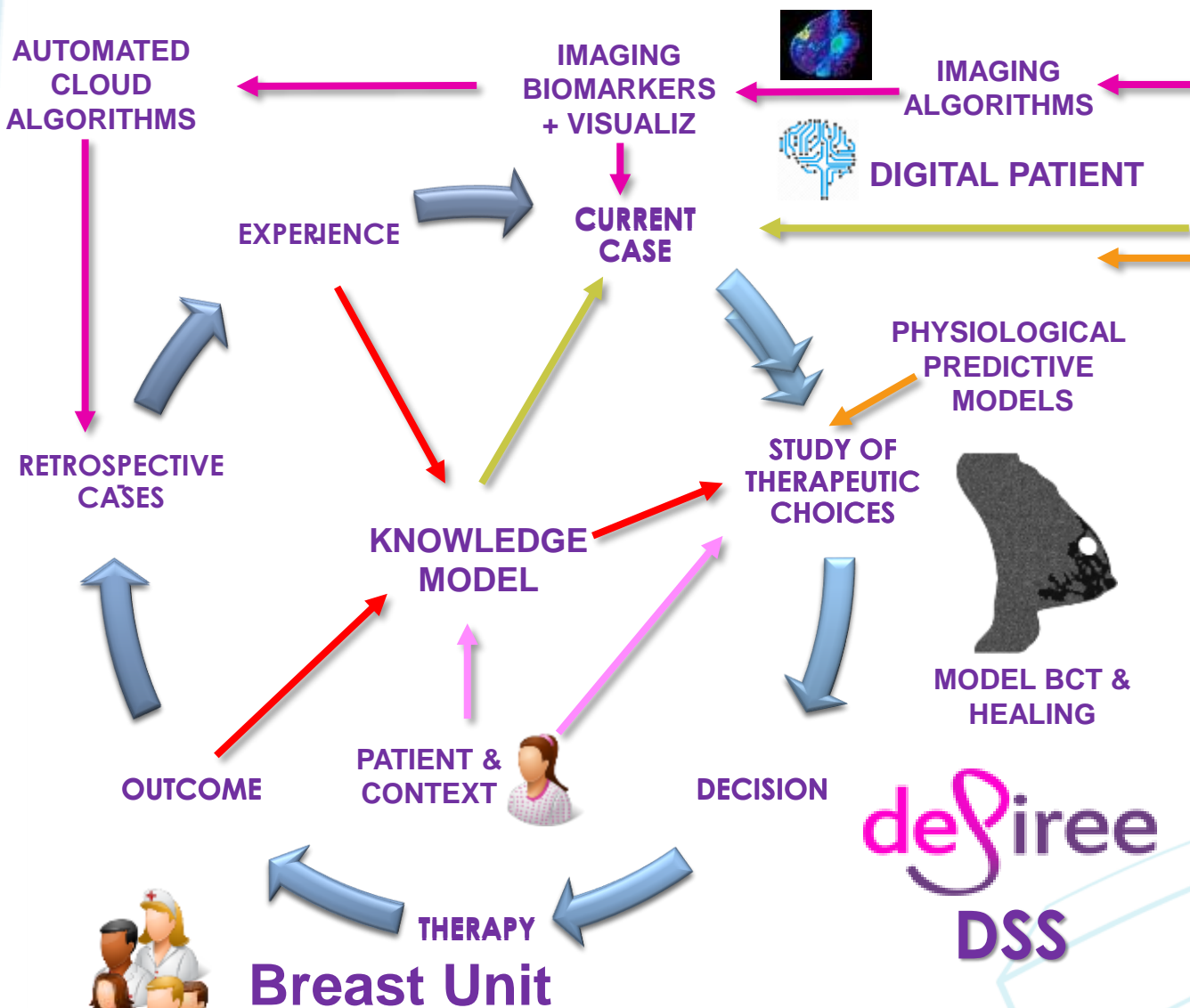
ERESA GRUPO MÉDICO

sistemas genómicos

MEDICAL INNOVATION AND TECHNOLOGY

Call: H2020-PHC-2015-single-stage
Topic: PHC-30 Personalizing Healthcare) -
Digital Representation of Health Data to
Improve Disease Diagnosis and Treatment
Budget: 3.340.720€

Clinical Decision Support Systems



Patient-specific Data

- Imaging
- Genetics
- Personal & Clinical
- RT Plans
- Biology
- Diagnostic Tests
- Therapy
- Environmental & Risk Factors

