5GASSAC – A Smart Sicilian Academic Campus

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5GASSAC - Project Overview

CEF first Call

European Union: CEF DIGITAL
5G infrastructure deployments
5G corridors
5G for Smart Communities

CEF Digital aims to leverage public and private investments in digital connectivity infrastructures of common European interest**:**
1 Gbps for families, 5G in high-density population areas, IoTs connection, 5G backbones, European 5G powered Clouds, Digital European Ecosystems transformation, Innovative Use Cases

5GASSAC - Project Overview

SCOPE

5G4ASSAC implements a **5G MPN** to unlock innovative and unique services based on AI, ML, AR/VR technologies, allowing intense *Adaptive Learning* and *Higher Student Engagement* and *Telemedicine Services development .*

Supporting new functional approaches to education and training, the Project develops the **Mixed Reality (XR) Learning Platform** and the **eHealth Learning & Management System** that, running on the 5G MPN, will enable immersive education experiences in both universities and hospitals and create interactive clinical scenarios based on IoT and Analytics for a 'Learning by Caring' approach thanks to the eHealth LMS.

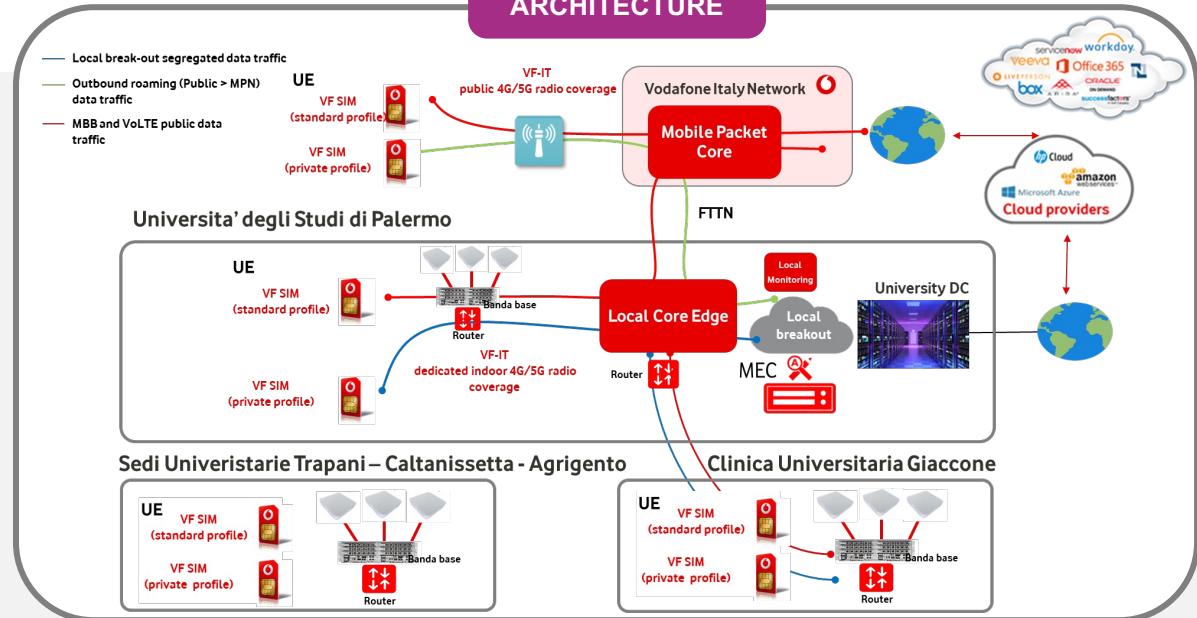## STAKEHOLDERS

Coordinator

Beneficiary

5GASSAC - Infrastructure

- **Data transmission speeds** up to **10x faster** than current ones
- **30x to 50x lower latency** than current services
- **Limited energy consumption**
- **Massive machine communication**
- **High reliability** and security
- Seamless **access from remote** to the Campus applications

- Local break-out segregated data traffic
- Outbound roaming (Public > MPN) data traffic
- MBB and VoLTE public data traffic

VF-IT public 4G/5G radio coverage

UE
VF SIM (standard profile)
VF SIM (private profile)

Vodafone Italy Network
Mobile Packet Core

Cloud providers

FTTN

Universita' degli Studi di Palermo

UE
VF SIM (standard profile)
VF SIM (private profile)

