

ICT at the Service of Cultural Heritage

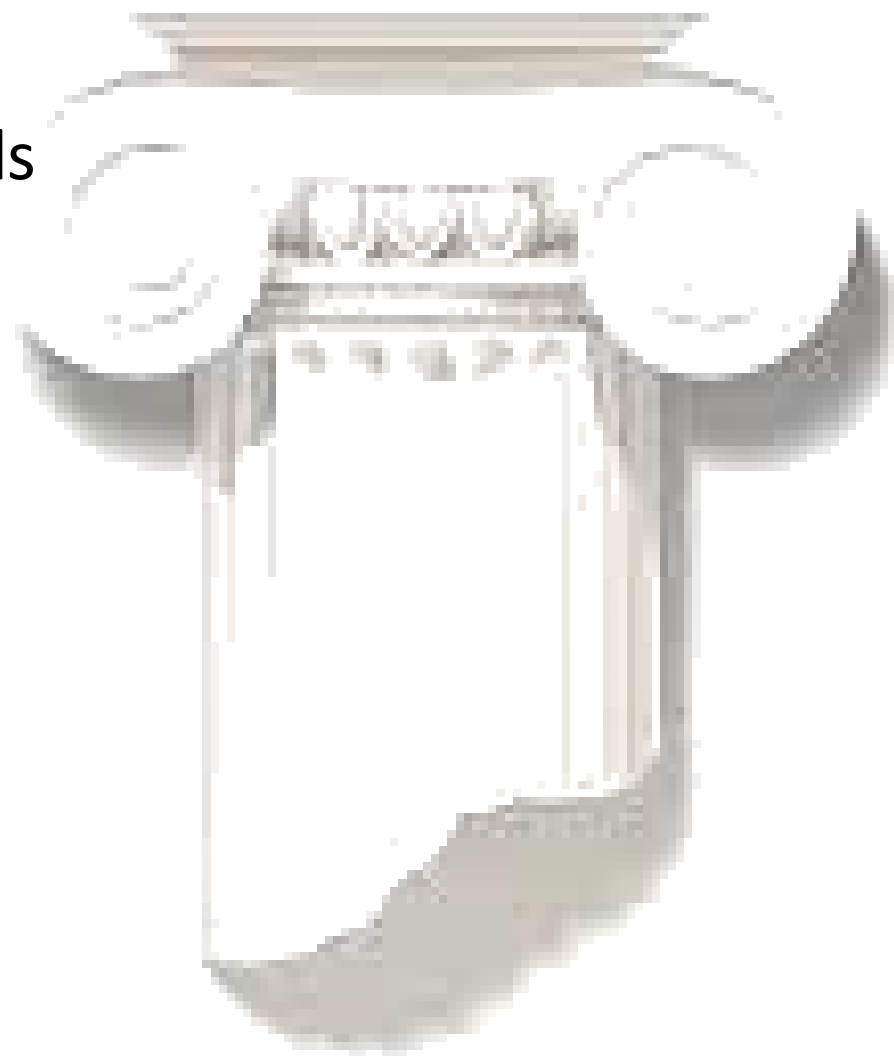


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Structure

- Cultural Heritage
 - Definition
 - Identification of needs
- ICT – Definition
- The role of CIPA-HD
- Contribution of ICT
 - Data acquisition
 - Processing software
 - Alternative products
- Future outlook



Cultural Heritage

- Implies the monuments, but also every kind of document or evidence of civilization
- Carrier of historic memory and ark of national and global civilization.
- Tangible and Intangible Cultural Heritage.

Cultural Heritage

Tangible



monuments



artifacts

Intangible

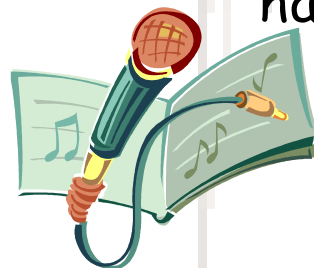


ideas - traditions

poetry - literature - songs

dances - performances - customs

handicraft



Cultural Heritage is in need of

- **Documentation** (Geometric, Architectural, Historic etc.) – 2D/3D for archiving, studies, planning etc.
- Accuracy/**accurate measurements** (for restoration, reconstructions, structural studies, protection etc.)
- **Monitoring** of its state
- Proper **Management** of its data (for sustainability, risk management etc.)
- **Preservation** possibilities (e.g. digital libraries etc.)
- **Public Outreach** (visualization, dissemination, awareness of the public ...)
- ...

