iASiS

Big Data for Precision Medicine

Integration and analysis of heterogeneous big data for precision medicine and suggested treatments for different types of patients.

http://project-iasis.eu

@Project_IASIS

iASiS: Big Data to Support Precision Medicine and Public Health Policy

Anastasia Krithara
Inst. of Informatics & Telecommunications
NCSR "Demokritos", Greece

SC1-PM-18-2016: Big Data supporting Public Health policies

iASiS Basic Facts

- Title: Integration and analysis of heterogeneous big data for precision medicine and suggested treatments for different type of patients

- Topic: H2020-SC1-PM-18-2016 - Big Data supporting Public Health policies

- Contract No.: 727658

- Budget: € 4.3M

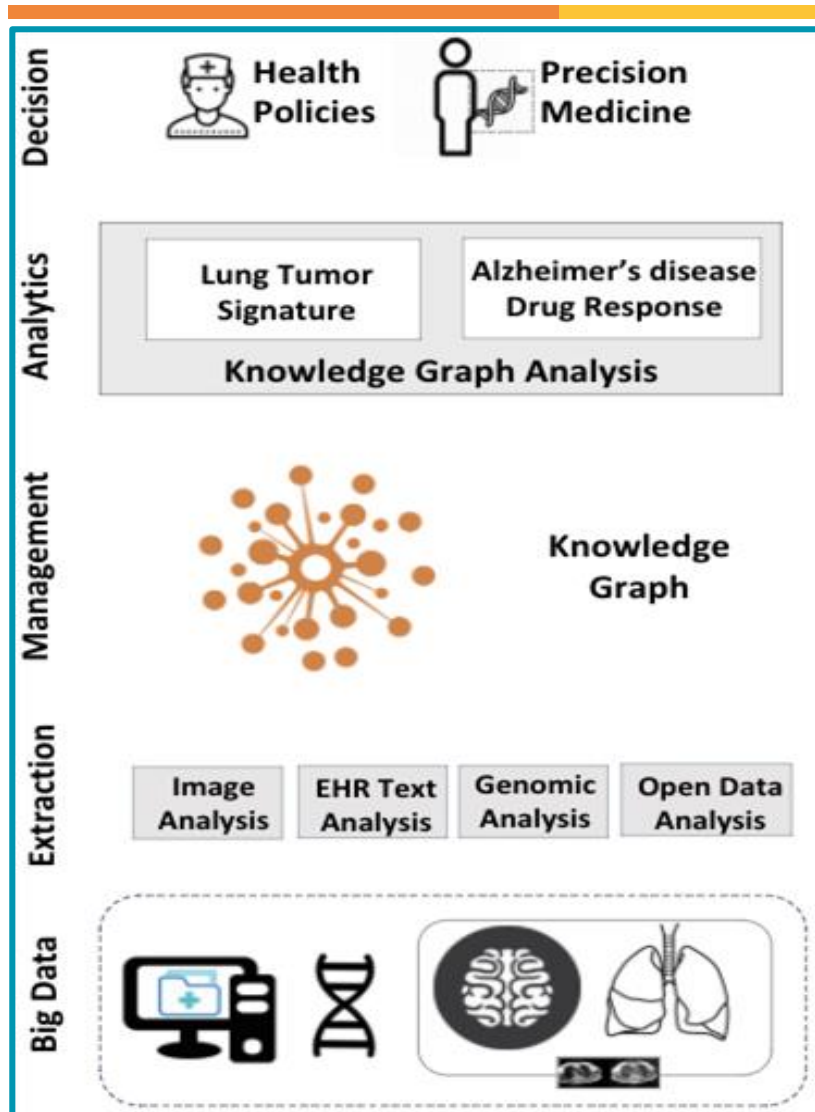April 1, 2017 — Present — Sept. 30, 2018 Reporting — March 31, 2020 Reporting

Vision and Objectives

iASiS Vision:

Turn clinical, pharmacogenomics, and other Big Data into actionable knowledge for personalized medicine and health policy-making

iASiS Objectives:

- Integrate automated unstructured and structured data analysis, image analysis, and sequence analysis into a Big Data framework