Banda base
Router

VF-IT dedicated indoor 4G/5G radio coverage

Local Core Edge

Local Monitoring
Local breakout

MEC

University DC

Router

Sedi Univeristarie Trapani – Caltanissetta - Agrigento

UE
VF SIM (standard profile)
VF SIM (private profile)
Banda base
Router

Clinica Universitaria Giaccone

UE
VF SIM (standard profile)
VF SIM (private profile)
Banda base
Router

GOALS

Support the **5G technology diffusion**, allowing researchers of University departments in **Palermo** and **Trapani** to to fully exploit the advantages of **Remote Education** and **eHealth LMS** through:

- Intelligent Expert Systems
- Immersive Learning Systems
- 3D rendering and XR simulators
- Remote patients monitoring
- Remote medical analysis and consulting
- Clinical Decision Support Systems

5GASSAC - University of Palermo and Policlinico "Paolo Giaccone" (including TP site)

5GASSAC - UC Education

Immersive learning

Use Cases

Innovative solutions supporting **3D models and objects** generation and interactions using multiple 3D visor devices, VR/AR mixed reality, hardware and software platforms enabling teachers and students interaction with computer-generated 3D objects and augmented reality. Two applications: human anatomy, cultural heritage.

Benefits
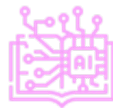
- **Innovative** and **Interactive** Learning Process
- **Stimulating** creativity and design
- Higher Student's attention and motivation to study
- Student's involvement in learning processes
- Reporting and Analysis

Impact

- **Augmented Classrooms** installed in the University Campus
- New **Educational Models** using:
  - 3D models and objects for training activities
  - A/R fully immersive experience with virtual objects manipulation and movement: *'presence* and *agence'*