Protection of Cultural Heritage

- Obligation of all generations for the preservation of historic memory
- International Conventions (Venice Charter, Granada Convention etc.)
- International Organizations for the protection of Cultural Heritage



International Council on
Monuments and Sites

Conseil International
des Monuments et des Sites

- UNESCO

- ICOMOS (National ICOMOS Chapters)

- **CIPA Heritage Documentation** (with ISPRS)



International Cooperation



1946

1946

1959

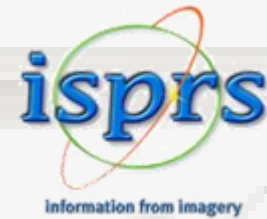
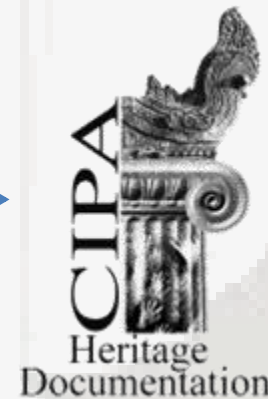


1964



ICOMOS

1964



1910

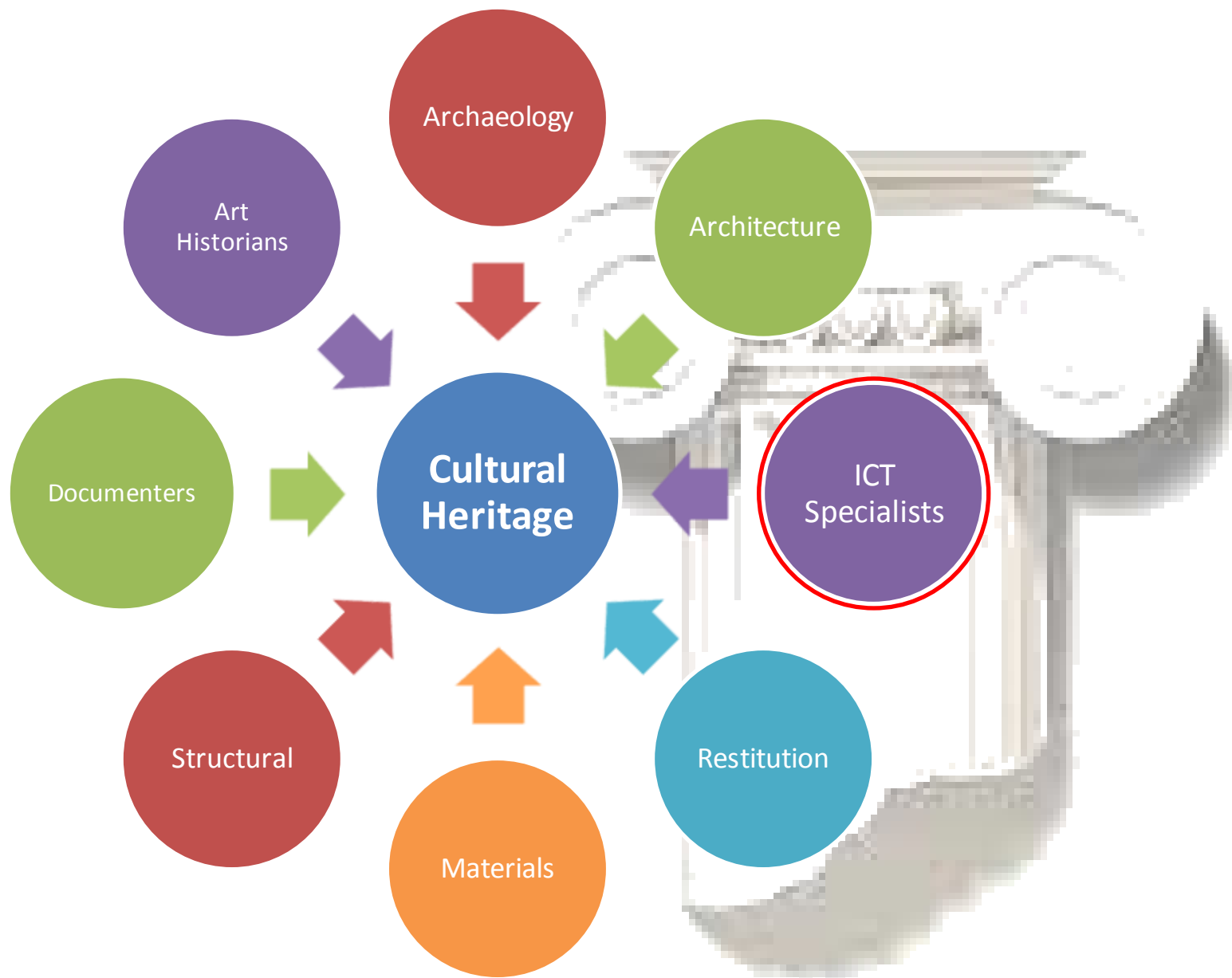
The role of CIPA HD



- Encourage and promote development of **principles** and **good practices** for recording, documentation and information management of cultural heritage
- Lead and participate in **international training programs** for conservation and informatics professionals, students and site personnel;
- **Advise** government bodies, regional authorities, non-profit groups and institutions on tools, technology and methods using technology;
- Promote an **international network of professionals** in the fields of technology and cultural heritage for research but also applied practical experience;
- Provide a platform with the bi-annual **International Symposium** for the exchange of ideas, best practices as well as scientific

