Introduction to Multimedia Data Modelling

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Multimedia Data …

… Data Modelling

What are Multimedia?

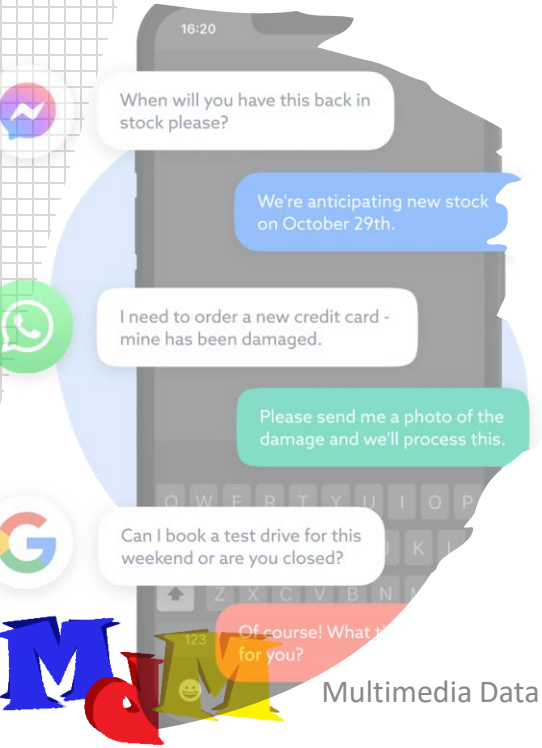
Multimedia Definition

Multimedia can be defined as a **combination of different forms of content** such as ***text***, ***graphics***, ***audio***, ***video***, and ***animation***

Exploring the different forms of multimedia

Text

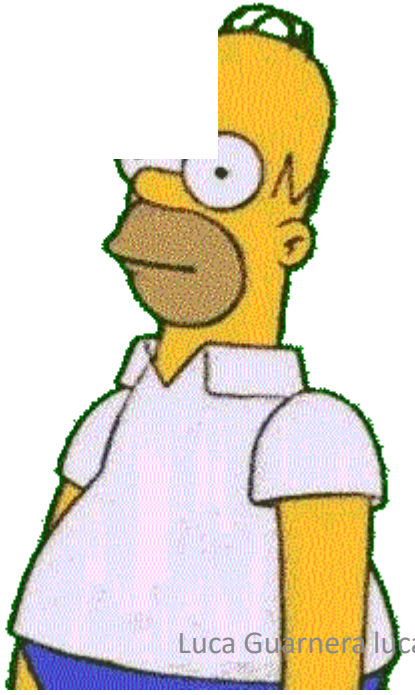
Text is the most **basic form of multimedia**. It is used to communicate information and ideas in a concise and structured way. Text can be used to explain complex concepts, tell stories, and provide instructions.



Graphics

Graphics are ***visual elements that can be used to convey a message or an idea***. They can be used to illustrate concepts, highlight important information, and create an engaging experience. Graphics can be **static** or **animated**.

Animated Graphics



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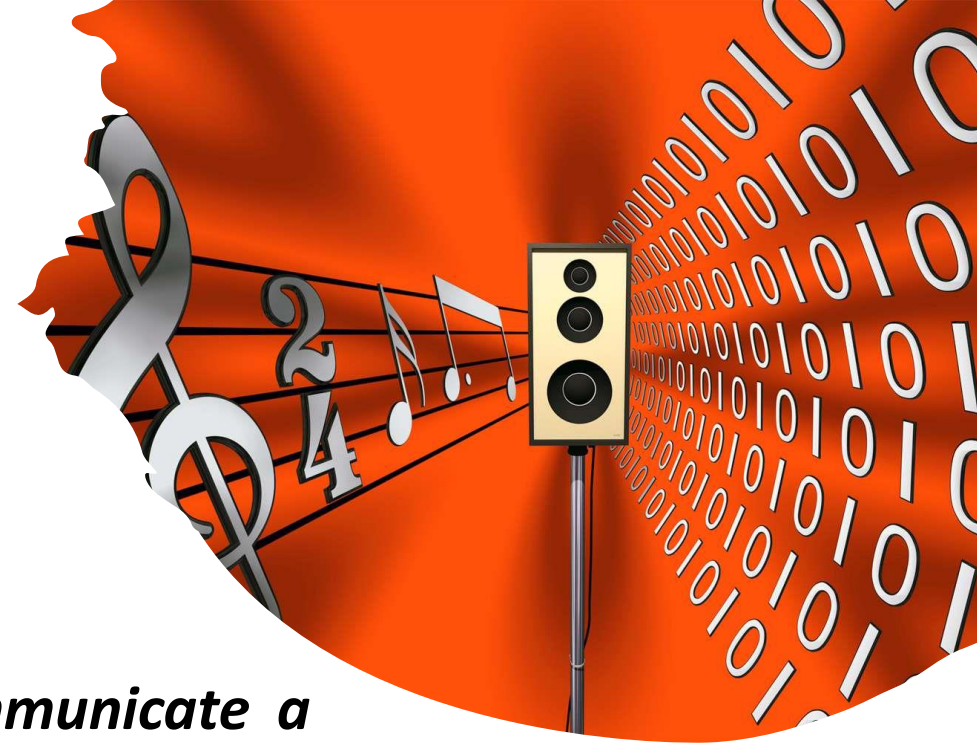
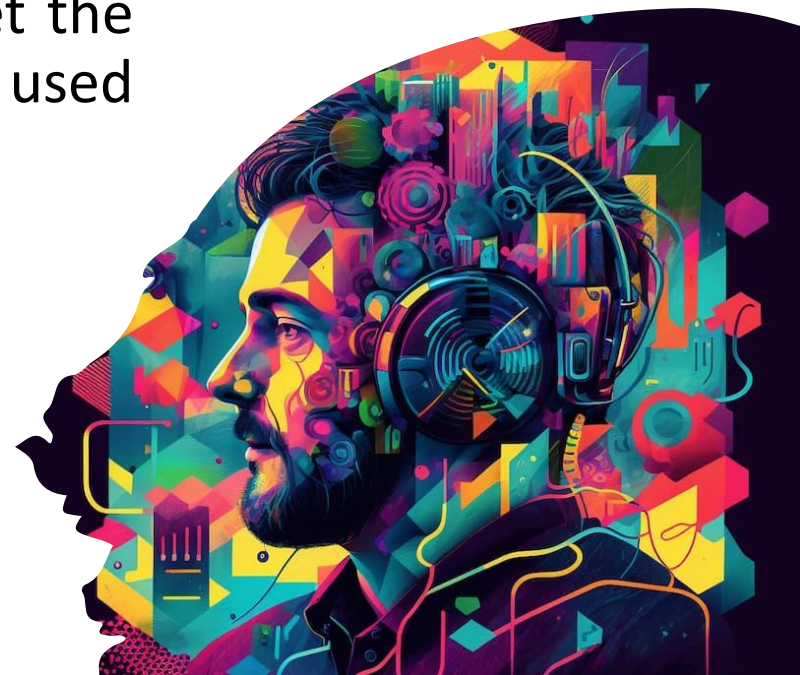
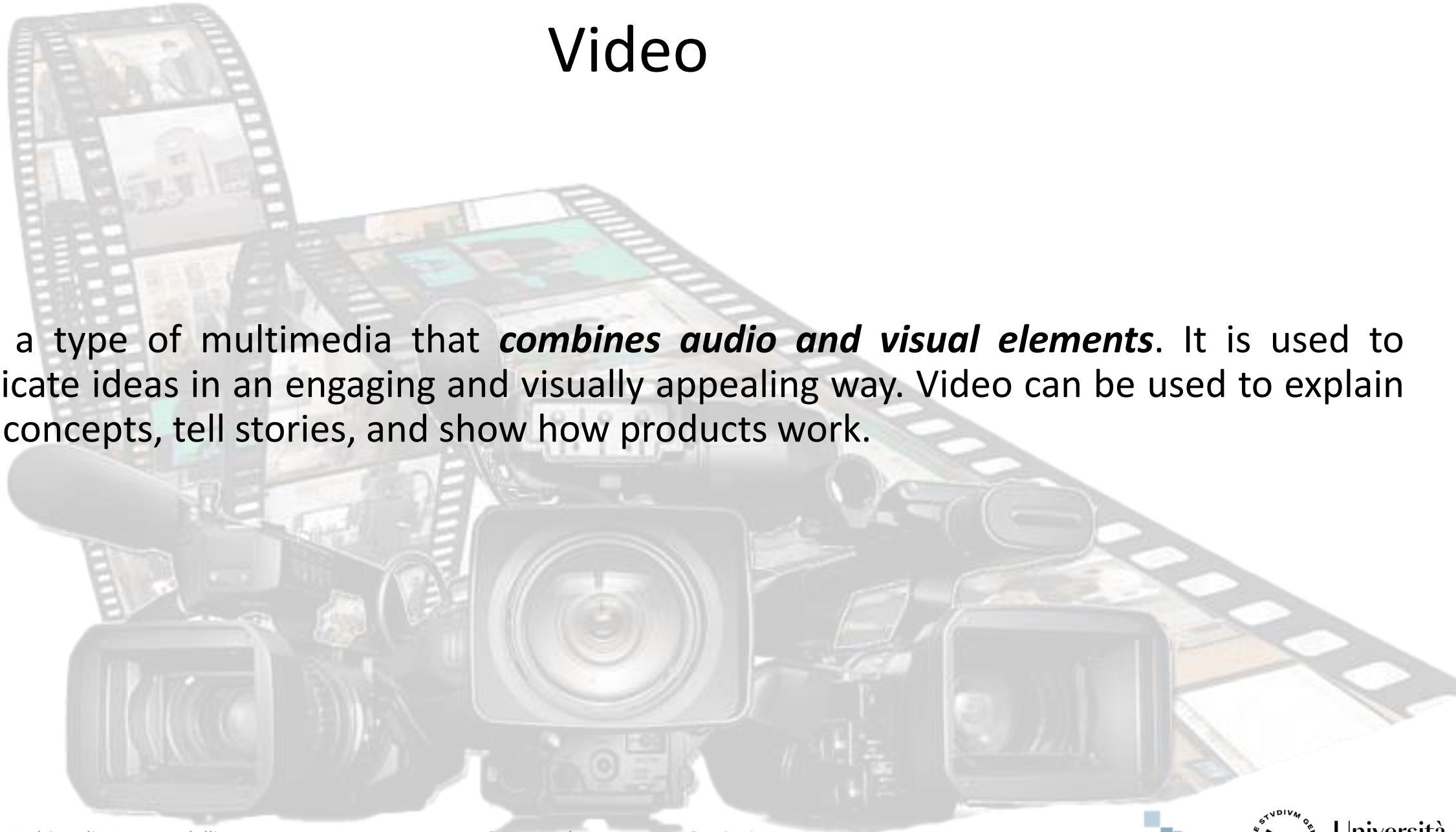
Audio



Audio is a type of multimedia that uses ***sound to communicate a message***. It can be used to create an immersive experience, set the tone for an experience, and convey emotions. Audio can also be used to provide instructions and feedback.