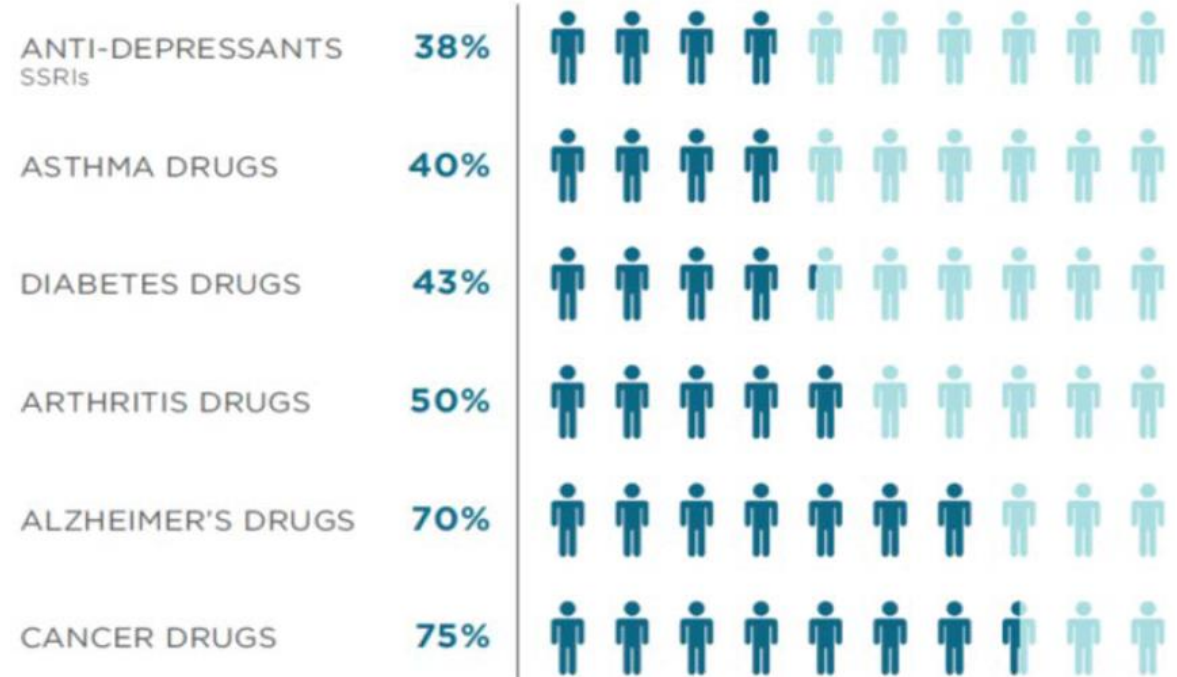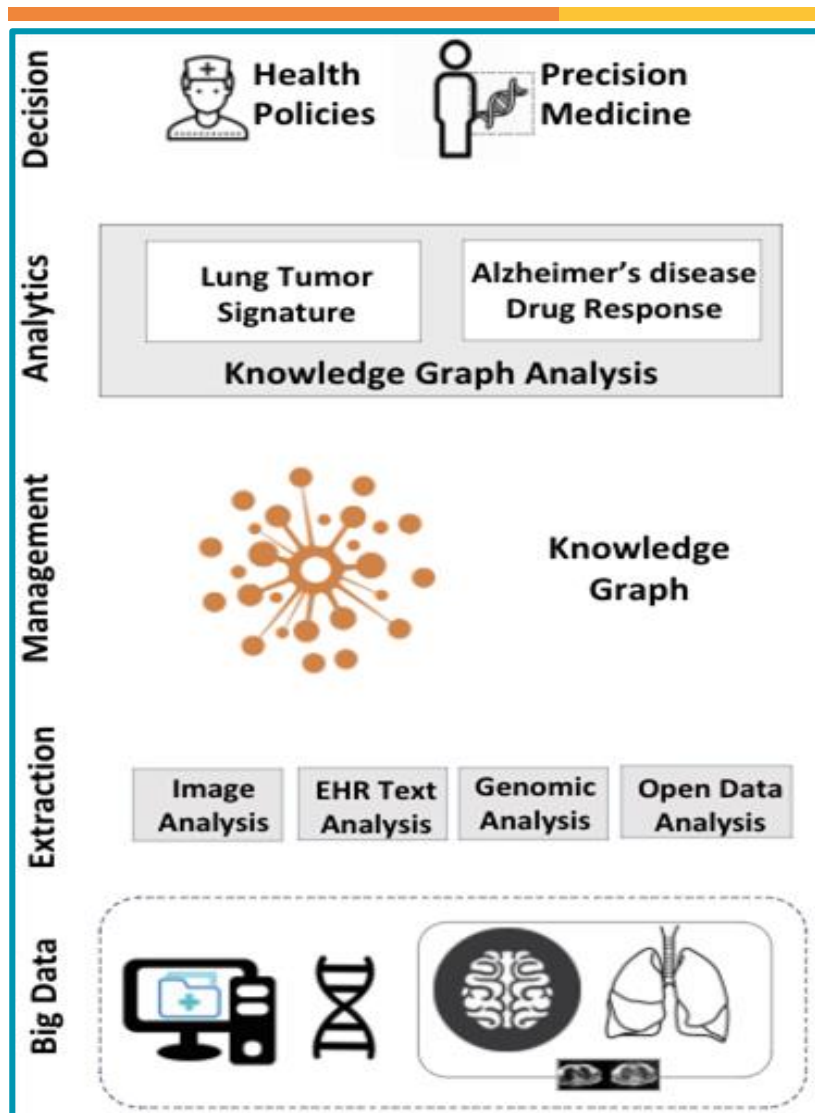- Use the iASiS framework to support personalized diagnosis and treatment