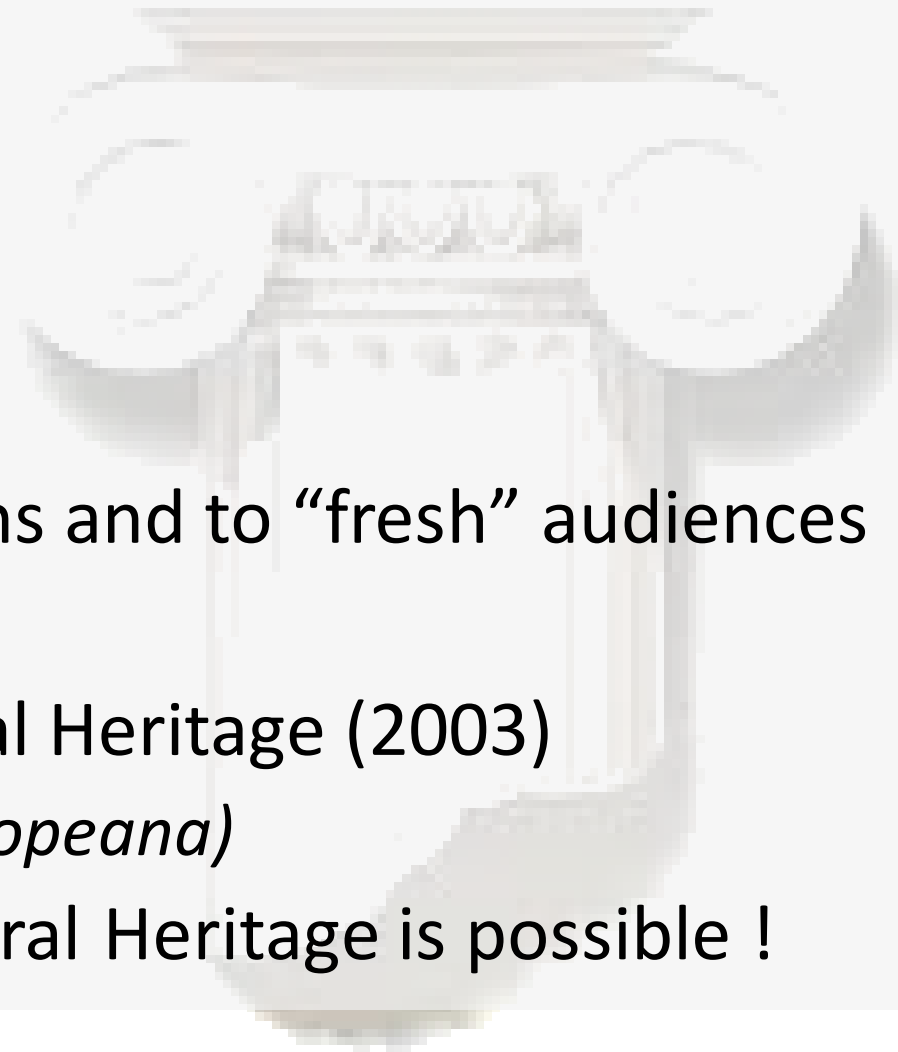
**2015 CIPA
SYMPOSIUM
IN TAIWAN !!**

Interdisciplinarity



Contribution of Digital Technologies

- To traditional professions
 - Archaeologists
 - Architects
 - Conservators
 - ...
- To the public
- To the younger generations and to “fresh” audiences
- UNESCO Charter for Digital Heritage (2003)
 - *Digital Libraries (e.g. Europeana)*
- Today digitization of Cultural Heritage is possible !



What does ICT have to offer ?

✓ Instrumentation

- ✓ Digital Sensors (optical, thermal, range etc.)
- ✓ Scanners
- ✓ Satellite navigation (GPS)
- ✓ LBS and indoor positioning systems
- ✓ 3D printers