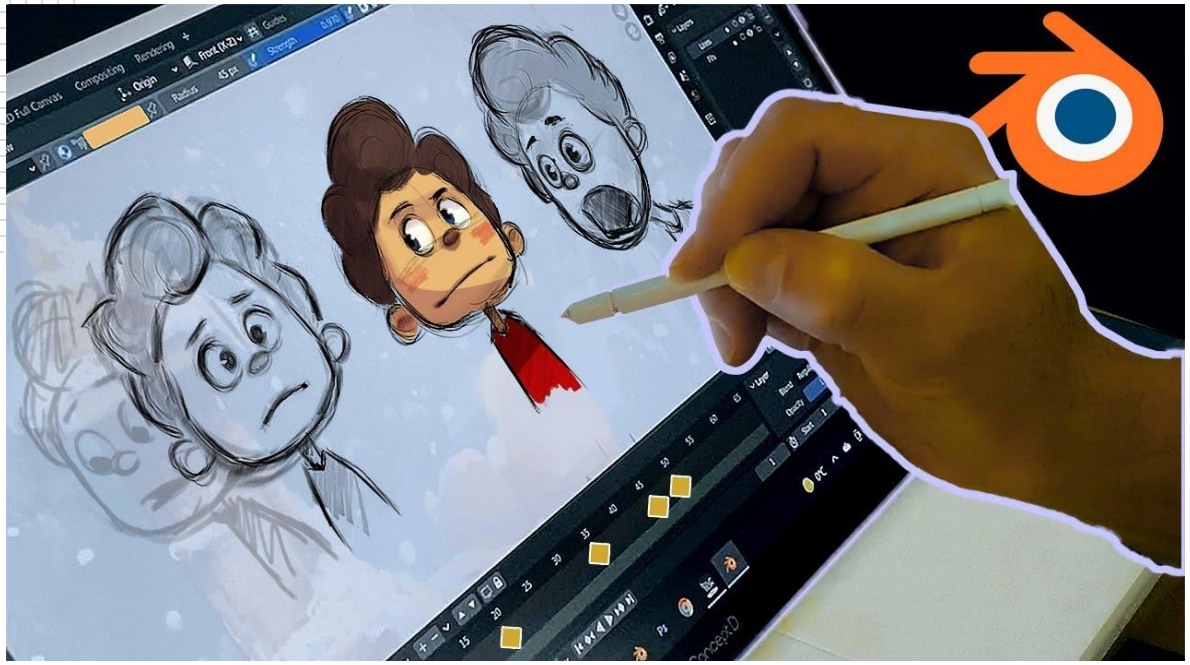
Video



Video is a type of multimedia that ***combines audio and visual elements***. It is used to communicate ideas in an engaging and visually appealing way. Video can be used to explain complex concepts, tell stories, and show how products work.

Animation

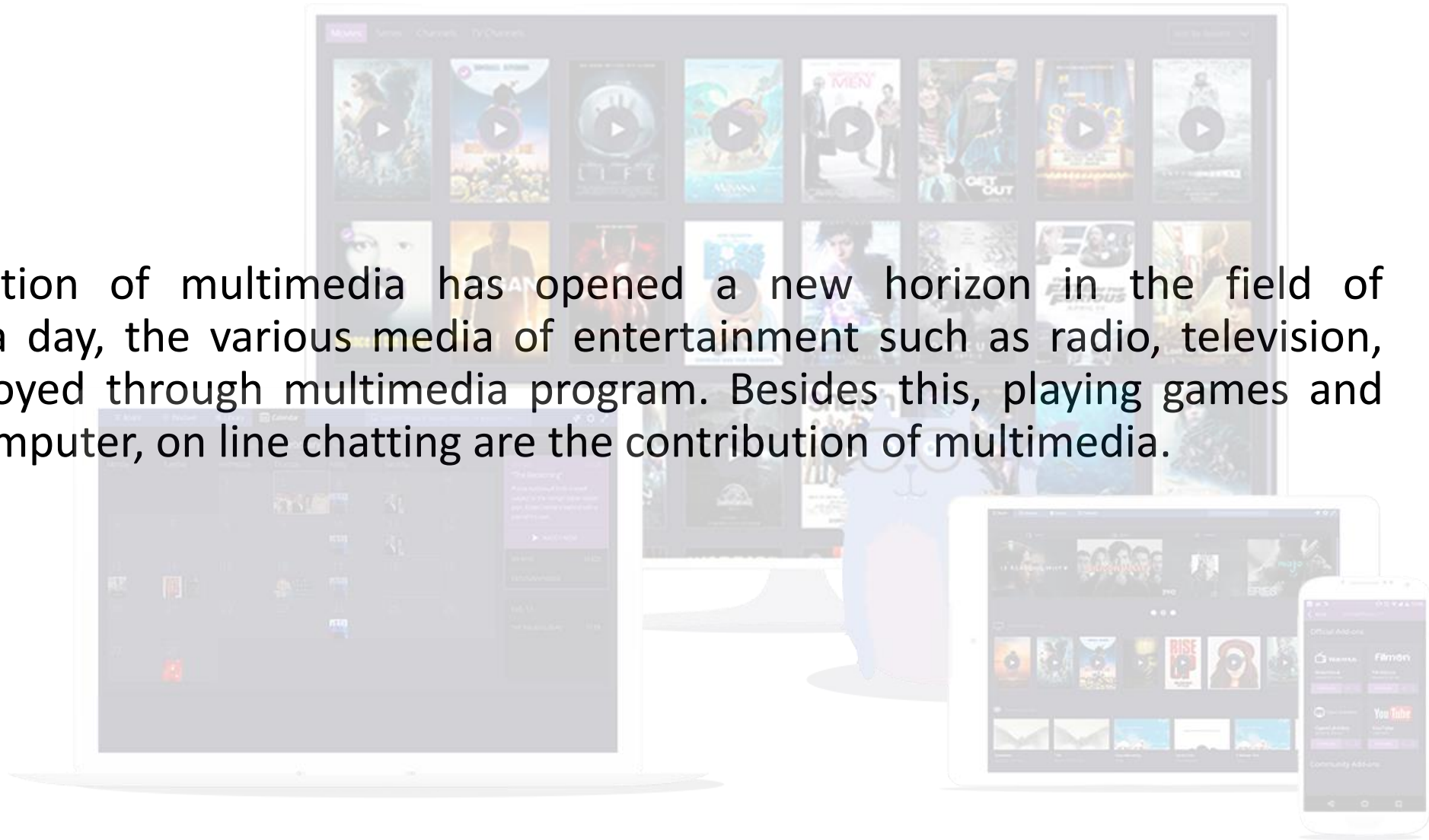
Animation is a type of multimedia that ***combines graphics and audio***. It is used to create interactive experiences that are engaging and entertaining. Animation can be used to explain concepts, tell stories, and provide feedback.



Multimedia Applications

Education: Multimedia has brought revolutionary changes in the field of education. It has made the system of education more attractive and effective than any other periods in the past. Now a day, multimedia presents the contents of education such as information, still and moving pictures, sounds pronunciations of words, clearly and attractively to the students. It is now possible to earn knowledge even staying at home through various multimedia software.

Multimedia Applications



Entertainment: Invention of multimedia has opened a new horizon in the field of entertainment. Now a day, the various media of entertainment such as radio, television, VCR, VCD can be enjoyed through multimedia program. Besides this, playing games and drawing pictures in computer, on line chatting are the contribution of multimedia.

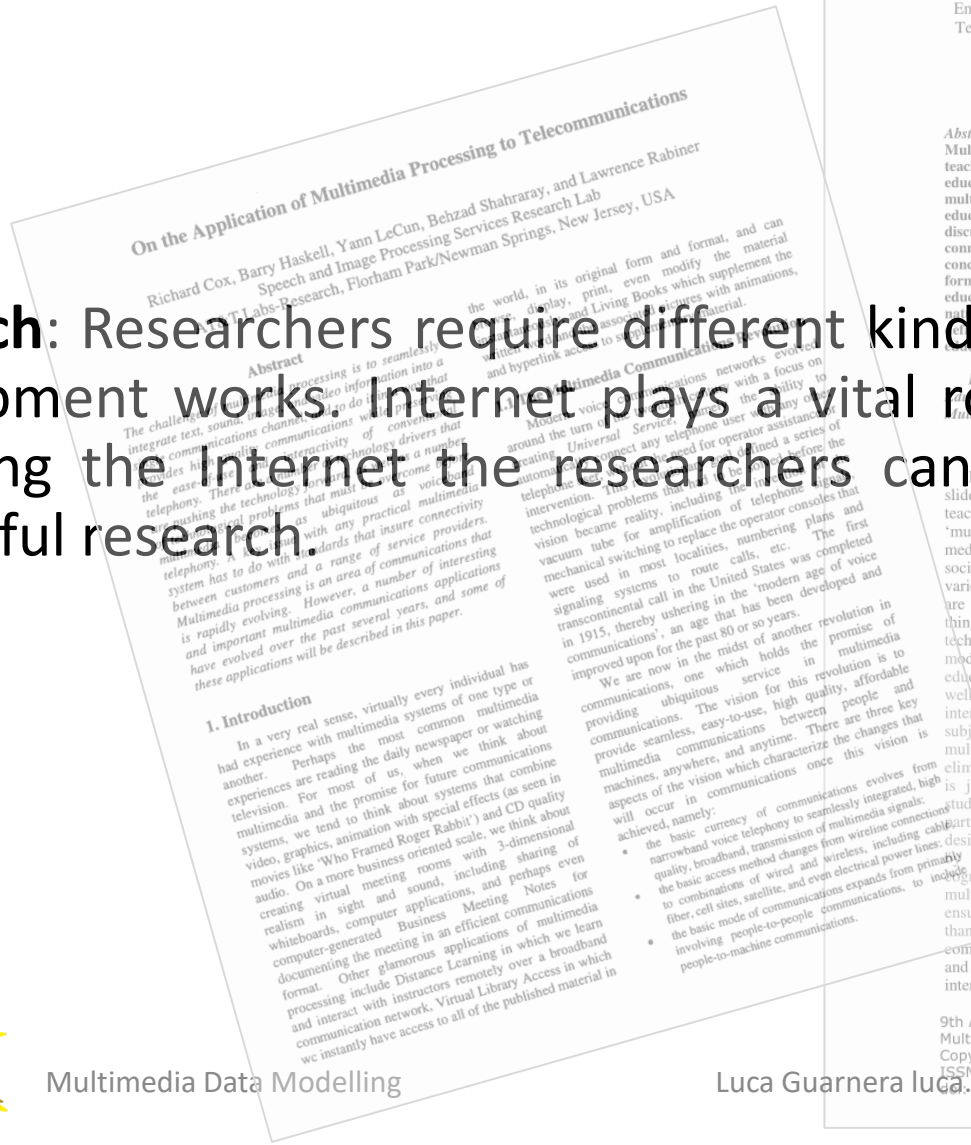
Multimedia Applications

Marketing: In order to increase sales, large companies develop CD Rom software with different information like prices, uses, terms of sales of their products and services and distribute them to the probable customers. Therefore, the buyers can buy their required products by knowing the prices, terms of sale etc. from the CD even staying at home or office.