5GASSAC - UC Education

5GASSAC - XR Learning Platform

LEARNING PLATFORM for **AUGMENTED CLASSROOMS** development and implementation
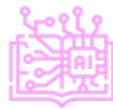
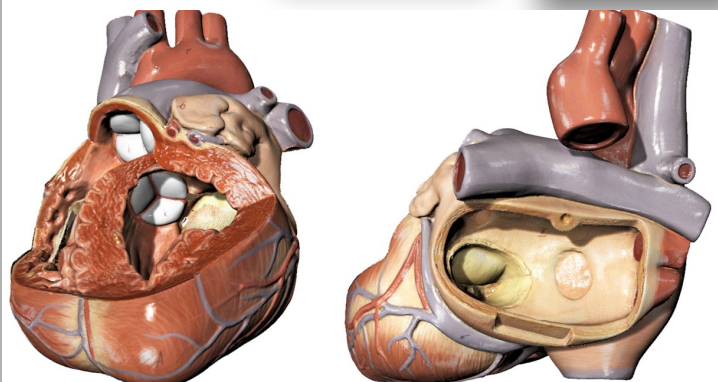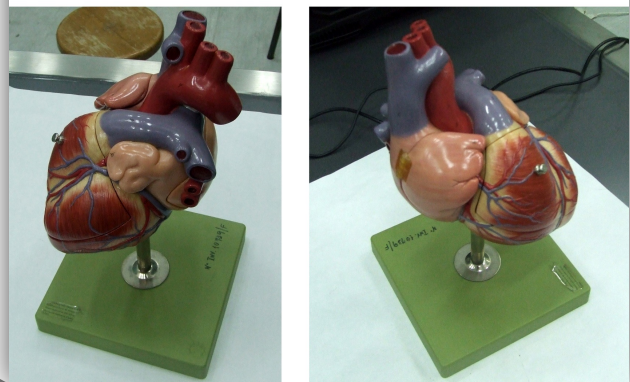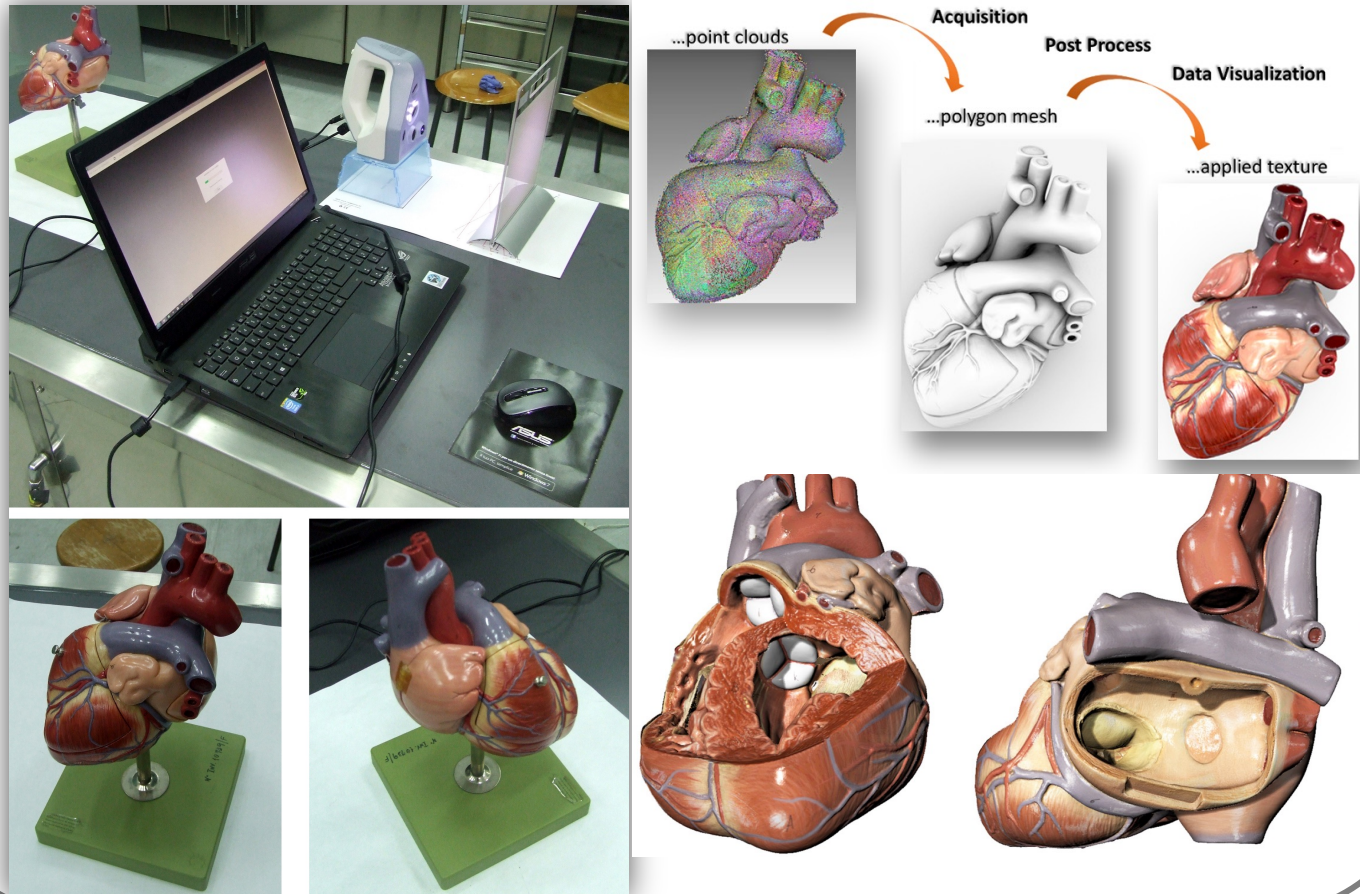**PRATICAL SCENARIO SIMULATIONS** with real-time teacher-student interactions

E-LEARNING WITH AUGMENTED REALITY integrating 3D models and objects
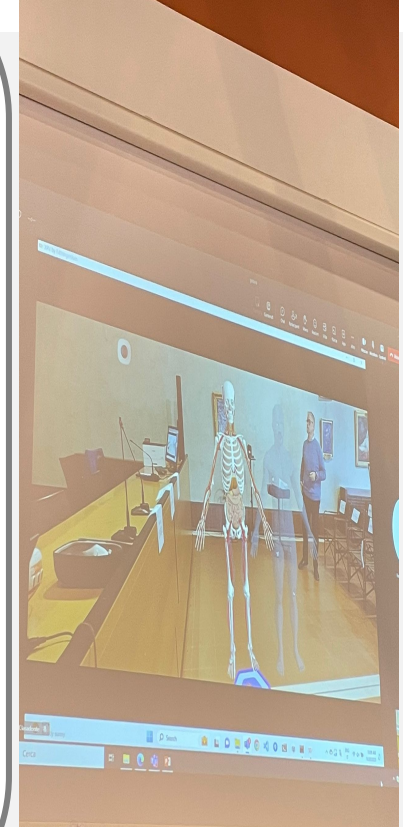
5GASSAC - UC Education