✓ Digital Data

- ✓ Images or Video
- ✓ Points in 3D space

✓ H/W & S/W

- ✓ 3D data processing
- ✓ Image processing
- ✓ GIS - MIS

Speed

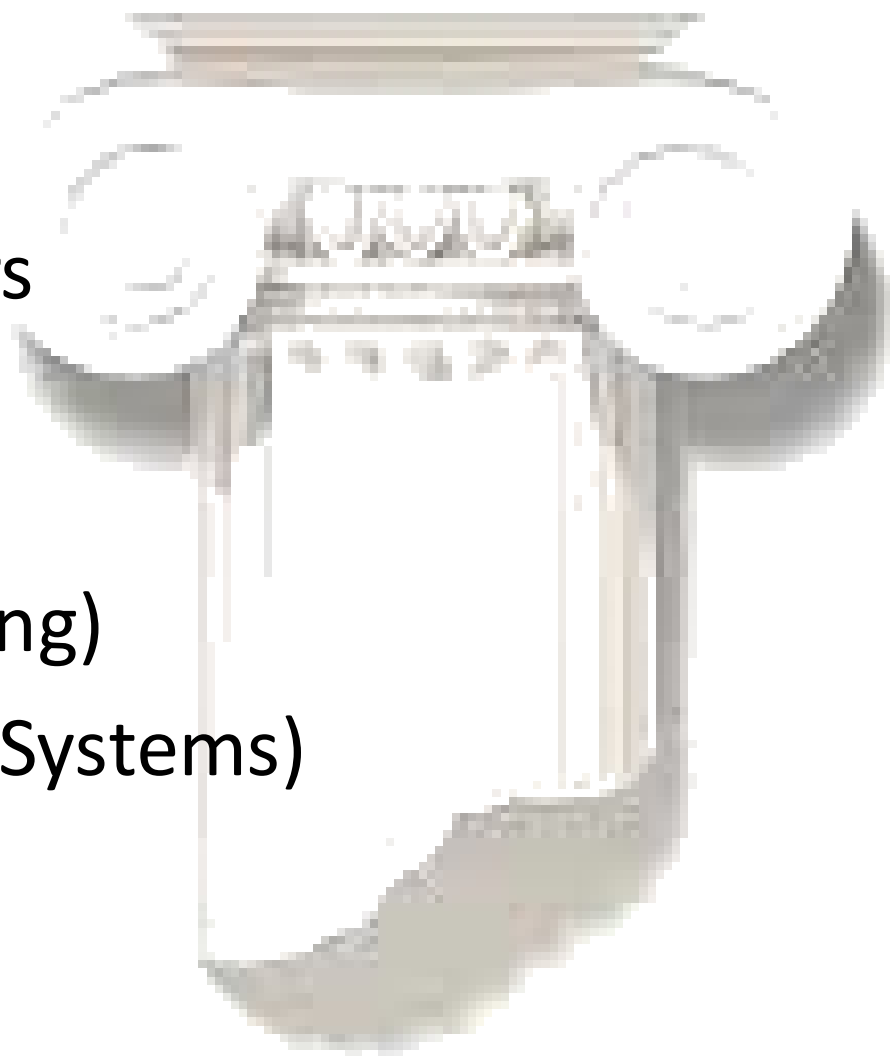
Accuracy

Automation

Alternative products

Data Acquisition

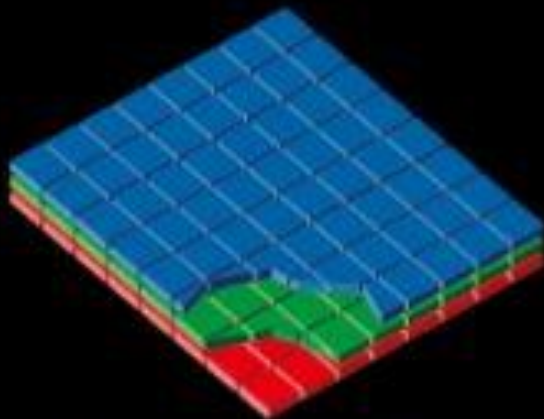
- Optical sensors
- Range sensors
- Underwater scanners
 - Other sensors
- Mocap systems
- IPS (Indoor Positioning)
- LBS (Location Based Systems)