iASiS
Big Data for Precision Medicine

The iASiS Framework

- iASiS focuses on two use cases:
  - Lung cancer
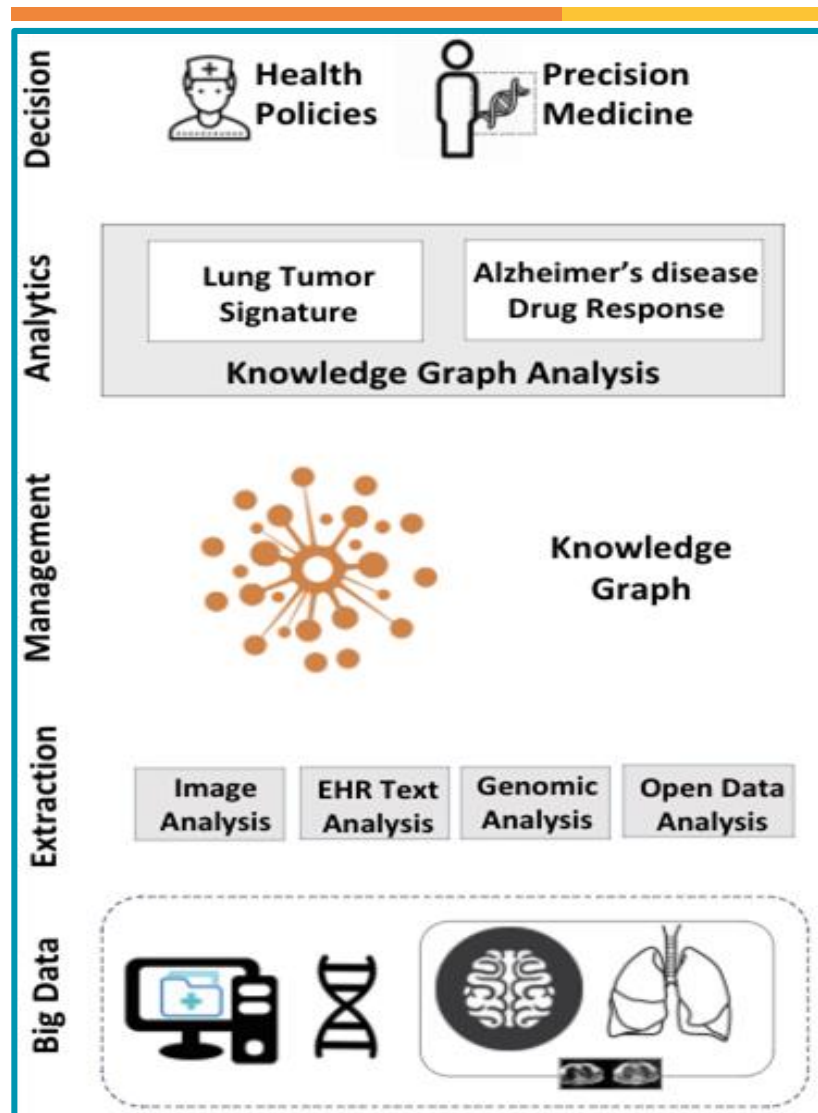 - Alzheimer's disease