Immersive learning: Human Anatomy

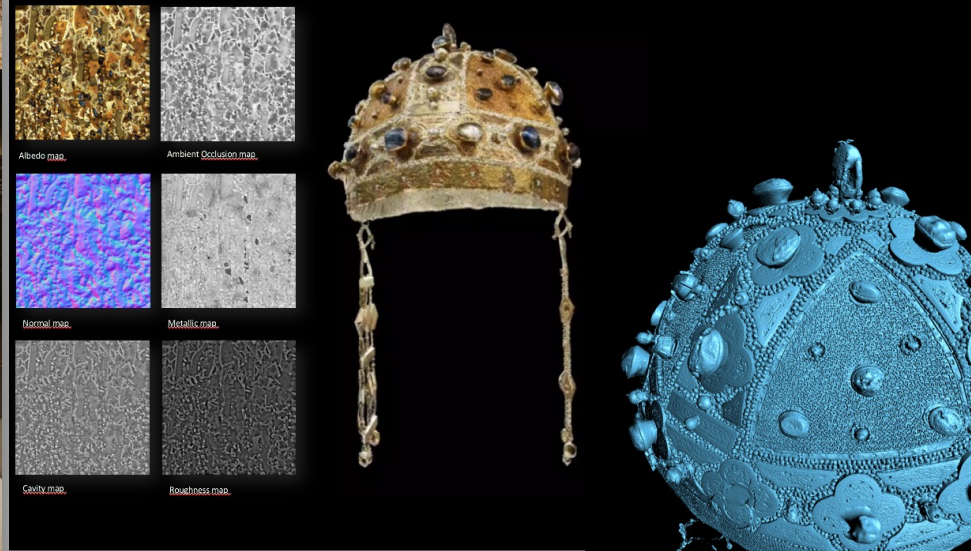*Credits: Institute of Human Anatomy, UNIPA, Prof. Francesco Cappello*

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Immersive learning: Digital model of the "Camaleuco di Costanza d'Aragona" (1220-1222), Cathedral Treasure of Palermo

Albedo map.

Ambient Occlusion map.

Normal map.

Metallic map.

Cavity map.

Roughness map.

Credits: Department of Architecture, UNIPA, Prof. Di Paola

5GASSAC - UC Education

Mannequin based Training System

Use Case

Mannequin Training Systems.
Multiple solutions supporting (robotic) mannequin based hands-on. Patient-like mannequins and simulators for practical training, hands-on, clinical skills in the medical domain.

Benefits
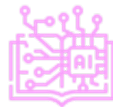
- Hands-on **creations**
- **In-lab** and **remote** lessons
- **Mannequin** based training
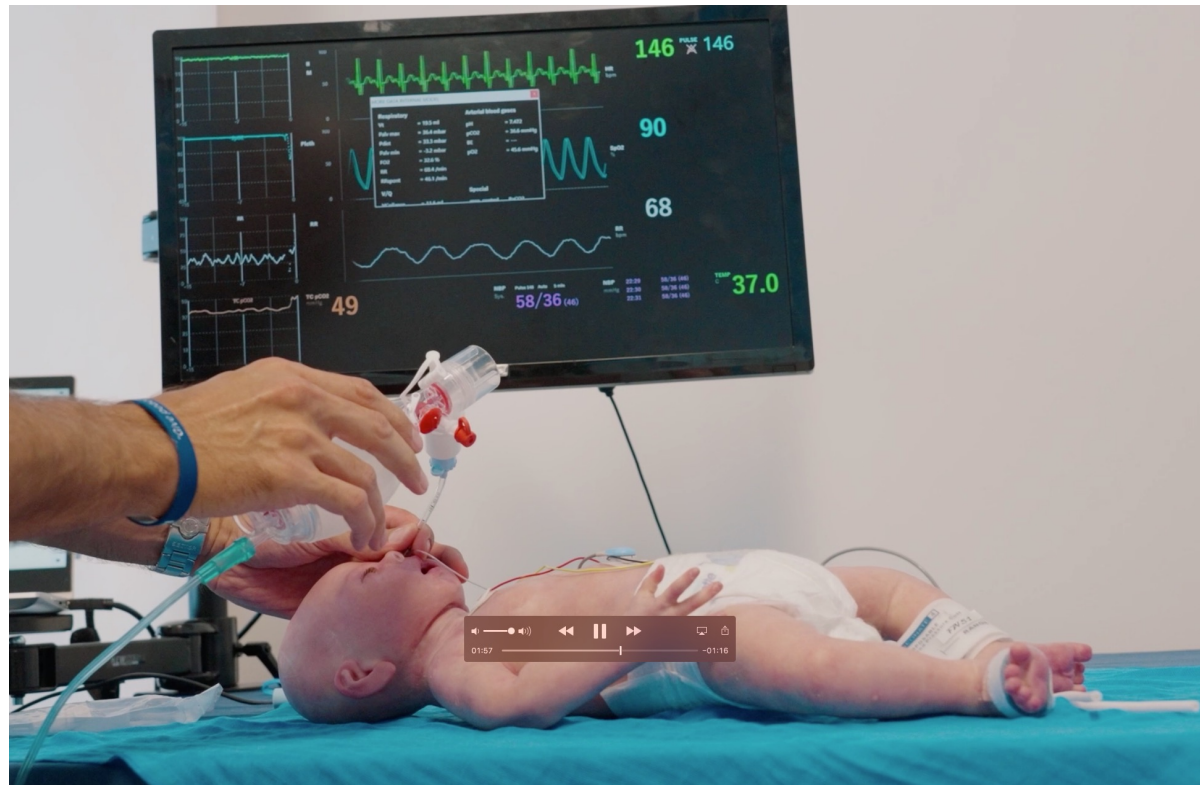- Procedural and manual **abilities** development
- Reporting and Analysis