Multimedia Applications

Communication: Today, multimedia has brought audio and video conference. These computer and electronic based communication creates dynamism in business, social, political, economic and international activities.

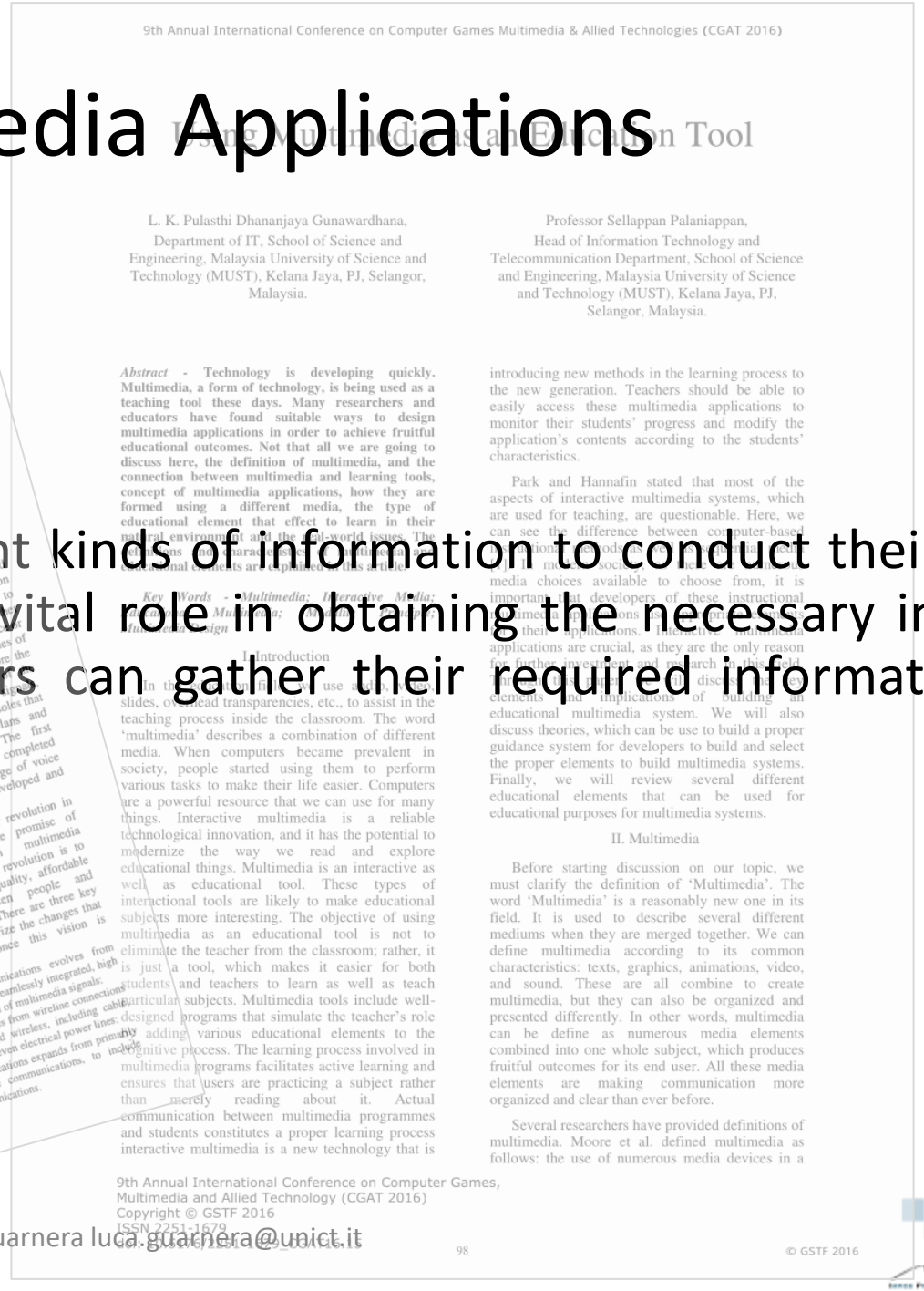
Multimedia Applications


On the Application of Multimedia Processing to Telecommunications

Richard Cox, Barry Haskell, Yann LeCun, Behzad Shahraray, and Lawrence Rabiner
Speech and Image Processing Services Research Lab
AT&T Labs-Research, Florham Park/Newman Springs, New Jersey, USA

Abstract

1. Introduction


9th Annual International Conference on Computer Games Multimedia & Allied Technologies (CGAT 2016)

Interactive Multimedia as an Education Tool

L. K. Pulasthi Dhananjaya Gunawardhana,
Department of IT, School of Science and Engineering, Malaysia University of Science and Technology (MUST), Kelana Jaya, PJ, Selangor, Malaysia.

Professor Sellappan Palaniappan,
Head of Information Technology and Telecommunication Department, School of Science and Engineering, Malaysia University of Science and Technology (MUST), Kelana Jaya, PJ, Selangor, Malaysia.

Abstract - **Technology is developing quickly. Multimedia, a form of technology, is being used as a teaching tool these days. Many researchers and educators have found suitable ways to design multimedia applications in order to achieve fruitful educational outcomes. Not that all we are going to discuss here, the definition of multimedia, and the connection between multimedia and learning tools, concept of multimedia applications, how they are formed using a different media, the type of educational element that effect to learn in their**

I. Introduction

II. Multimedia

9th Annual International Conference on Computer Games, Multimedia and Allied Technology (CGAT 2016)
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Research: Researchers require different kinds of information to conduct their research and development works. Internet plays a vital role in obtaining the necessary information. By searching the Internet the researchers can gather their required information and make successful research.

Multimedia Applications

Virtual Reality: Virtual reality is a technology which allows a user to interact with computer-simulated environment. The simulated environment can be similar to the real world. For example: simulation for pilot or combat or surgery training. This simulated environment can also differ significantly from reality, as in virtual reality games. This virtual reality is actually based on multimedia bounder technology.

