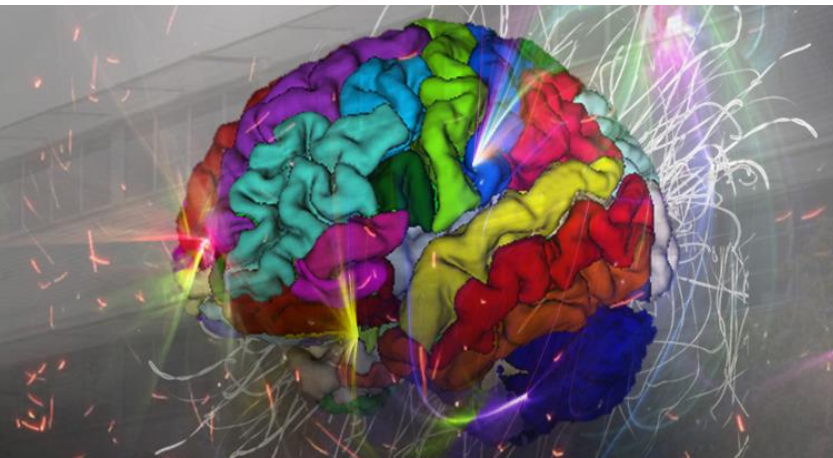




# E-Health

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# Presentation

- Lecturers:
  - Jordi Freixenet ([jordi.freixenet@udg.edu](mailto:jordi.freixenet@udg.edu))
  - Robert Martí ([robert.marti@udg.edu](mailto:robert.marti@udg.edu))
- 5 ECTS (125 h)
  - Theory & Discussions
  - Labs (Computer Vision Lab)
  - Final Project: report, lab, presentations.

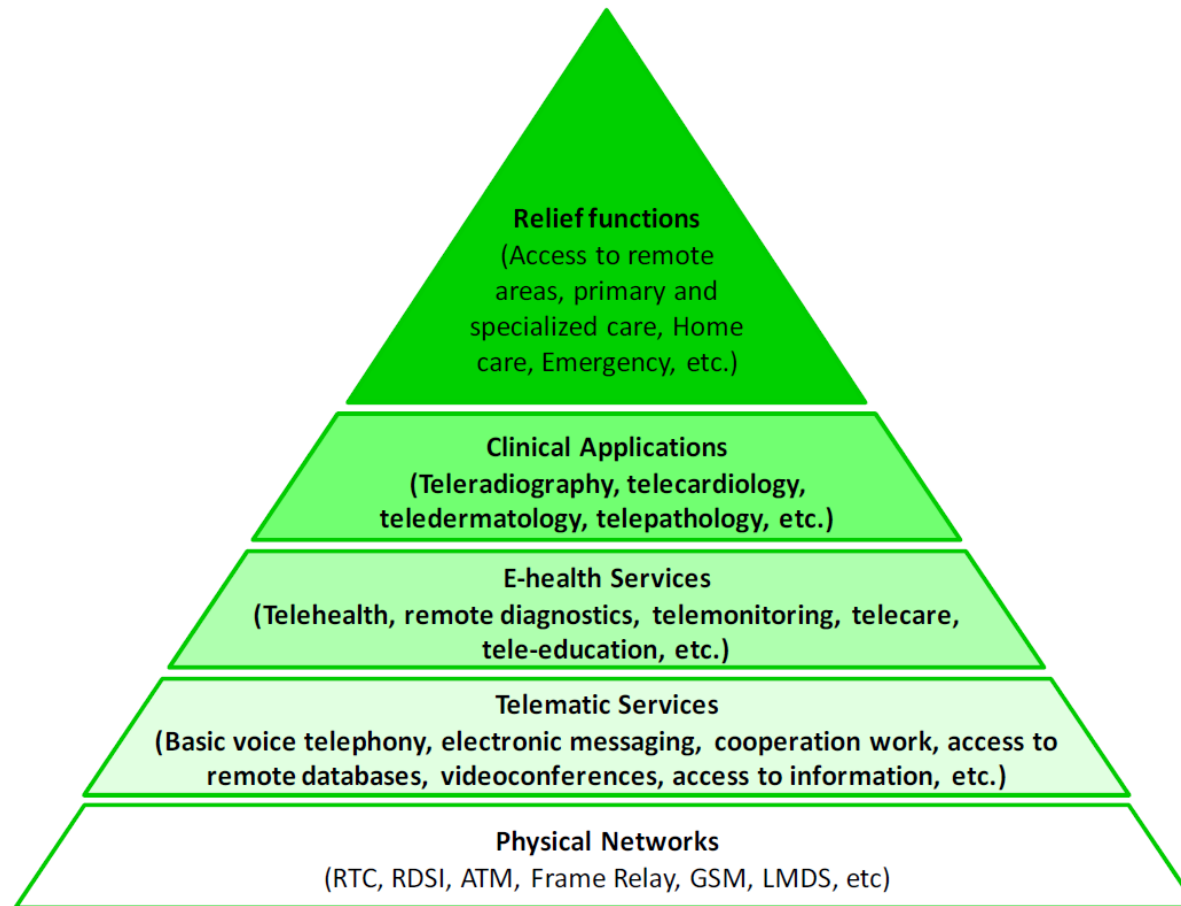
# What is e-Health?