Impact

- High student **engagement** and **involvement**
- **Tasks driven** training environment
- **1 training building** installed in the University Hospital
- Clinical skills understanding
- Advanced and real training for physicians and nurses

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Mannequin based Training System
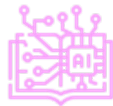
5GASSAC - UC eHealth

Medical Imaging

Use Case

Real-time DICOM transfer. Real-time DICOM volumetric medical image transfer (50 Mbit/s throughput) enables clinical remote collaborations and models involving sub-domain experts for remote diagnosis and second-opinion teleradiology services.
4K/8K real-time audio-video streaming.

Benefits

- **Virtually** and **remotely** working
- Offering **specialized services** anytime
- **Diagnosis quality** anywhere, anytime
- Cost saving

Impact

- **Collaborative** models for radiologist
- **Uniform** and **accurate** diagnosis process
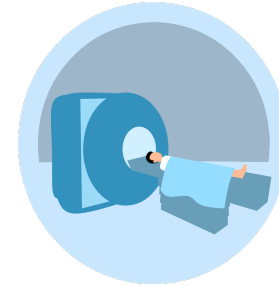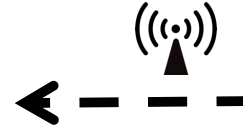- **Healthcare quality improvement** outside large urban centers

5GASSAC - UC eHealth

DICOM Client
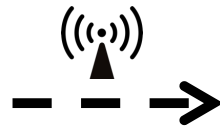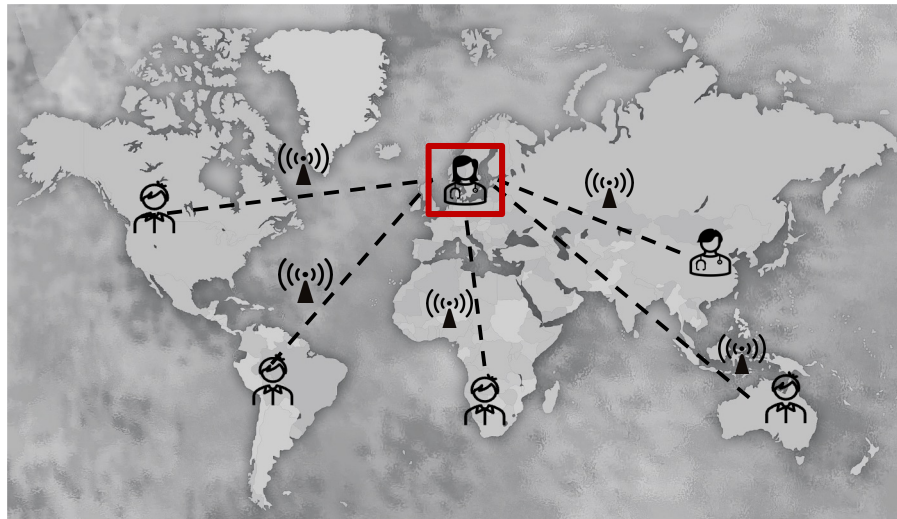
PACS