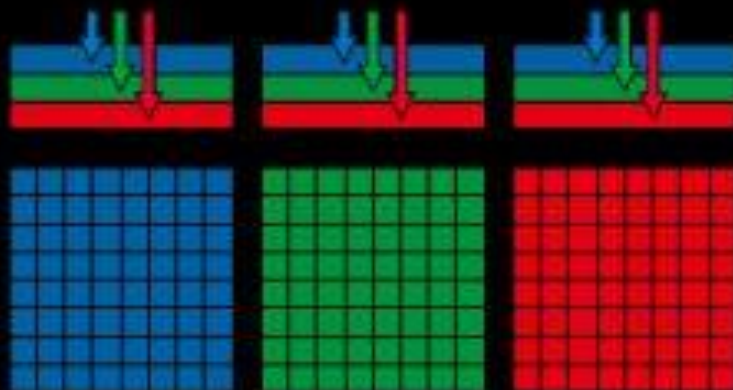
Digital Optical Cameras

- CCD/CMOS
- FoveonX3 (for better colour)
- Off-the-shelf
- Technological maturity
- Flexibility
- S/W development + technological advances
- *Project Tango*



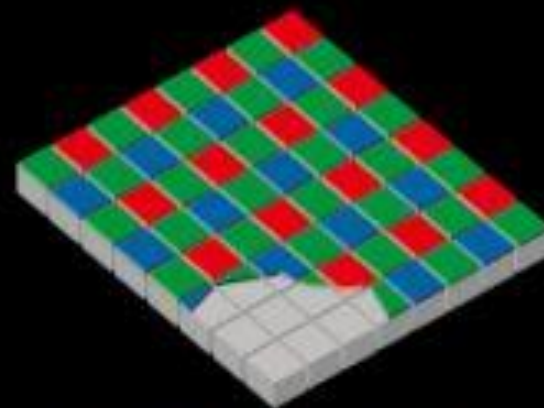


R: 100% G: 100% B: 100%

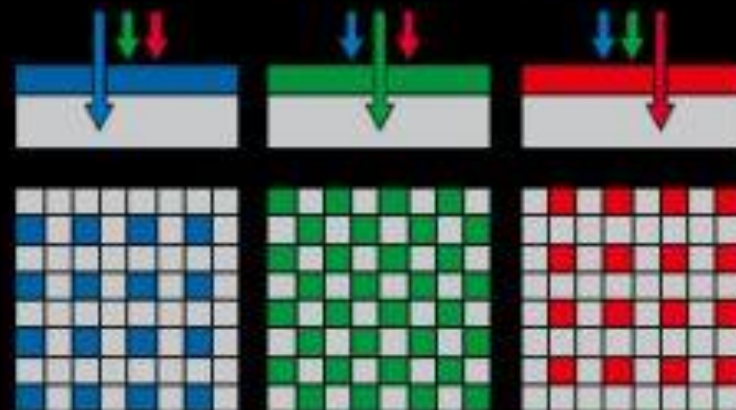


The Foveon X3® Sensor

The Foveon X3® has three layers of photosensors, enabling it to capture 100% of the RGB color data at once.