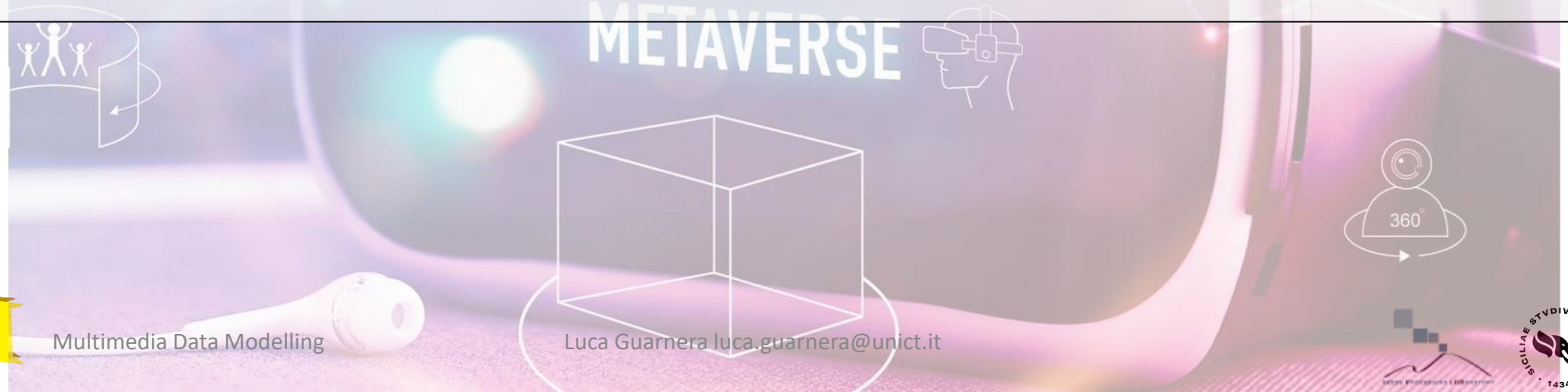
Metaverse

Brief introduction to the Metaverse

Metaverse

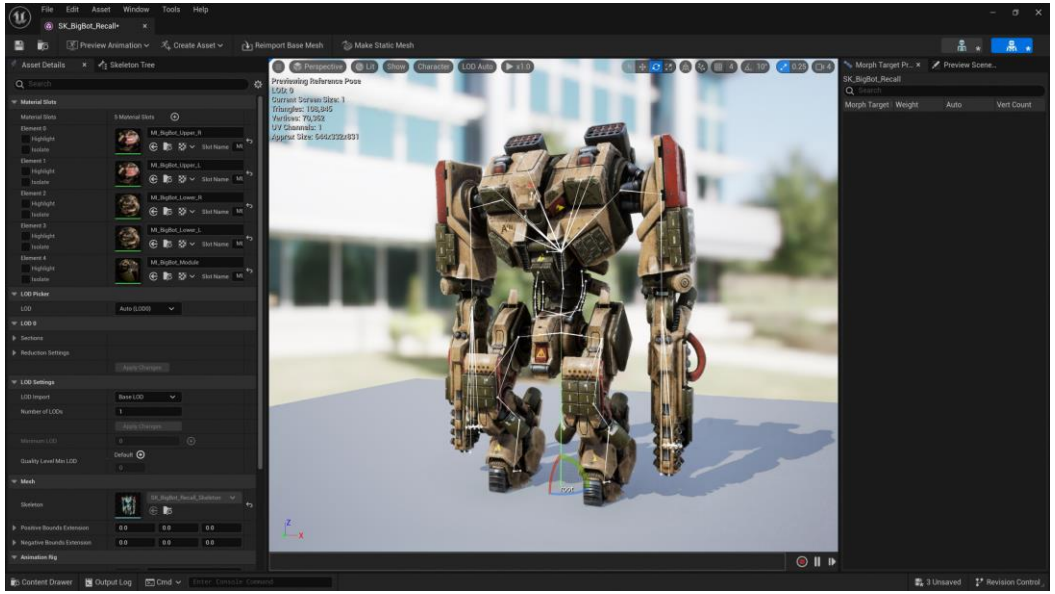
A first definition

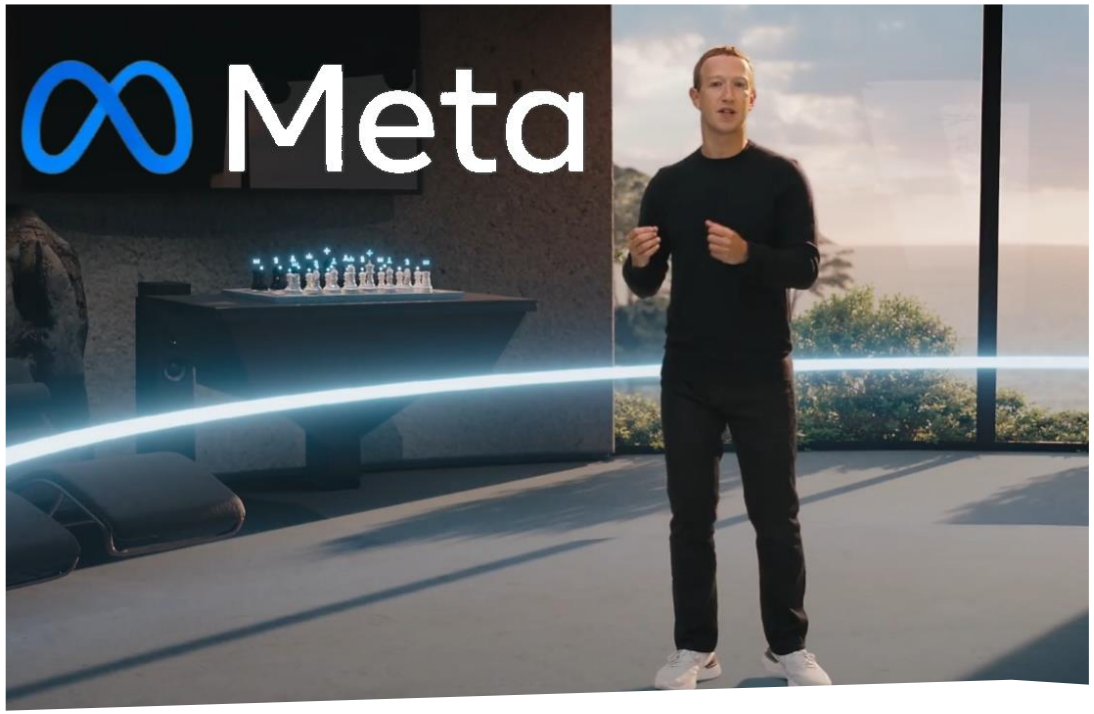
Metaverse, a term born in the cyberpunk world in 1992 and now in the limelight because it is used by Facebook, is the evolution of the Internet, but does not replace it. This is a difficult concept to define exactly, which prefigures a set of interconnected virtual and real worlds, populated by avatars. There are many questions still open



UNREAL
ENGINE

Unity





Meta = Metaverso & Facebook

The Metaverse is not new, but it rose to prominence with the announcement of Facebook, which decided to name the Group's holding company (which controls the Facebook, Whatsapp, Instagram and Oculus platforms) "Meta" and to start a project with this name, a project about which little is known yet.

Mash = Metaverso & Microsoft

A few days later, Microsoft announced that from 2022 it will integrate the Metaverse into the Teams platform with a feature called Mash: users will be able to create an avatar with which to participate in work meetings.

Metaverse is the future of the Internet, a set of virtual spaces crossed by avatars, a step forward compared to virtual reality.

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… The metaverse is a virtual space, but its impact will be real …

- **https://about.meta.com/it/metaverse/impact/**

Meta

The benefits of the metaverse to society are immense

The metaverse will connect people to a new range of experiences: from immersive sessions in education and training, to incredible possibilities for healthcare and workplaces.

"With the metaverse, one day firefighters will have the tools to rescue more people in less time."

"One day doctors will be able to view diagnostic images like never before and make decisions more quickly."

"Surgeons will be able to do all the necessary practice."

"Students will take a field trip to the Ice Age to rediscover the past."

"Urban planners will be able to run simulations to help reduce traffic."

Luca Guarnera, luca.guarnera@unict.it

Ways to enter the metaverse

Eyeglasses Smart

Augmented reality

Virtual reality

2

3

Metaverse, how to access?

Università di Catania

Virtual reality

Virtual reality allows you to discover new worlds and new shared experiences. Live new experiences with your friends and family, even if you are far apart.

Immersed app requires compatible PC. Images for illustrative purposes and are not formatted to fit your screen.

Luca Greco, luca.greco@unict.it

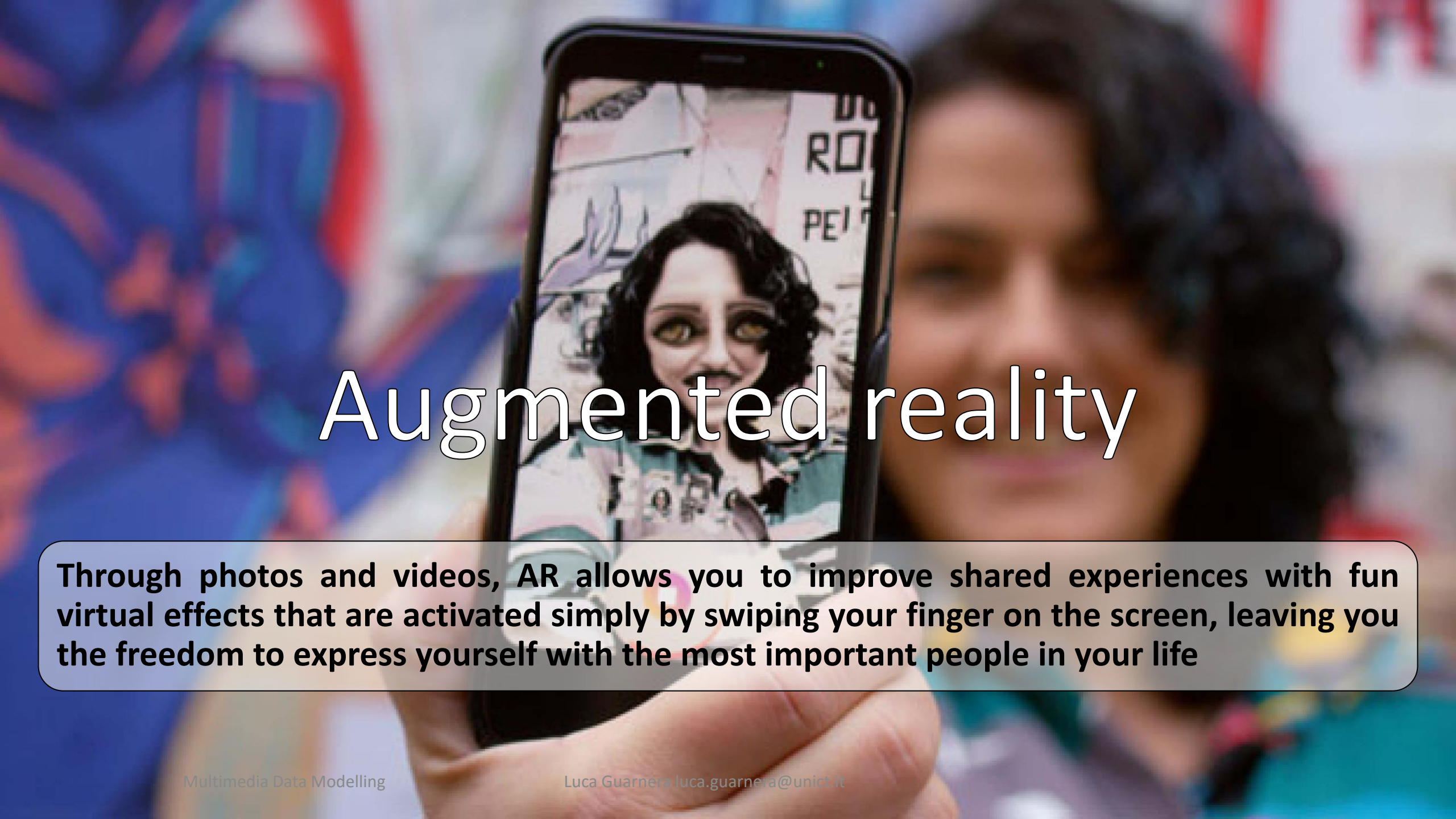
Example of Virtual Reality

https://www.youtube.com/watch?v=YaRastZmucQ

L'avventura ti attende con Meta Quest 2

Ora con due fantastici giochi inclusi (valore fino a € 43).
Divertimento infinito. L'esperienza completa. Termina il 3/6.*

Acquista Meta Quest 2 › Scopri di più



Augmented reality

Through photos and videos, AR allows you to improve shared experiences with fun virtual effects that are activated simply by swiping your finger on the screen, leaving you the freedom to express yourself with the most important people in your life

Augmented reality for plant maintenance

https://www.youtube.com/watch?v=tIWu5g2_6XA

Multimedia: Film & Cinema

Film & Cinema

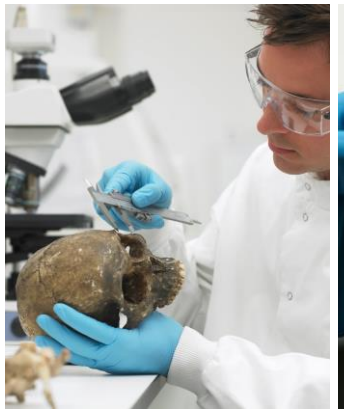
Film means single media or multimedia entertainment content for distribution or exhibition to the general public by any means and media in any digital media format, film, or videotape, including, but not limited to, a motion picture, a documentary, a television series, a television miniseries, a television special, interstitial television programming, long-form television, interactive television, music videos, interactive games, video games, commercials, internet programming, an internet video, a sound recording, a video, digital animation, or an interactive website.

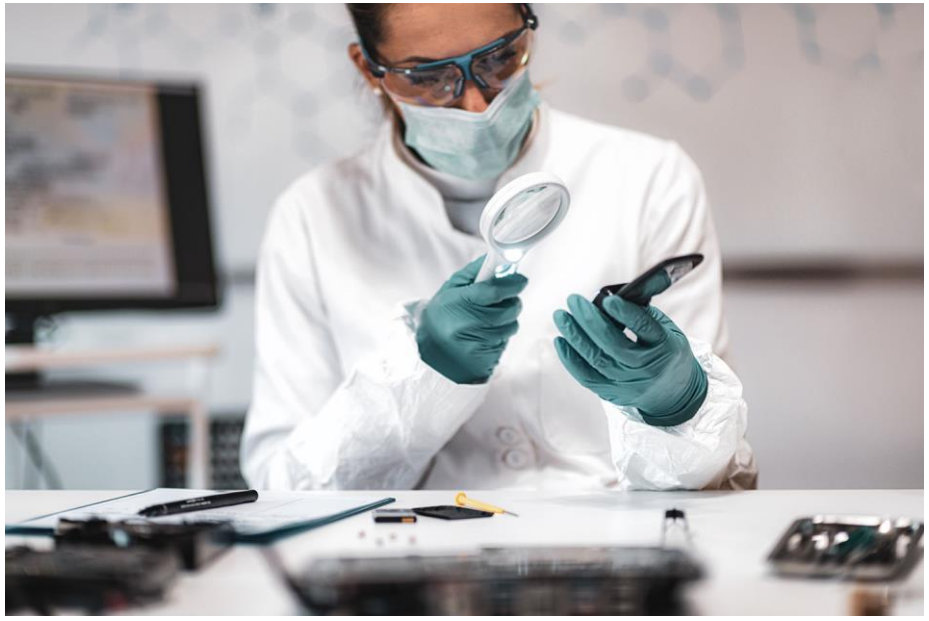
Multimedia:
Application an Digital Forensics

Forensic Science

(sometimes shortened to Forensics) is the application of technical and scientific methods to the justice, investigation and evidence discovery domain.