- A wide concept!
- The provision of health services at the local, national or global level through the use of information and communication technologies (ICTs).
- Ranges from healthcare applications, such as teleconsultation, telemonitoring and remote diagnostics related to patient management, to patient training and healthcare professionals.
- The aim is to improve quality and patient safety, and also improving management and allowing for modern healthcare systems that can be adapted to suit the needs of patients and healthcare professionals.
- **E-Health is based on the use of ICTs to improve patients' management, diagnosis and monitoring.**



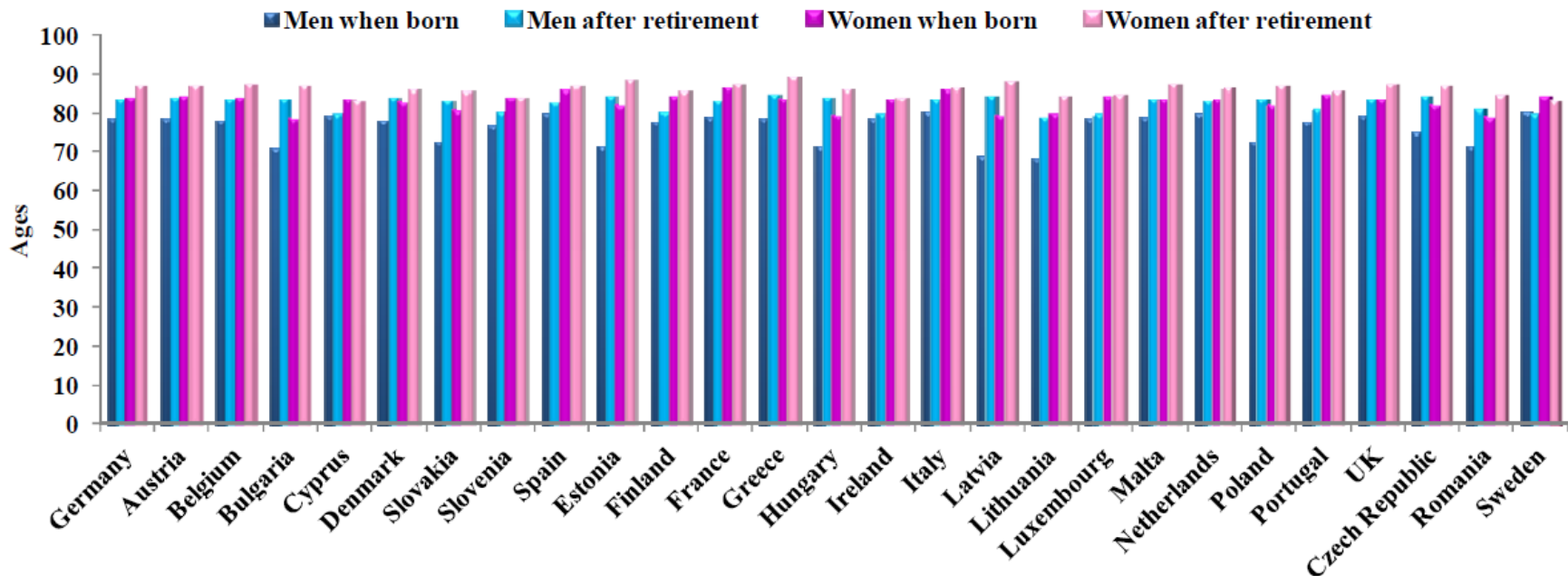
# E-Health Pyramid

- ICT implications at different levels.