R: 25% G: 50% B: 25%



The Bayer filter Image Sensor

The old-fashioned Bayer filter image sensor can only capture 50% of the green color data, and a mere 25% each of the blue and the red.

Project Tango

What could I do with it?

What if you could capture the dimensions of your home simply by walking around with your phone before you went furniture shopping? What if directions to a new location didn't stop at the street address? What if you never again found yourself lost in a new building? What if the visually-impaired could navigate unassisted in unfamiliar indoor places? What if you could search for a product and see where the exact shelf is located in a super-store?

Imagine playing hide-and-seek in your house with your favorite game character, or transforming the hallways into a tree-lined path. Imagine competing against a friend for control over territories in your home with your own miniature army, or hiding secret virtual treasures in physical places around the world?

sensing

camera

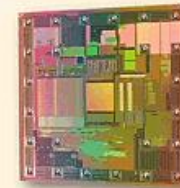
Range Sensors



HD 720p Image sensor

The World's smallest 3D Time of Flight Camera ...

Measurement range 8m
Power consumption 300mW
Only 30x25x20 mm
Sunlight resistant



... is using
ESPOS Photonic CMOS™
technology!

Power LED
indicator

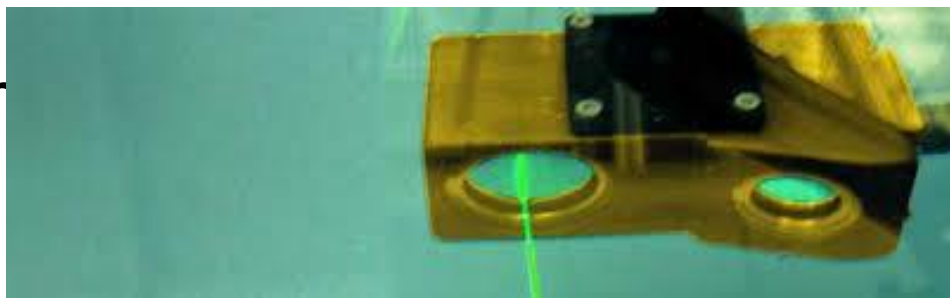


Multi-attach
base



Scanners

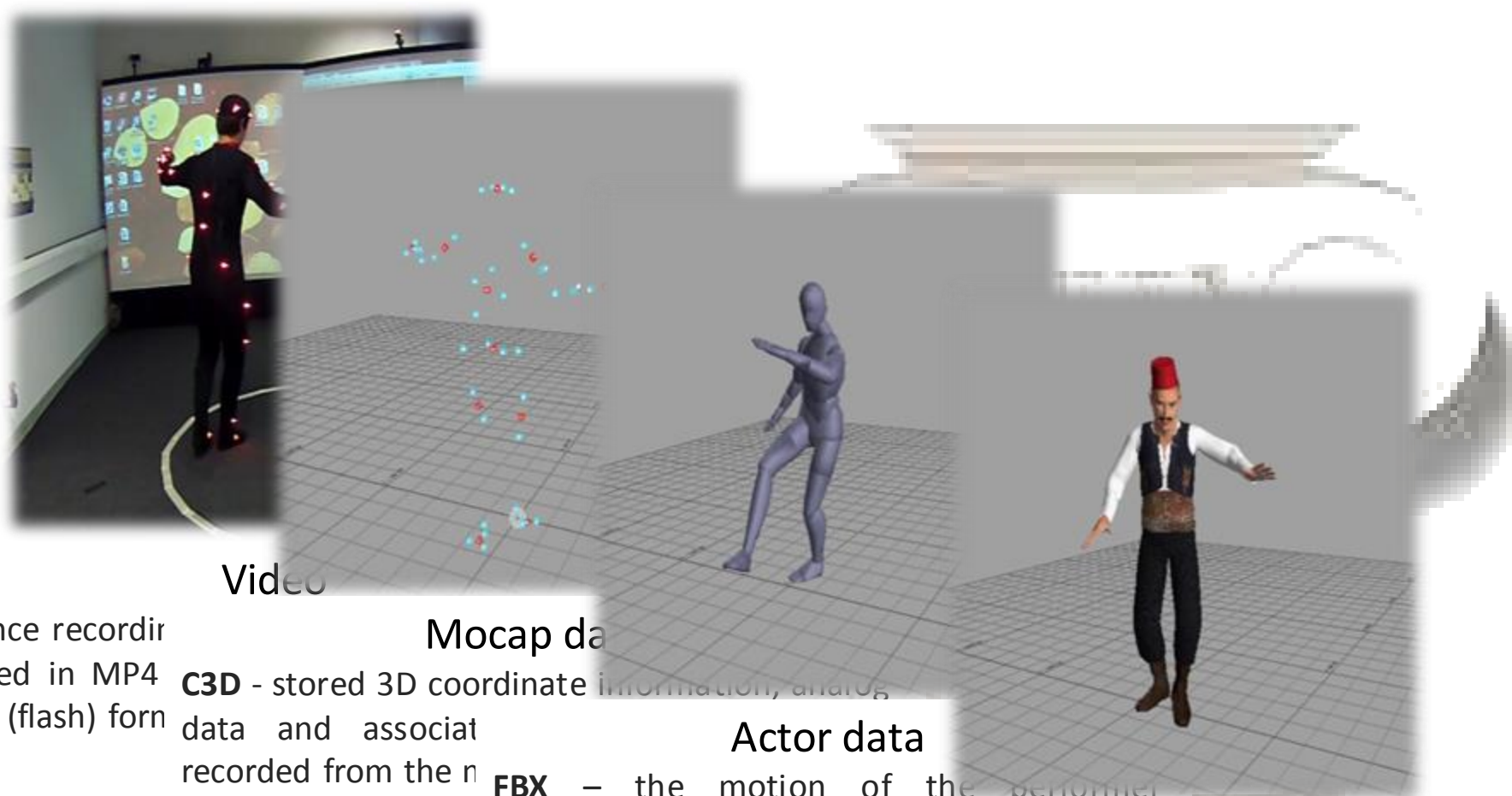
- Laser Scanner
- Structured



ers Zeb 1 **NEWTON**



Motion capture systems



Video

Dance recording
saved in MP4
FLV (flash) format

Mocap data

C3D - stored 3D coordinate information, analog data and associated
recorded from the motion capture system

Actor data

FBX - the motion of the performer
is saved as an actor. A
(avatar) can be incorporated
into the dance

Character data

FBX - A virtual character has been
incorporated to the actor.