Population / Knowledge Data

- Therapeutic Admin. Data
- Clinical Guidelines
- Evidence
- Previous cases & outcomes

desiree
DSS

Breast Unit



Clinical Decision Support Systems

- Development and Implementation of powerful Clinical Decision Support System for Breast Units. Components



NCCN

Guideline-based DSS

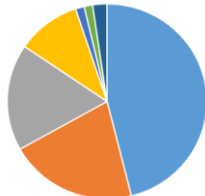
- Implementation of relevant clinical guidelines
- Provide GL-based recommendations for current case



EVIDENCE

Experience-based DSS

- Advice based on previous cases, decisions and outcomes
- Generation and exploitation of Real World Evidence



Case-based DSS

- Data-driven, based on cases + outcomes
- Similarity search, visual analytics

Clinical Decision Support Systems

CDSS
Hide ▲

Get recommendations from

NCCN ✕

Clean

NCCN
 ESMO
 ONK

Get recommendations

Similar cases

Select recommendation

- SURGERY

NCCN

1	Mastectomy	1	SHOULD
1	Axillary sentinel lymph node biopsy	2A	SHOULD
1	Breast reconstruction	2A	MAY

NCCN

1	Simple lumpectomy	1	SHOULD
1	Clips on tumor bed	2A	SHOULD
1	Axillary sentinel lymph node biopsy	2A	SHOULD

NCCN

1	AxillaryLymphNodeSurgicalProcedure	2A	MAYNOT
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+ ONCOLOGY

Submit decision

Visual Analytics for Real-World Evidence (RWE)

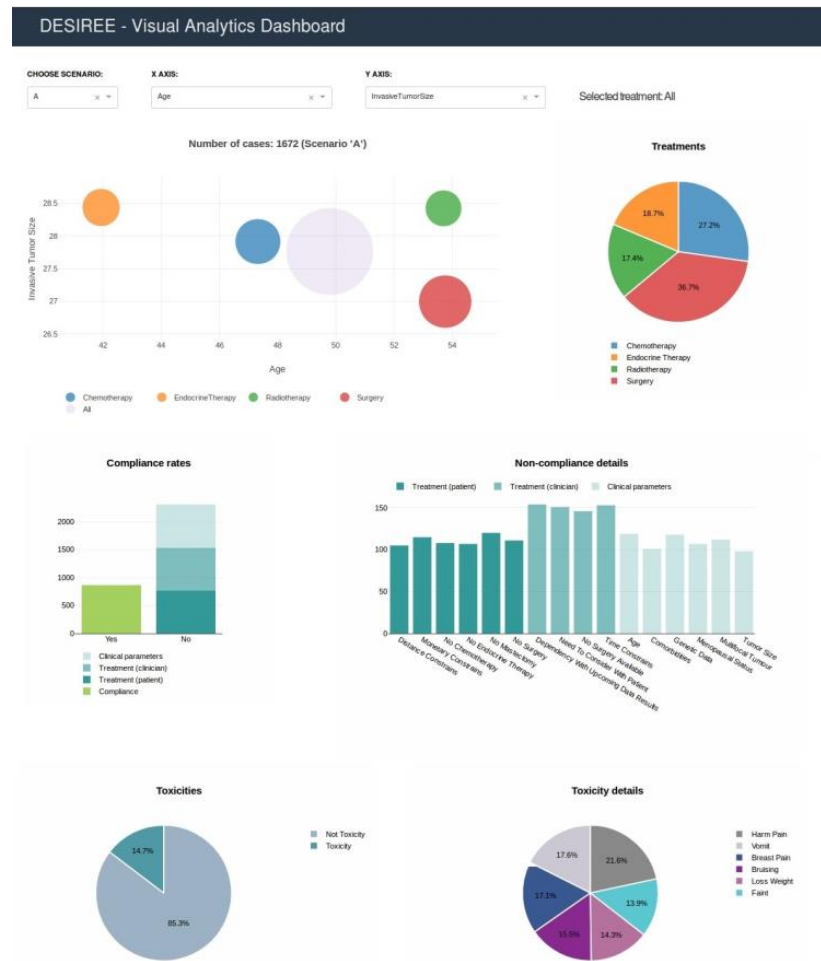
Retrospective analysis of cases, treatments and outcomes

Allows to:

- Identify and study patient groups based on variables
- Detect possible correlations
- Study non-guideline-compliance
- Evaluate results of different treatments
- Assess overall performance

Possible users

- Clinicians: retrospective evaluation and Real World Evidence
- Managers: assessing quality or treatment response for value-based healthcare
- Researchers: hypothesis generation





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