5G enabled DICOM streaming

Consultation Hospital
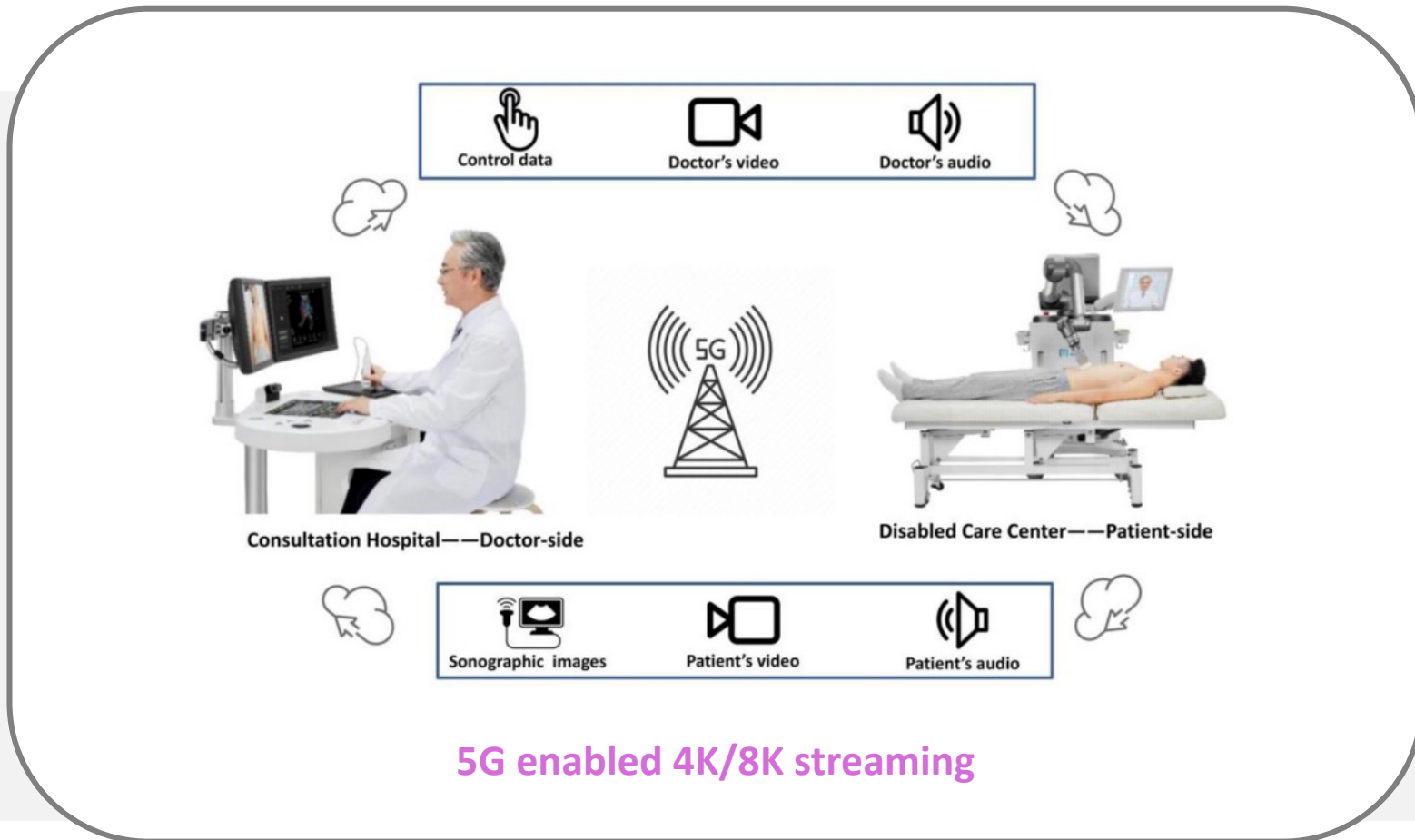
Second Opinion

5G enabled 4K/8K streaming

5GASSAC - UC eHealth - Remote Expert Consultations

5G enabled 4K/8K & DICOM streaming

# 5GASSAC - UC eHealth - Teleultrasound diagnostic system

5G enabled 4K/8K streaming

5GASSAC - UC eHealth

Decision Support Systems

Use Case

Clinical Decision Support System. CDSSs can be accessed on **cloud platforms** in real-time. **Machine Learning** and **Deep Learning** models support the medical diagnosis process. CDSSs **improve diagnosis accuracy** even in the **early stage**.