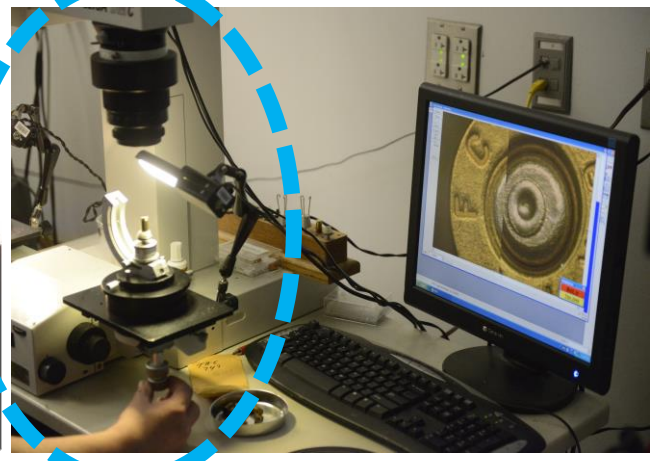





Forensic firearm ballistics

Forensic firearm ballistics is the science of examining the characteristics of **firearms**, **cartridges**, and/or **bullets** found at a crime scene.

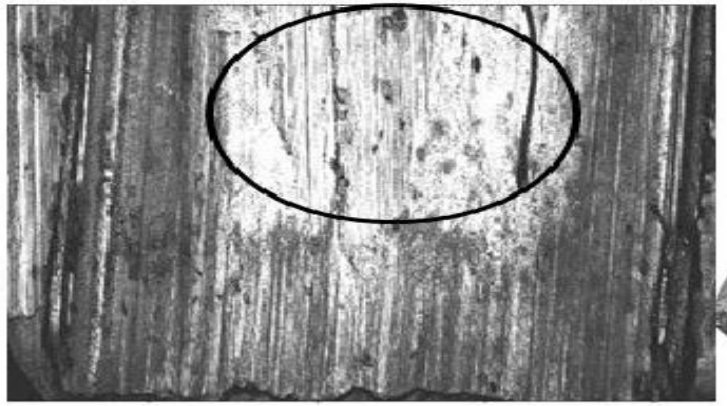



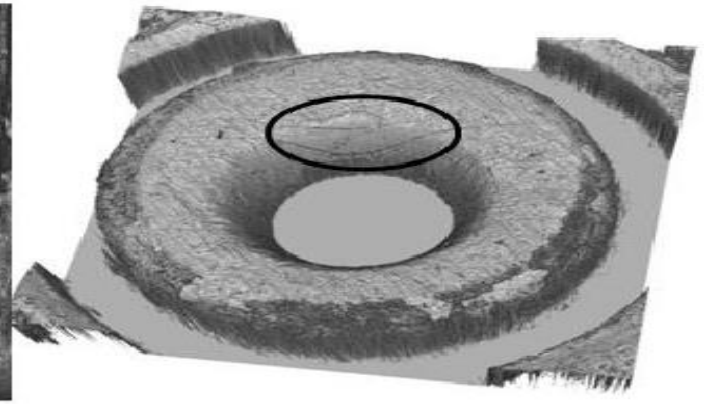
- Ballistic Forensics Specialists are tasked with tying this evidence to crime suspects.
- Comparison Microscope