# Why e-health?

- Increasing costs of healthcare
- Aging population and prevalence of chronic diseases
- Improve management
- Improve patient safety and minimise errors



# What is e-Health?

- Telehealth, mobile health (m-Health), but also about the health-related use of e-Learning, social media, health analytics, connected devices or even “Big Data”.
- Challenges
  - Personal Health Systems
  - Patient Safety
  - Virtual Physiological Human
    - <http://www.vph-institute.org>

<https://youtu.be/tx9ZXtInVmg>

<https://youtu.be/Y10fDCnRjo4>



# Electronical Medical Records

- Access of patient data by clinical staff at any given location
- Accurate and complete claims processing by insurance companies
- Building automated checks for drug and allergy interactions
- Clinical notes
- Prescriptions
- Scheduling
- Sending and viewing labs
- Telehealth / Telediagnosis
- Digital / Digitised data.





# Electronical Medical Records

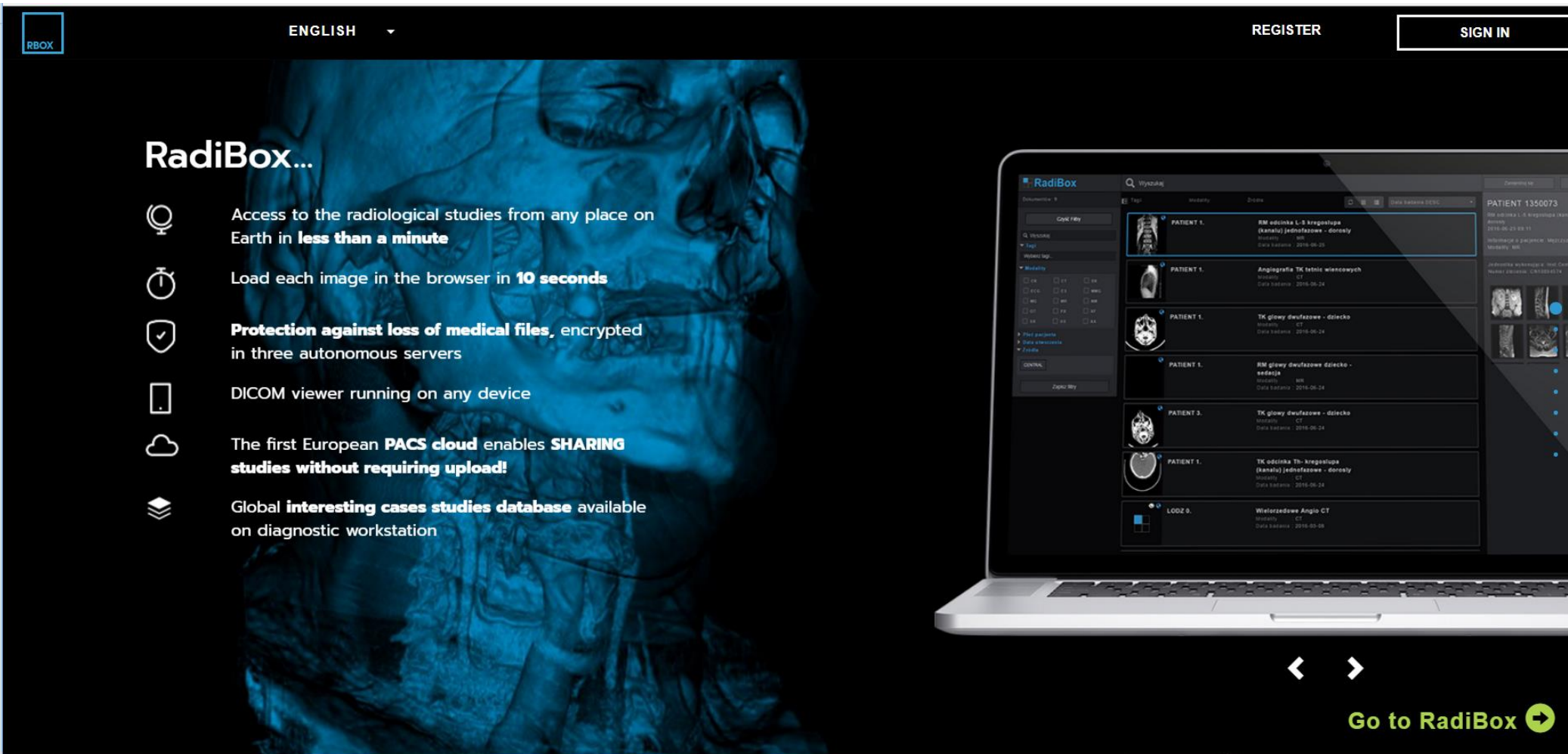
- Challenges:
  - Record maintenance (after death!)
  - Standardisation (many formats, conversions,..)
  - Media degradation & storage
  - Protection and privacy



