

AI4Health

Inês Dutra

Francisco Bischoff, Mafalda Santiago, Cláudia Camila Dias,
Cristiano Lemes, Daniela Ferreira-Santos, Pedro P.
Rodrigues, Pedro H. Abreu



CINTESIS

Health. Research.

AI4Health



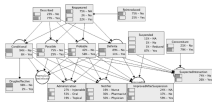
- ✓ 2D4H – Secondary Data for Healthcare Research
- ✓ AI4Health – Artificial Intelligence for Health Care
- ✓ BioData – Biostatistics & Intelligent Data Analysis
- ✓ EvidenS&HTA – Evidence-Based Decision Making, Research Synthesis and Health Technology Assessment
- ✓ HIS-EHR – Health Information Systems & Electronic Health Records
- ✓ Neurolmag – Neuroimaging in Psychiatry and Dementia
- ✓ PaCeIT – Patient Centered Innovation and Technologies
- ✓ SPA – Signal Processing Applications
- ✓ Tech4edusim – Technologies for Education and Simulation in Healthcare

AI4Health

BAYESIAN NETWORKS IN EVIDENCE-BASED MEDICINE

Causality Assessment of ADR Reports

Artif. Intell. Medicine (2018); AIME (2017)

[illegible]

Empirical Evidence



Intelligent Modelling



Decision Support

Endoscopic Gastric Submucosal Dissection

Endosc. Int. Open (2017); Semana Digestiva (2016); CBMS (2017)

[illegible]

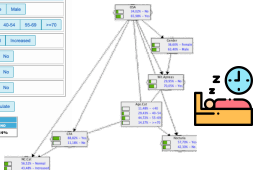
Obstructive Sleep Apnea

Int. J. Data Sci. Anal. (2018); MIE (2018); CBMS (2018); STC (2018); CBMS (2017)

Webform 01-3

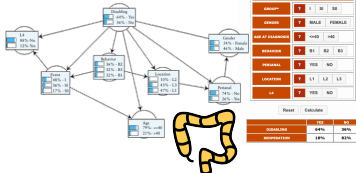
Name	<input type="text"/> Female <input type="text"/> Male	
Age	<input type="text"/> <10 <input type="text"/> 40-54 <input type="text"/> 55-69 <input type="text"/> =70	
Hair Color/Hair	<input type="text"/> Normal <input type="text"/> Increased	
Wilsonian Eyes	<input type="text"/> Yes <input type="text"/> No	
Chlorine Metabolism	<input type="text"/> Yes <input type="text"/> No	
Smoking	<input type="text"/> Yes <input type="text"/> No	

YES	
YES	NO
68%	32%

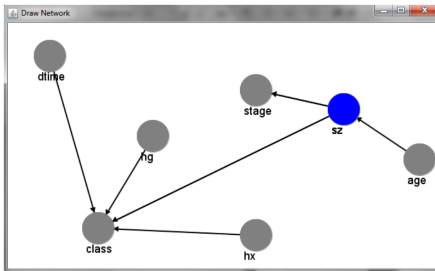
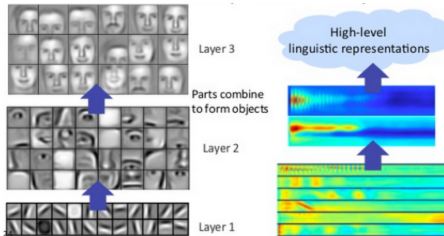


Inflammatory Bowel Disease

J. Crohn's Colitis (2017, 2019); CBMS (2016); CBMS (2015)



AI Techniques



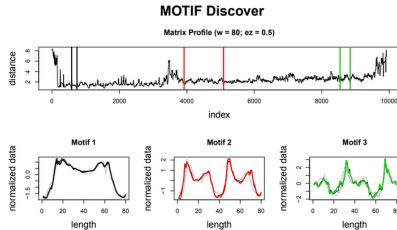
```
is_malignant(Case):-
    biopsyProcedure(Case,usCore),
    changes_Sizeinc(Case,missing),
    feature_shape(Case).

is_malignant(Case):-
    assoFinding(Case,asymmetry),
    breastDensity(Case,scatteredFDensities),
    vacuumAssisted(Case,yes).

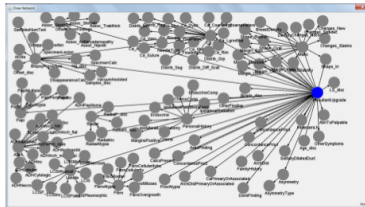
is_malignant(Case):-
    needleGauge(Case,9),
    offset(Case,14),
    vacuumAssisted(Case,yes).
```

Tools

- **tsmp**: An R Package for Time Series with Matrix Profile



- ExpertBayes: an interactive Bayesian network interface and system



Case Studies

- Obstructive Sleep Apnea
- Breast Cancer



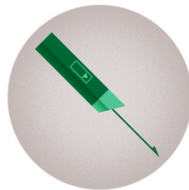
Case Study: Obstructive Sleep Apnea



- Predictive model obtained a proportion of normal results in 66 patients (34%), revealing a **large number of unnecessary exams** that are performed every day in Vila Nova de Gaia/Espinho hospital center
- Model can potentially **generalize** to the different hospital centers in the country
- Sensitivity above 90% which **prevents 1 out of 5 healthy individuals from unnecessarily performing a polysomnography (PSG) exam**
- Specificity above 20% **improving from current clinical practice**

Case Study: Breast Cancer

Core-Needle Biopsy



↓
CAN BE INCONCLUSIVE (~3%)

↓
ALL INCONCLUSIVE CASES GO THROUGH SURGICAL EXCISION

↓
IN GENERAL, **85%** ARE BENIGN!

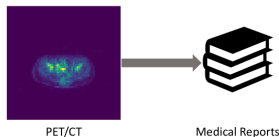


Case Study: Breast Cancer

- Predictive model trained on 60 discordant cases using a probabilistic model:
 - ▶ identified 11/60 lesions (7 masses and 4 areas of calcifications) with $> 98\%$ probability of malignancy
→ all 11 were benign at excision

Case Study: Breast Cancer

- Objective: Medical Image Annotation from PET/CT



- How:
 - ▶ Pre-processing
 - ▶ Neuro-linguistic programming (NLP)
 - ▶ Image feature extraction
- Interpretability:
 - ▶ Correlate image with text and express the knowledge acquired by the ANN in text

Remarks

- AI is going to have a very good impact on health care
- AI systems nowadays can save time of health care providers who can focus on other tasks
- Ethics is still a challenge

Questions



<http://www.cintesis.eu>