Benefits
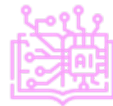
- Medical diagnosis and treatments improvements
- Ad-hoc and case-driven examples and solutions
- Early and Personalized diagnosis
- Error rate reduction

Impact

- Multi-centre and multi-source data (radiomic, -omic, clinical, etc.)
- Real-time validated health data availability and accessibility
- Real-time validated AI based models availability and accessibility
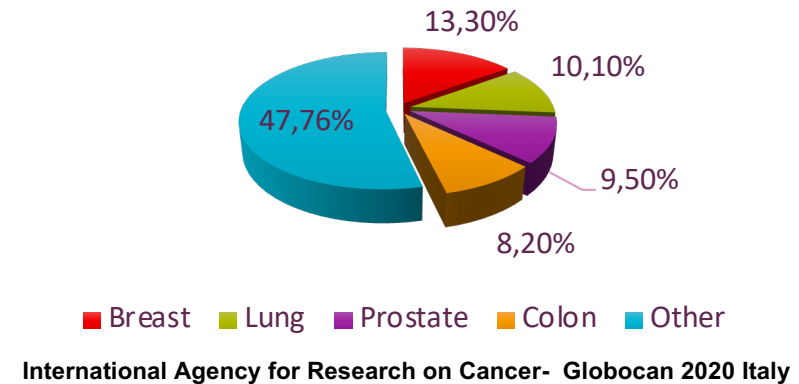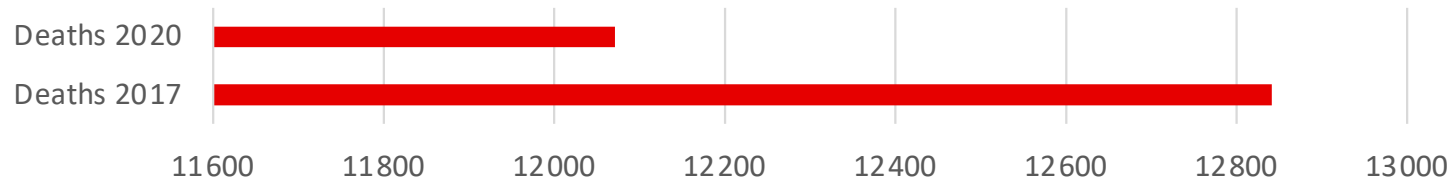- International cooperation

Early Breast Cancer Detection

- **Clinical Decision Support System**

- **AI powered**

- **Early Breast Cancer Detection**

Breast cancer incidence in Italy

13,30%
10,10%
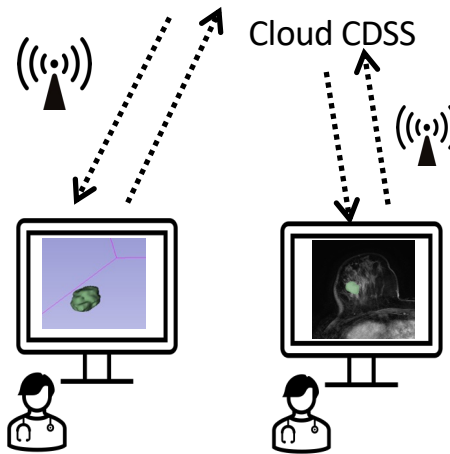9,50%
8,20%
47,76%

■ Breast ■ Lung ■ Prostate ■ Colon ■ Other

International Agency for Research on Cancer- Globocan 2020 Italy

Screening program results

Deaths 2020
Deaths 2017

11 600 11 800 12 000 12 200 12 400 12 600 12 800 13 000

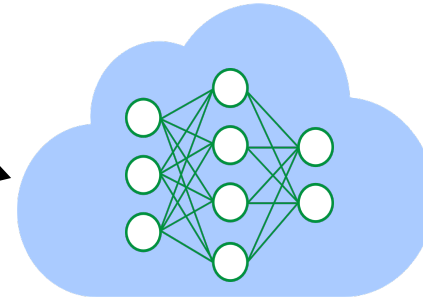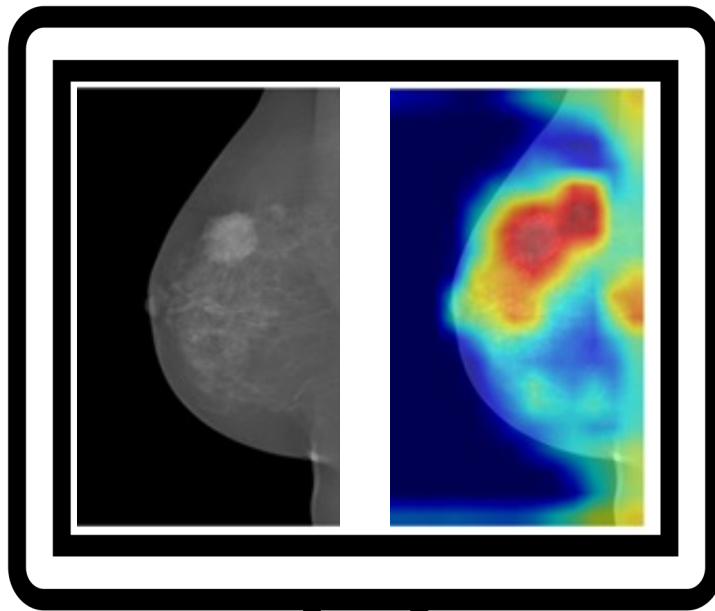**Source: AIRTUM**