# Clinical Decision Support

- Software to help aid clinical decision-making; characteristics of patient are matched to knowledge base, recommendations are presented to the clinician/patient.
  - Diagnostic support
  - Drug dosing
  - Preventive care reminders
  - Disease management (diabetes, hypertension, AIDS, asthma)
  - Test ordering, drug prescription

# Telemedicine / Teleradiology



**RadiBox...**

- Access to the radiological studies from any place on Earth in **less than a minute**
- Load each image in the browser in **10 seconds**
- Protection against loss of medical files**, encrypted in three autonomous servers
- DICOM viewer running on any device
- The first European **PACS cloud** enables **SHARING studies without requiring upload!**
- Global **interesting cases studies database** available on diagnostic workstation

**Go to RadiBox**

<https://www.youtube.com/watch?v=LWXmqBtKDZI>



# Mobile health in 2024



## 1. Contact lenses

A microscopic camera in the lens takes pictures of the **retina** and matches these to past cases, identifying early symptoms of **diabetic retinopathy**

### Fact

1% of global blindness can be attributed to diabetes. Approximately 4,200 people in England are blind due to diabetic retinopathy

## 2. Fridge

The fridge monitors the **digestive system**: drinks consumed (thirst); vitamin consumption (**deficiencies**); calories/sugar consumption (insulin levels)

### Fact

Diabetes is set to cost the NHS £16.9 billion by 2035/6

## 3. Artificial pancreas

Mini artificial **pancreas** to detect irregular **blood sugar** levels and injects insulin when necessary

### Fact

Worldwide in 2013, 382 million people had diabetes; by 2035 this is projected to rise to 592 million

## 4. Clothes

**Smart fibres** in all clothes sense a rash or skin condition appearing, signalling the possible onset of diseases such as **skin cancer**

### Fact

There are currently almost 13,000 new cases of skin cancer diagnosed each year in the UK

## 5. Thermometer patch

An electronic stick-on "tattoo", half the width of a human hair in size that detects precise **temperature changes** around the area of skin where it is placed, tracking **heat flow** through the bloodstream. This indicates **cardiovascular activity**

### Fact

The number of people who die from cardiovascular diseases, mainly from heart disease and stroke, will increase to 23.3 million by 2030

## 6. Shoes and socks

Shoes and socks track movement of **feet**, detect when you are too sedentary and update you on **fitness** goals, as well as monitoring your **weight**

### Fact

Physical inactivity costs the NHS £900 million annually

## 7. Nappies

Smart nappies monitor children's **sleeping patterns** and **body temperature** for symptoms of illness such as **dehydration**

### Fact

Approximately 440,000 children around the world have diabetes with 70,000 new cases diagnosed each year

## 8. Toilet

The smart toilet monitors the **liver** and **kidney** by measuring the frequency and amount of urine passed, analysing for **glucose levels**, **dehydration**, **infection** and kidney problems. It also alerts for high **blood pressure**, a symptom of heart disease

### Fact

Coronary Heart Disease is the UK's biggest killer with 82,000 deaths annually. Globally, more people die from cardiovascular disease than any other cause

## 9. Monitoring

Continuous **data collection** and instant **reporting** of fitness mean that prevention of disease can be **incentivised** with rewards for positive behaviour - the "gamification" of healthcare, driving **positive behaviour change**