- General-purpose drugs are often ineffective

ANTI-DEPRESSANTS SSRIs	38%	
ASTHMA DRUGS	40%	
DIABETES DRUGS	43%	
ARTHRITIS DRUGS	50%	
ALZHEIMER'S DRUGS	70%	
CANCER DRUGS	75%	

The iASiS Framework

- iASiS analyses:
    - EHRs (English & Spanish)
    - MRI & PET/CT images
    - Genomic data (e.g. liquid biopsy samples)
    - Related bibliography (e.g. PubMed)
    - Biomedical databases (e.g. DrugBank)
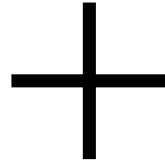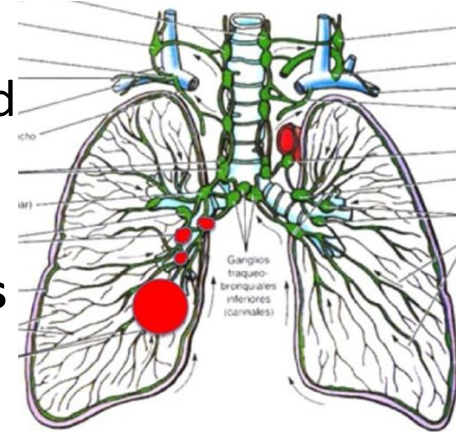   - Biomedical ontologies (e.g. GO, UMLS)

The iASiS Framework

- Extracted knowledge is fused in the iASiS knowledge graph
  - Unified semantic schema
  - Linked data
  - Machine-processable knowledge

- iASiS end-users can:
  - Perform natural language questions
  - Receive answers along with justifications
  - Identify patterns in patient populations
  - Make informed decisions

- All steps of data management and analytics enforce privacy and access control

Lung Cancer Pilot Data

- **EHRs in Spanish**

- **PET/CT Images**

- **Genomic Data/Liquid Biopsy Samples**

+

- Pharmacological knowledge extracted from **publicly available datasets**

- **Biomedical ontologies** and **taxonomies**
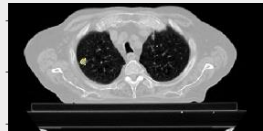 - terminology standardization
  - semantically describing the EHRs

Lung Cancer Use case

Select treatment for long survival

Input: patient data
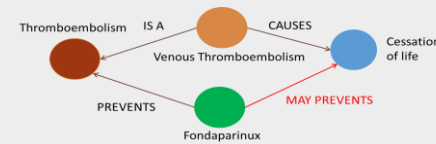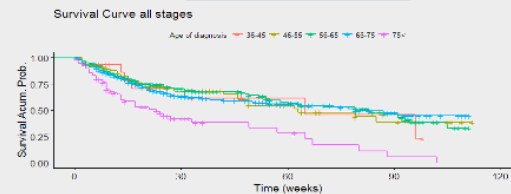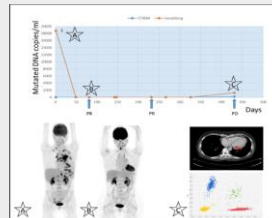