Forensics Examination of Firearms

Weapon serial numbers

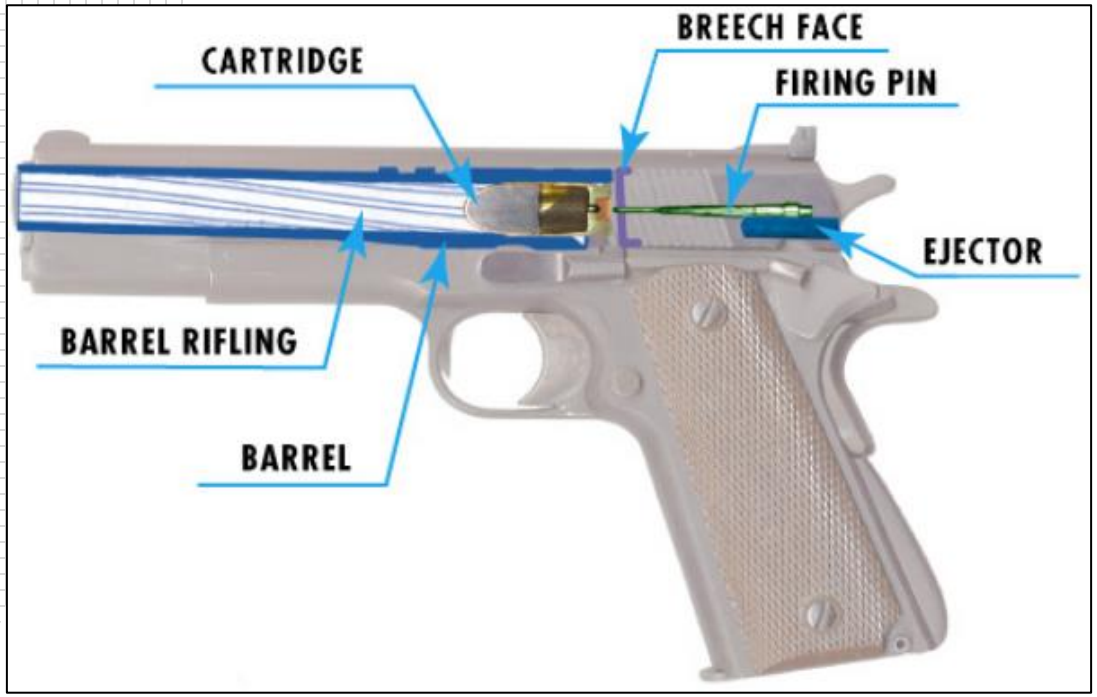
Fingerprints on the weapon's surface

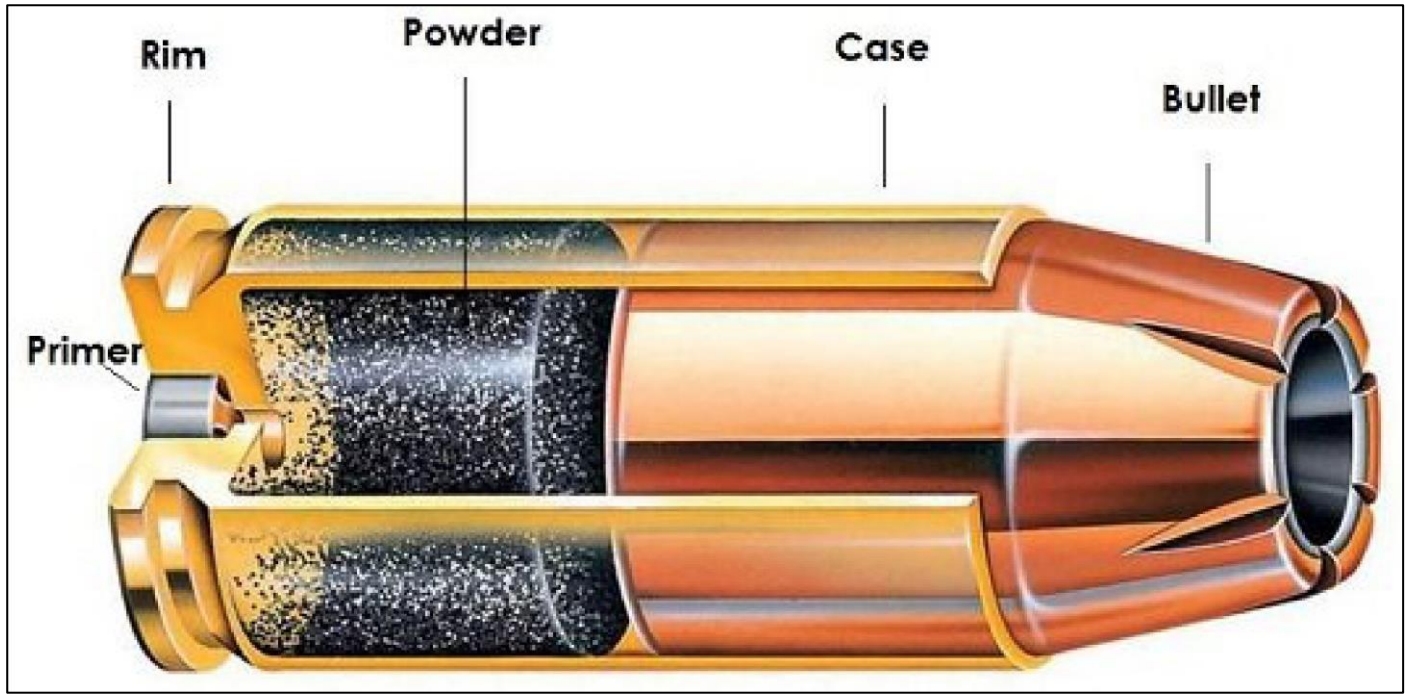




Ballistic striations

Firearm and Cartridge components





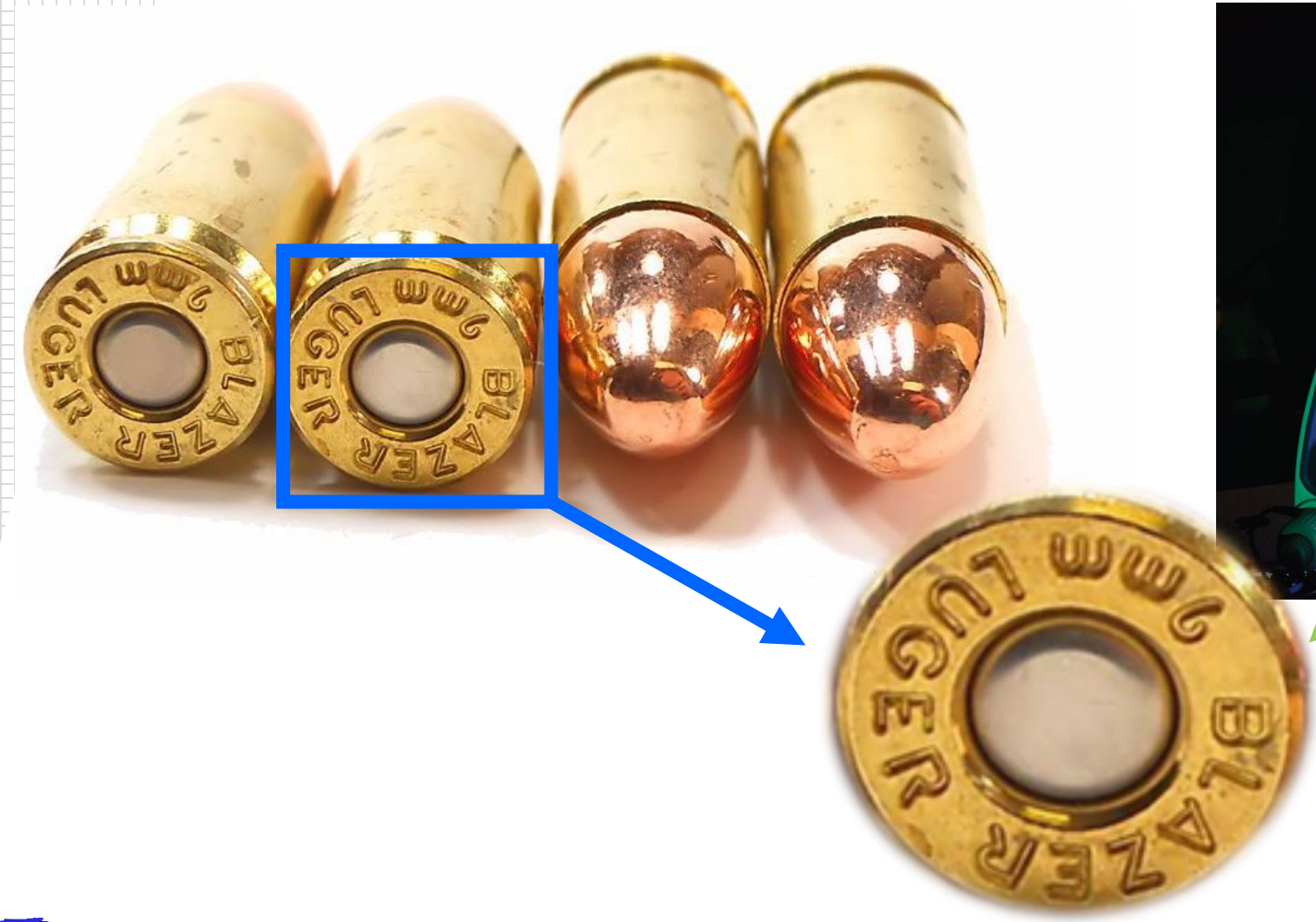
Weapon firing process

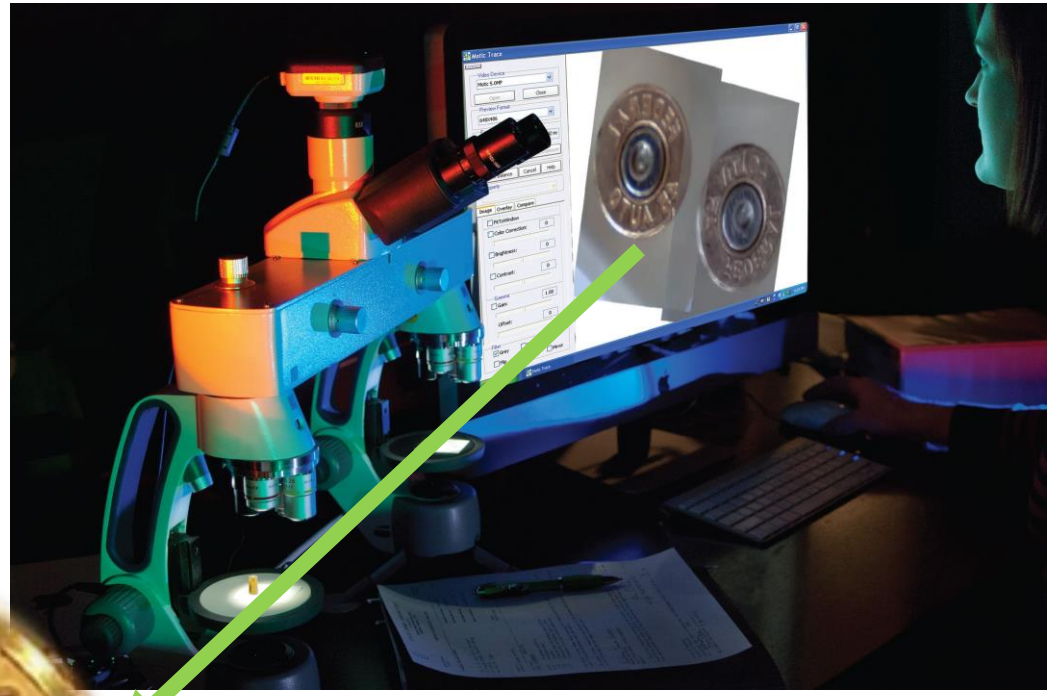
The weapon **loading**

The **shot**

The cartridge **ejection**

Cartridge Analysis





DEMO - 3D Forensic Ballistics Comparison

https://iplab.dmi.unict.it/mfs/Forensic-Firearms-Ballistics-VR/

Assessing Forensic Ballistics Three-Dimensionally through Graphical Reconstruction and Immersive Observation

Luca Guarnera[1], Oliver Giudice[2], Salvatore Livatino[3], Antonino Barbaro Paratore[4], Angelo Salici[5], Sebastiano Battiato[1]

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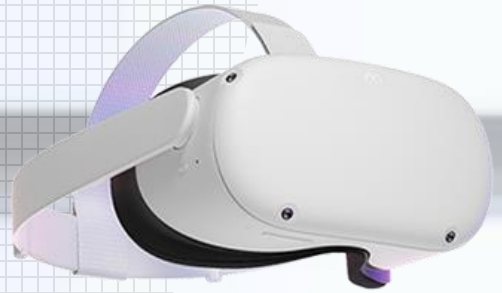
[5] Carabinieri Scientific Investigations Department of Messina, Via Monsignor Dâ€™Arrigo, 5, Messina, 98122, Italy - *angelo.salici@carabinieri.it*

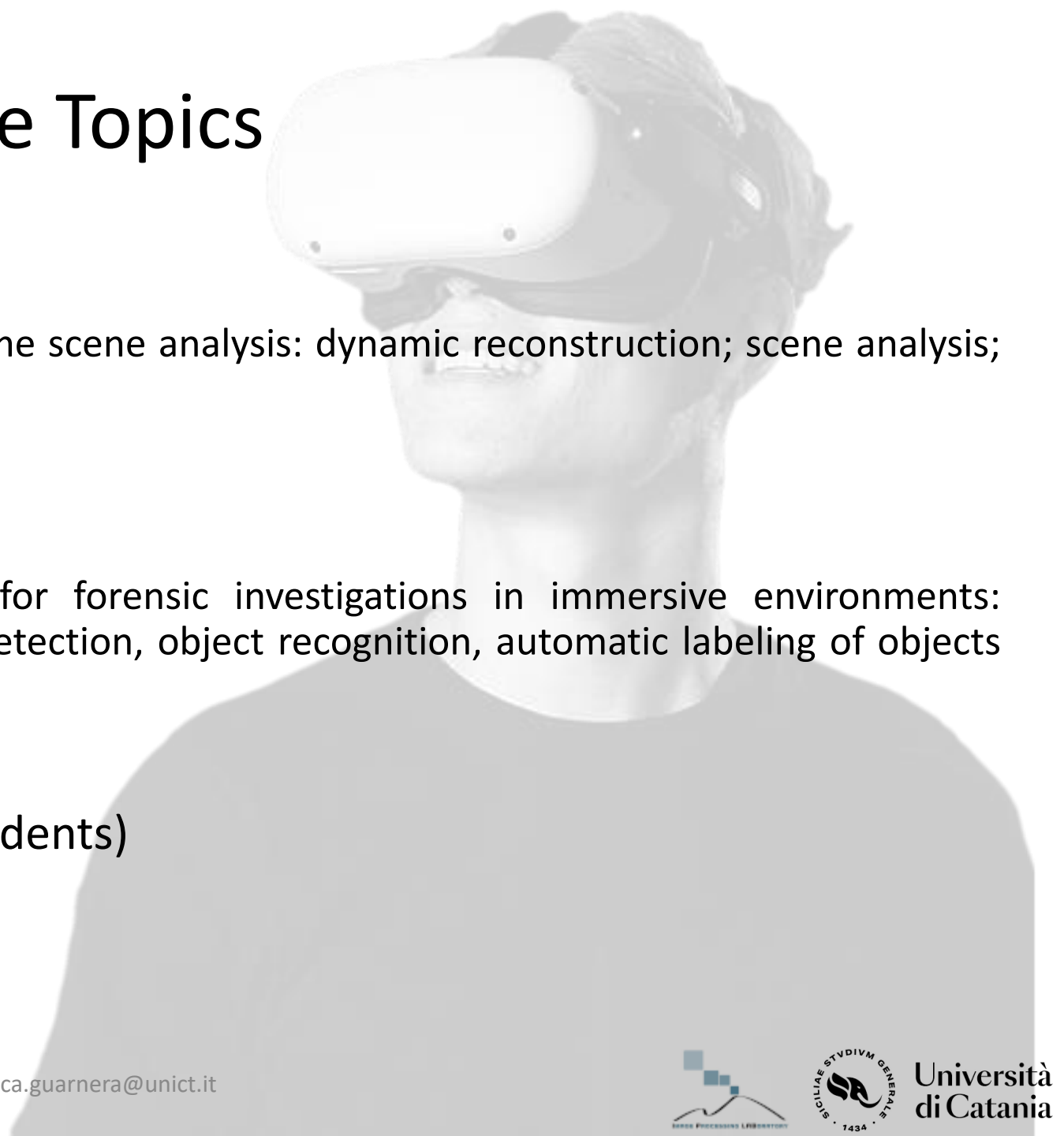
Opportunities for Students

Thesis



Students will be able to use advanced technologies in order to implement applications in the immersive environment through tools such as Meta Quest.

Some Topics



- Applications in Forensics:
  - Virtual laboratory (basic and manual) for crime scene analysis: dynamic reconstruction; scene analysis; educational laboratory; etc....
- Applications in AI Forensics:
  - Machine and Deep Leargning algorithms for forensic investigations in immersive environments: Intelligent Forensic Laboratory with object detection, object recognition, automatic labeling of objects in the scene, and more...
- Applications in other fields (chosen by students)

Main skills/requirements

- Basic knowledge of object-oriented programming

Depending on the application to be made, it is preferable that the student also knows

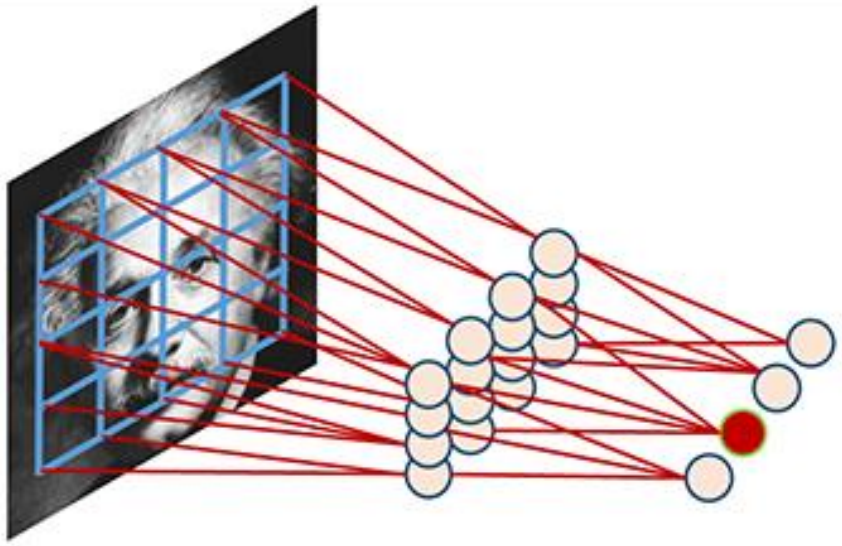
- Basic Knowledge of Computer Graphics, Unity, C# language (or Unreal and C++ language)