### Fact

Obesity could cost the NHS £9.7 billion more by 2050



[www.bupa.com/mhealth](http://www.bupa.com/mhealth)



@Bupa



BupaHealth



Bupa

<https://www.youtube.com/watch?v=lo6D67MY4J4>

- <https://www.youtube.com/watch?v=Y3phCyMynos>

# Course outline

- Introduction to e-Health (RM/JF) 20/9
- Medical Image acquisition (RM) 20/9
  - US, MRI, X-ray, PET SPECT, Contrast Enhanced, Spectral imaging, dual energy.
- The digital Hospital (JF, 2h) 27/9
  - Integrating the healthcare enterprise (IHE), Electronic patient record, PACs, DICOM
  - Seminar by Josep Fernández (UDIAT, Sabadell). 18/10 (TBC)
- User interface/ Software design for e-health (JF 2h). 4/10
- Image displays, visualization, calibration (RM). 11/10
- Assisted Diagnosis: development, evaluation and integration (RM, JF)
  - Commercial CAD systems, software tools, integration, certification, (JF) 25/10
  - Clinical trials, ground truth generation, tools for annotation, inter observer variability, virtual clinical trials, image quality and evaluation. (RM) 8/11
- Seminars on e-health: Teleradiology, mobile e-health, Decision support systems
  - Digital Pancreas, Josep Vehi, UdG (November/December, TBC)
  - Tele-medicine and Tele-radiology, JL Marzo (November/December, TBC)
  - IA and e-health, Bea López (November/December, TBC)
  - EM-line, Jordi Gich -Lluís Ramió, Hospital Josep Trueta (November/December, TBC)



# Evaluation

- Final Mark (FM):
  - Guided Lab (GL). Source code + report.
  - Student Labs (SL). Presentation + Peer evaluation + exercises
  - $FM = 0.4 GL + 0.6 SL$
- Plan your deadlines!
  - 100 % mark before the deadline
  - 80 % up to a week after
  - 50 % more than a week after

# Guided Labs

- Labs start the week 15th October 2017
- Robotics Lab
- 2 groups
  - G1: Monday 12-14h
  - G2: Friday 12-14h
- Lab Assistants: Jordi Freixenet & Robert Martí
- Guided Lab sessions
- **Groups of 2.**
- Don't copy! Plagiarism will be prosecuted, cite your sources of information.

# Guided Labs (II)

- Topics (2 labs)
  - Visualization & PACS (1w, JF)
    - Week 15/10/18 (15&19)
  - Software tools (1w, RM)
    - Week 22/10 (22&26)
- Deliverables
  - Source code (Good programming practice!)
  - Demonstration
  - Short report (2-3 pages) regarding problems, results and conclusions.

# Student labs

- Students prepare lab exercise (flipped classroom).
- Student Labs structure
  - Information search, exercise preparation (2w, JF)
    - Weeks 5/11/18, 12/11/18
  - Test lab group (2w, JF). Present, discuss and prepare an exercise to the rest of your lab group classmates.
    - 1h x group.
    - Week 19/11 26/11
  - Test in the other lab group (1w, JF/RM). Best student lab will present to the other lab group.
    - Week 17/12
- Deliverables
  - Presentation, files needed for exercise and source code if applicable.
  - Rest of the group will have to submit the exercise
  - Peer evaluation of the SL (you will evaluate your classmates).

# Bibliography

- *E-Health systems : theory, advances and technical applications* (2016). Elsevier.
- Prince, Jerry L. (2015). *Medical imaging : signals and systems*. Pearson Education/Prentice Hall.
- *Medical imaging : principles and practices* (2013). Taylor & Francis/CRC Press.
- *Informatics in medical imaging* (2012). Informatics in medical imaging.
- *Related Journals and Conferences: IEEE Transactions on Medical Imaging, Medical Image Analysis, IEEE Transactions on Information Technology in Biomedicine, MICCAI (Medical Image Computing and Computer Assisted Intervention) Conference, IEEE Int. Symposium on Biomedical Imaging (ISBI), SPIE Medical Imaging Conference, CARS (Computer Assisted Radiology) Conference, ...*