Output

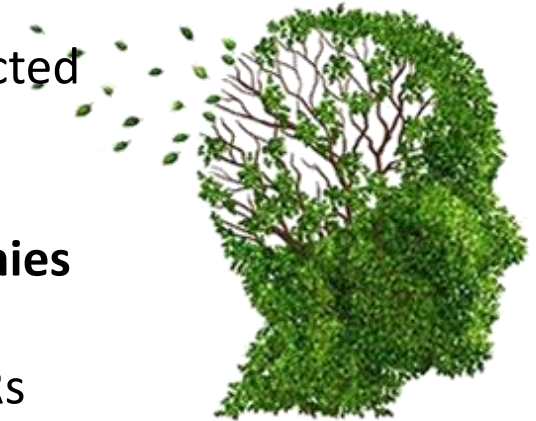Patient categorization into survival groups

Treatment Recommendation

online

offline

Analysis

Survival Curve all stages

Age of diagnosis   36-45   46-55   56-65   66-75   75+

Thromboembolism   IS A   Venous Thromboembolism   CAUSES   Cessation of life

PREVENTS   Fondaparinux   MAY PREVENTS

iASiS
Big Data for Precision Medicine

Alzheimer's Disease Pilot Data

- **EHRs in English**

- **MRI Brain Images**

- **Genomic Data**

\+

- Pharmacological knowledge extracted from **publicly available datasets**

- **Biomedical ontologies** and **taxonomies**
  - terminology standardization
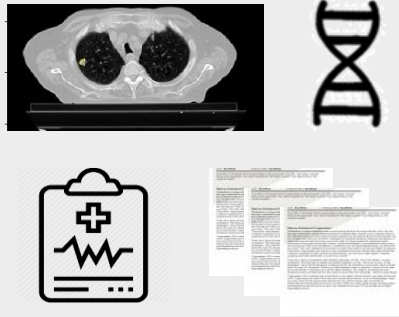 - semantically describing the EHRs

Alzheimer's Use case

Which drug is most suitable for a particular patient?

Input: patient data
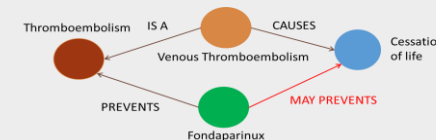
Output
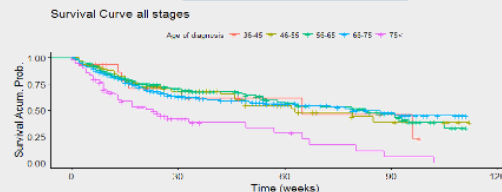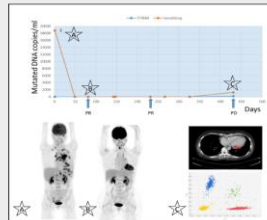
Positive response estimates for each available drug

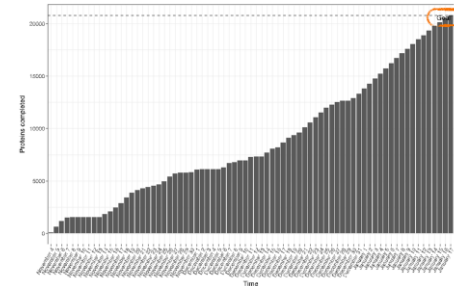Drug Recommendation

online
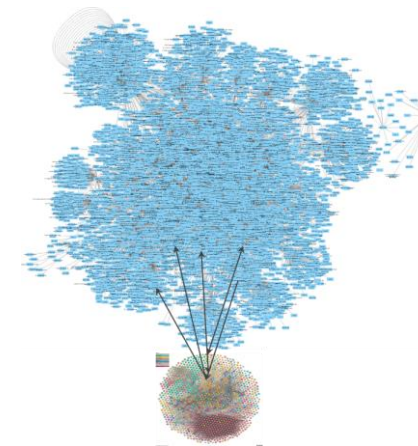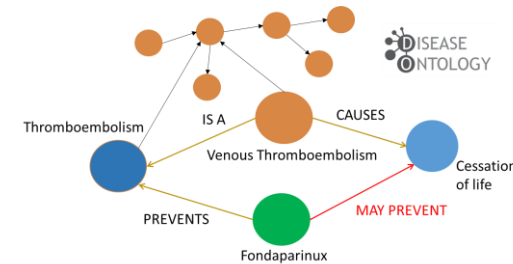
offline