5GASSAC - UC eHealth

Clinical Decision Support System – Breast Cancer Detection
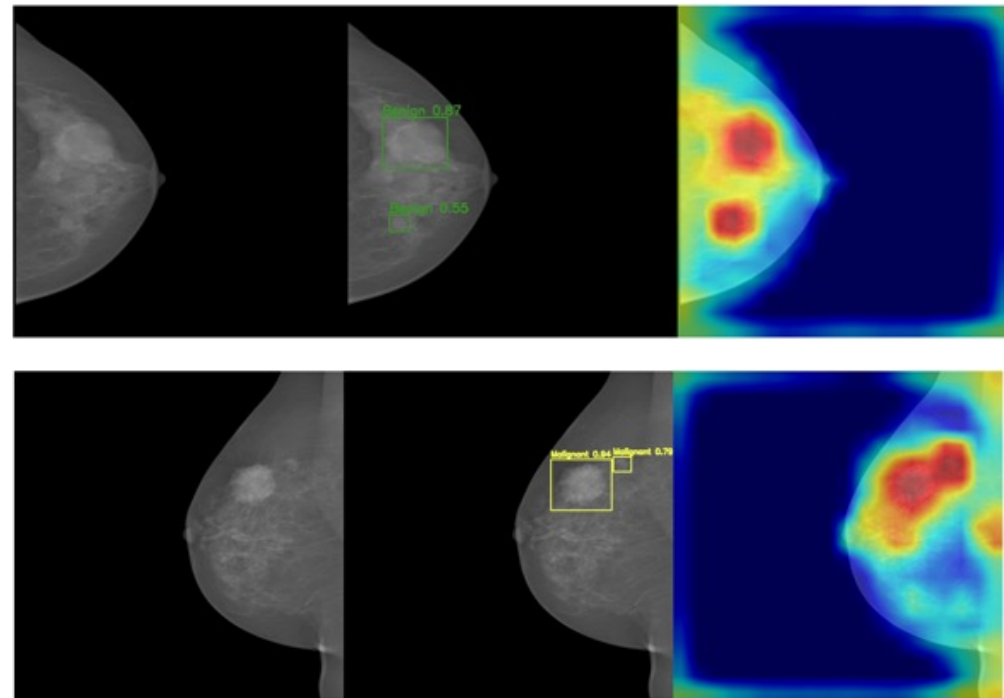
Deep Learning Inference

Cloud CDSS

Real-time consultation

CDSS: Results

- Performance
  - Accuracy (92%)
  - PPV (+12%)
  - NPV (+15%)
- Saliency Maps
- Trustworthiness
  - Explainability

Explaining the prediction

5GASSAC - Use Case eHealth

Decision Support System – Breast Cancer Detection

Weill Cornell Medicine-Qatar · Women'sHealth

Recent Findings from University of Palermo Has Provided New Information about Cancer Detection (A Yolo-based Model for Breast Cancer Detection In Mammograms).

Date: Sept. 21, 2023

From: Women's Health Weekly
Publisher: NewsRX LLC

Document Type: Article
Length: 500 words
Lexile Measure: 1430L

Agenda Digitale.eu

INTELLIGENZA ARTIFICIALE

AI e radiomica per la classificazione di tumori alla mammella: le prospettive

Cognitive Computation

Cognitive Computation
https://doi.org/10.1007/s12559-023-10189-6

A Yolo-Based Model for Breast Cancer Detection in Mammograms

Francesco Prinzi[1] · Marco Insalaco[2] · Alessia Orlando[2] · Salvatore Gaglio[3,4] · Salvatore Vitabile[1]

Grazie per l'attenzione