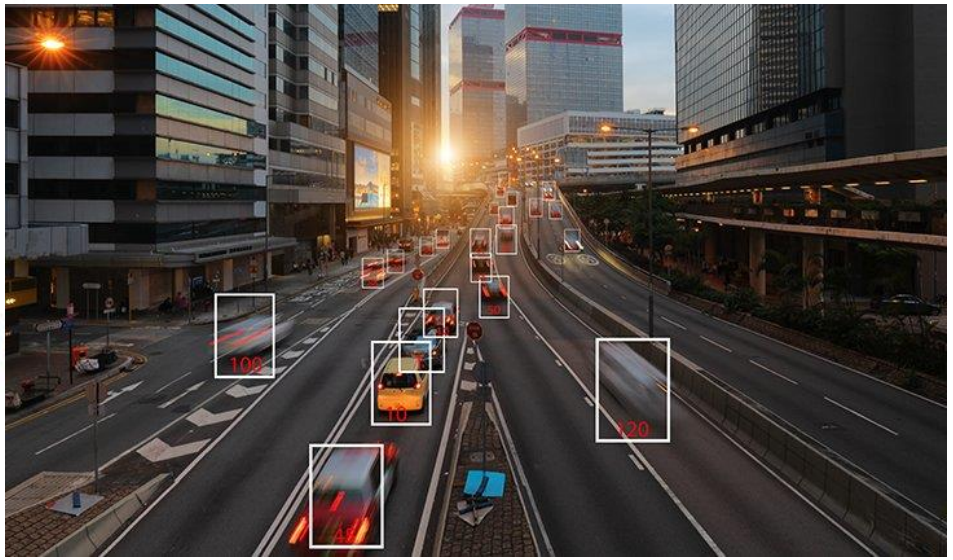
Multimedia Data …

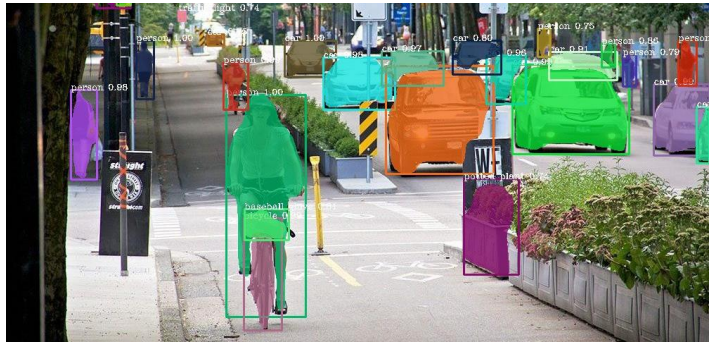
… Data Modelling

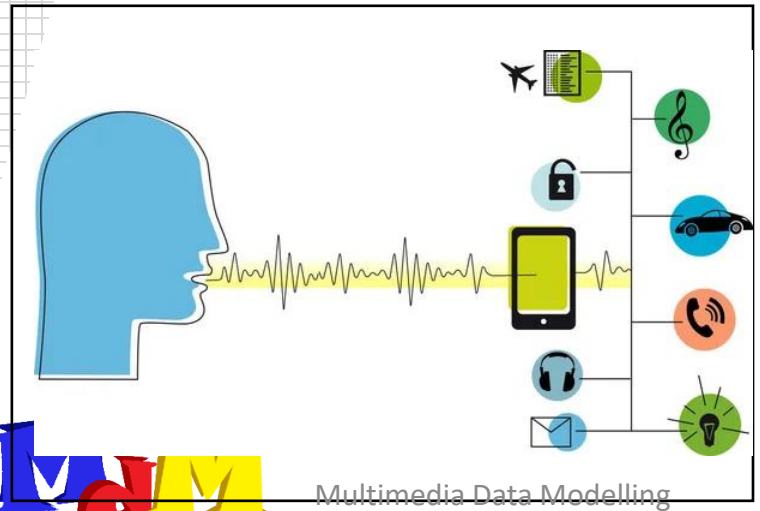
… Data Modelling

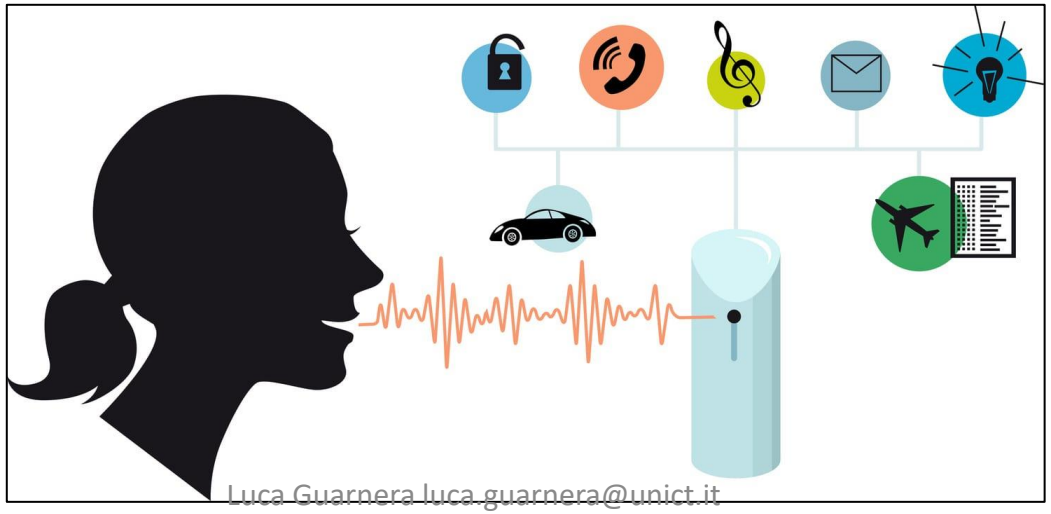
Applications



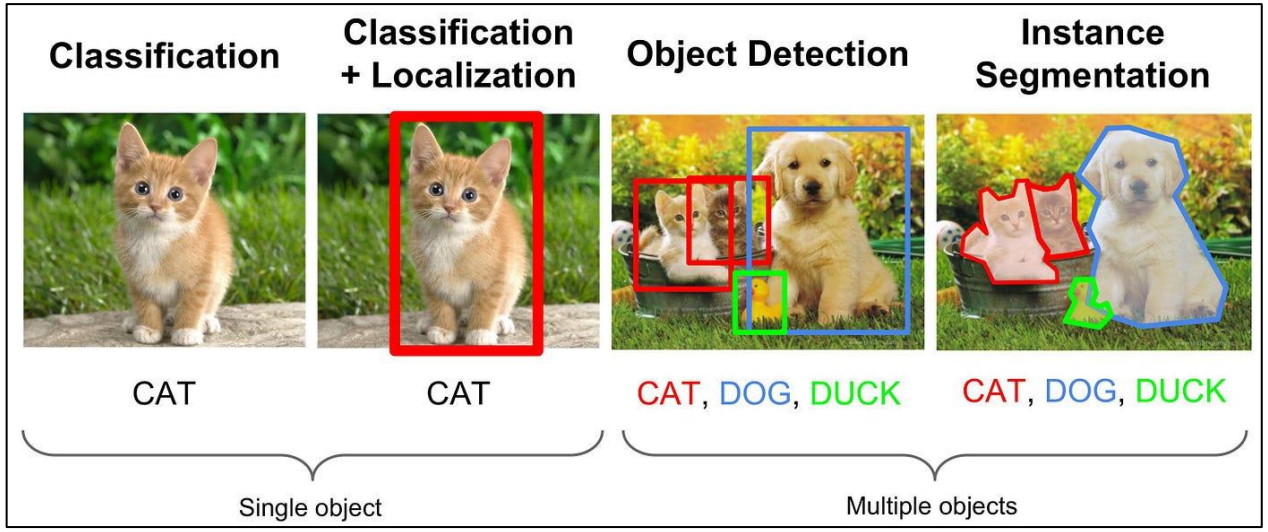


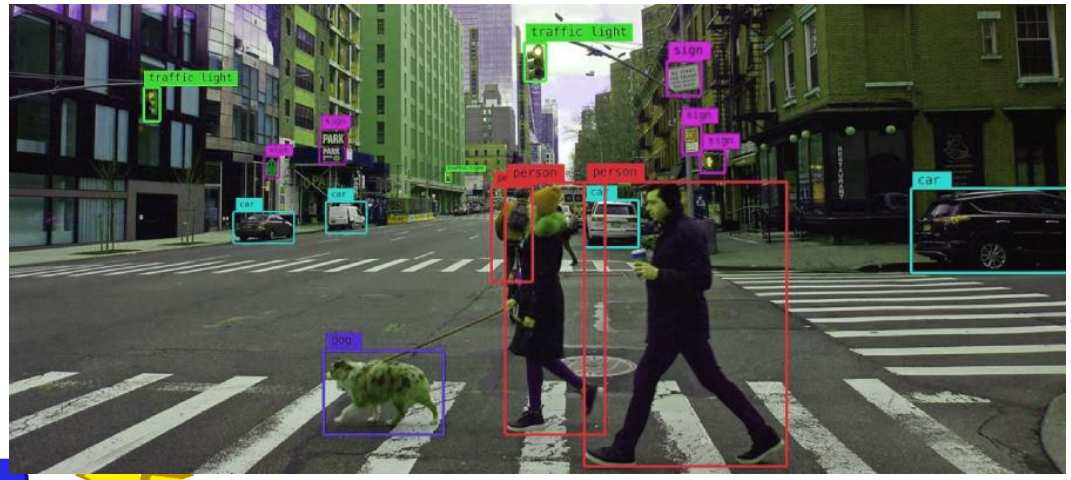


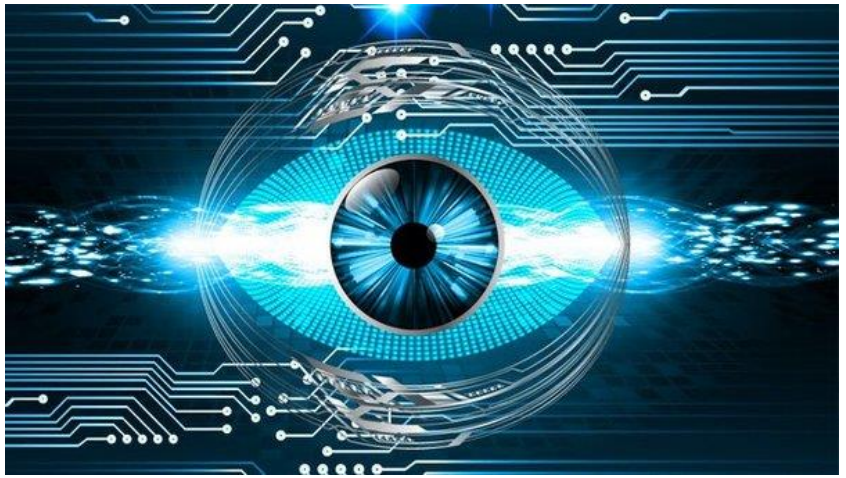




Applications





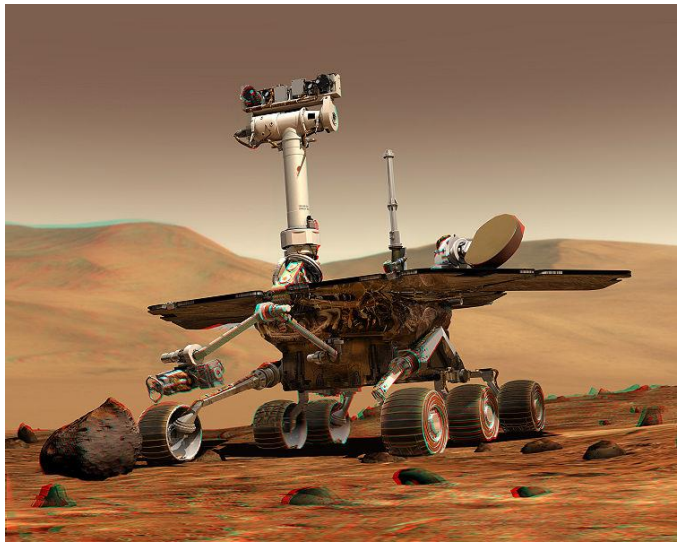


What is Computer Vision?