Analysis

Current status: iASiS in numbers

- Electronic health records: 7,146 reports, 171.878 clinical notes, 706 patients (LC)
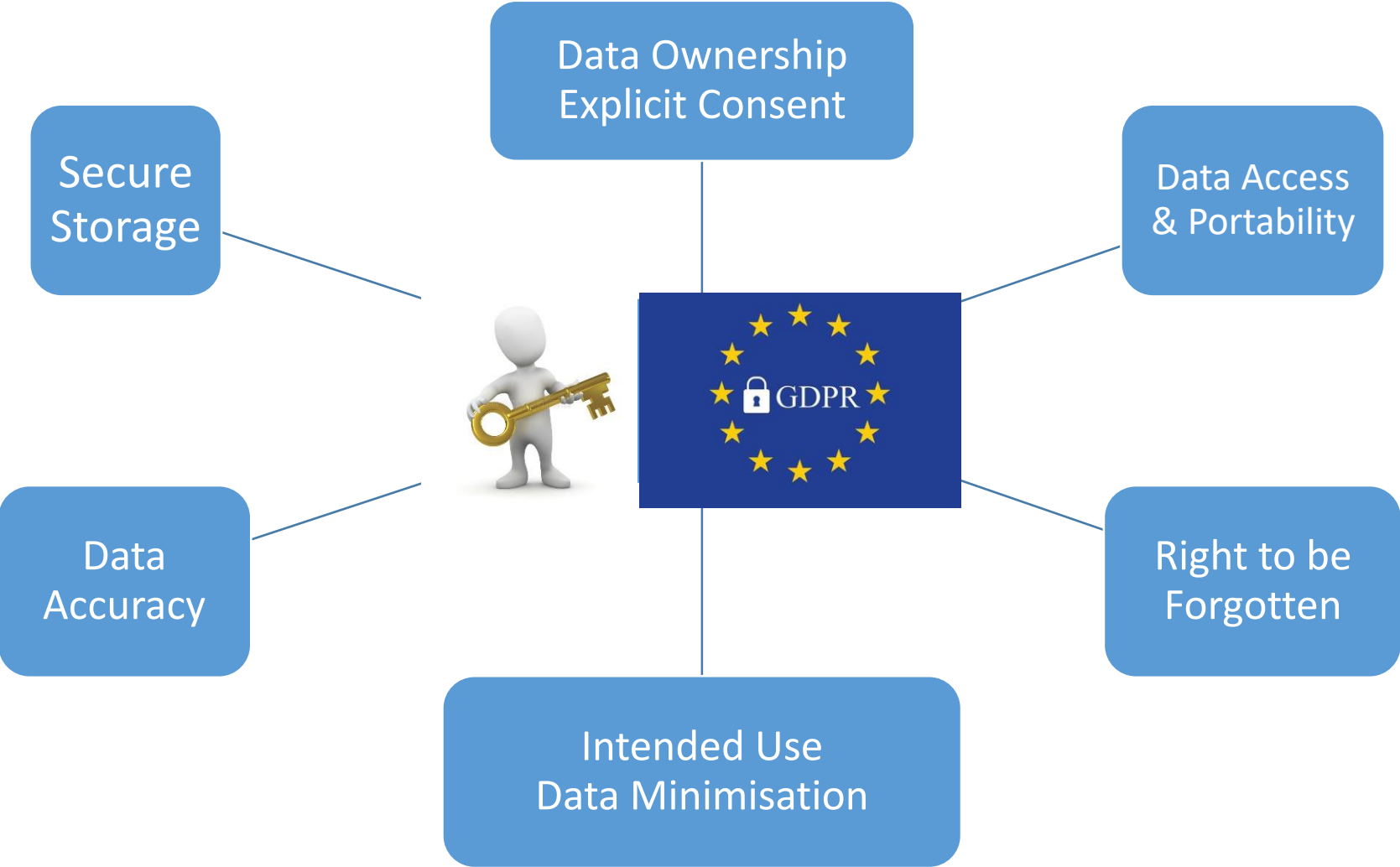

- Open data: 266,170 articles (LC & AD), 168,831 concepts, 1,001,180 extracted relations

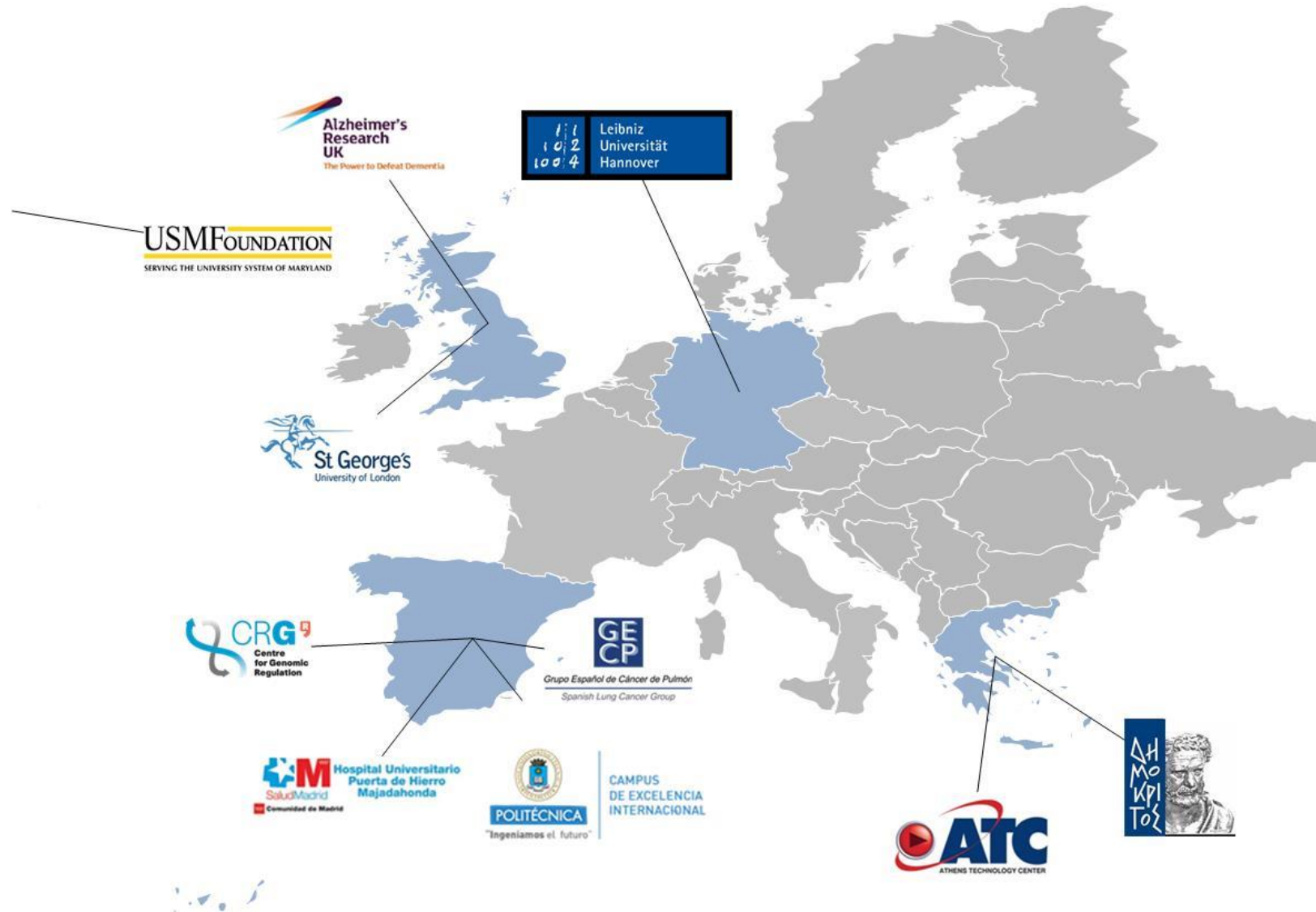- Genomic data: 20,778 proteins x 98,608 RNAs interaction network

→ Knowledge graph: 231,693,984 triples

iASiS
Big Data for Precision Medicine

Beyond Data Analysis

iASiS Partners

Thank you for your attention

http://project-iasis.eu   @Project_IASIS

iASiS
Big Data for Precision Medicine