Vision is perhaps the **most important sense that humans possess**. It enables us to infer the three-dimensional world, recognize and locate objects in a scene, perceive rapid changes in the environment, etc.

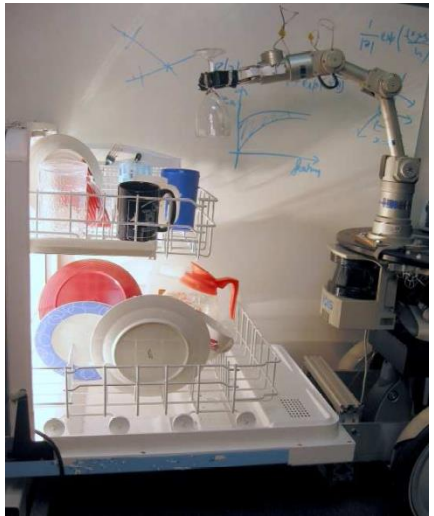
Computer Vision is the discipline that studies how to enable computers to understand and interpret visual information present in images or videos.

CV Applications: Mobile robots



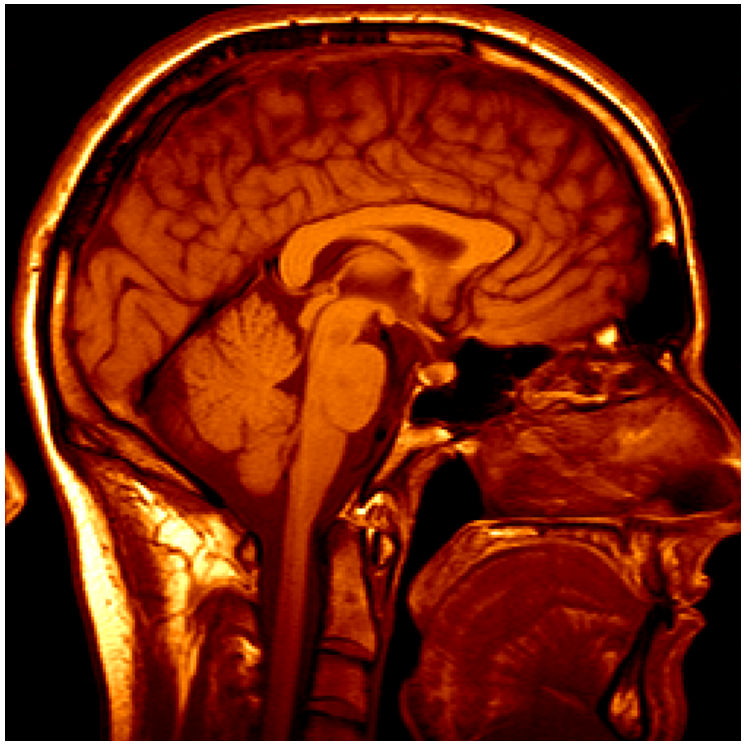
NASA's Mars Spirit Rover
http://en.wikipedia.org/wiki/Spirit_rover

http://www.robocup.org/



Saxena et al. 2008
STAIR at Stanford

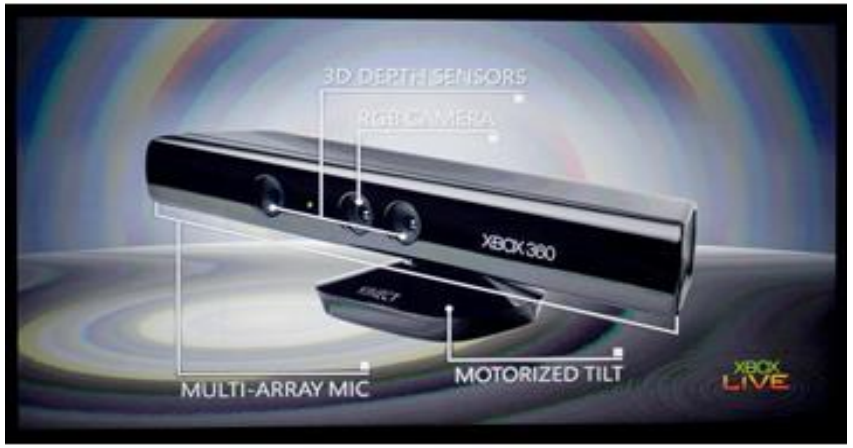
CV Applications: Medical imaging

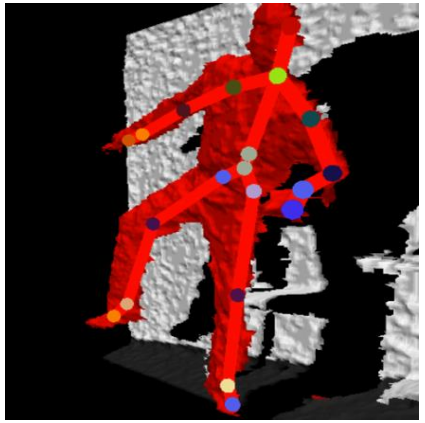


3D imaging
MRI, CT

Image guided surgery
Grimson et al., MIT

Vision-based interaction: Xbox Kinect





http://electronics.howstuffworks.com/microsoft-kinect.htm

slide credit: Lazebnik

CV Applications: Safety and Security

Goal:

Camera Stereo – Real time monitoring of dangerous conflicts (car, pedestrian, etc.)

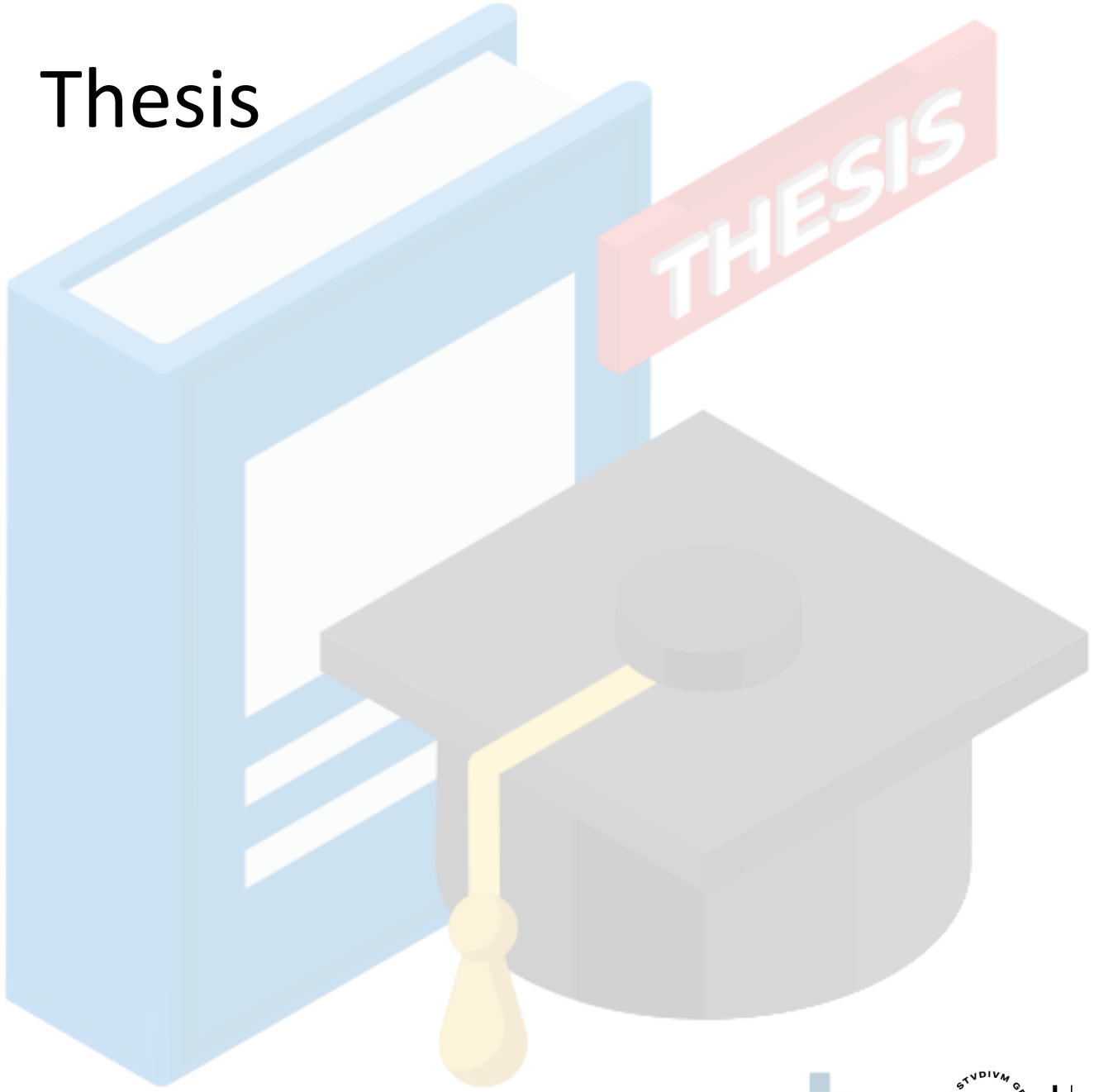
Real-time traffic monitoring

Computer Vision Goals

- Build systems capable of making decisions starting from a description of the scene extrapolated from images/videos;
- Infer the 3D world from digital images;
- Recognition of objects, scenes, context from digital images.
- ….

Opportunities for Students (2)

Thesis



- Deepfakes:
  - Creation
  - Detection
  - Adversarial
- Digital Forensics
- Computer Vision Task
- …

Questions?

Luca Guarnera, Ph.D.

Research Fellow

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University of Catania
Dipartimento di Economia e Impresa

Let's start with the course program …

Details

- **The first part of the course is about digital images**
- The second part of the course is about digital video
- The third part of the course covers Low-Level Vision
- The fourth part of the course concerns modeling and processing of digital data

Introduction to Multimedia Data Modelling

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