LBS and IPS

Location based services & Indoor Positioning Systems



Platforms



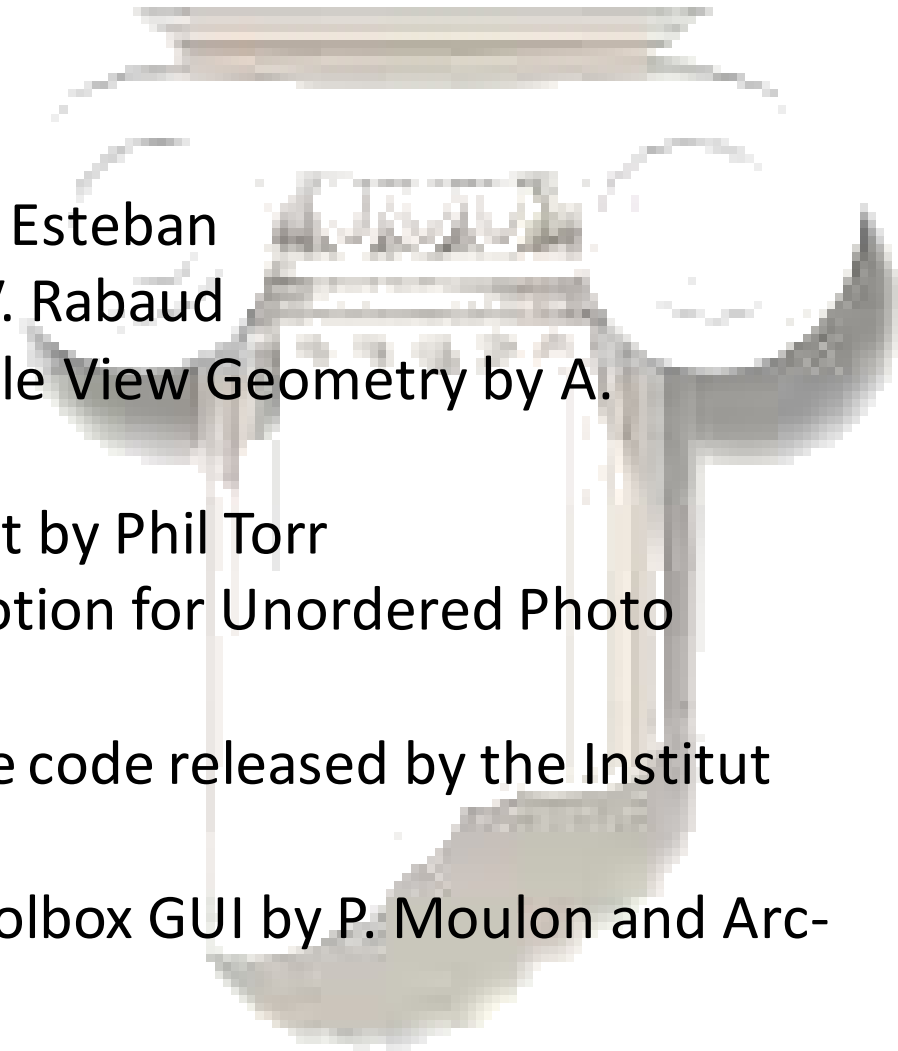
Processing S/W

- Image based
 - SfM
 - Oblique Images
- 3D Point cloud
- Management
- Big Data – Cloud services



SfM

- **Web based**
 - Arc3D (epoch)
 - 123D Catch (AutoDesk)
 - MS Photosynth
- **Open Source**
 - FIT3D - Matlab Toolbox by I. Esteban
 - SfM toolbox for Matlab by V. Rabaud
 - Matlab Functions for Multiple View Geometry by A. Zissermann
 - Structure and Motion Toolkit by Phil Torr
 - Bundler - Structure from Motion for Unordered Photo Collections by Noah Snavely
 - MicMac, a SFM open-source code released by the Institut Géographique National (FR)
 - Python Photogrammetry Toolbox GUI by P. Moulon and Arc-Team



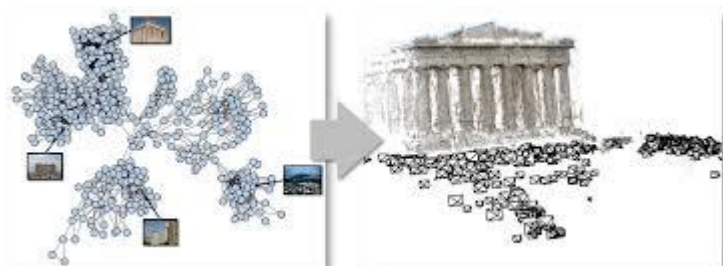
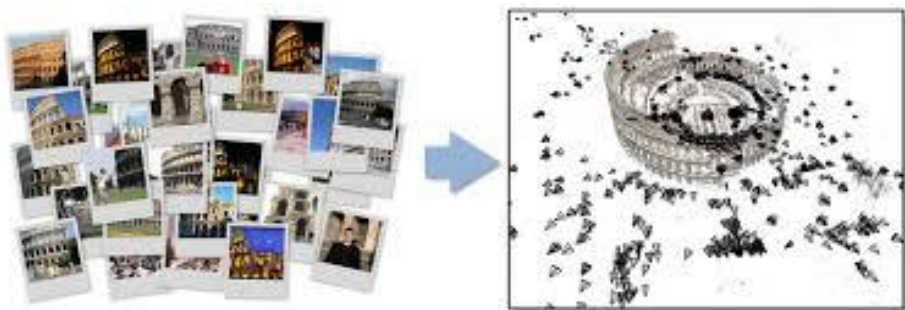
SfM

- **Commercial**

- Photoscan by Agisoft
- Smart3DCapture, by Acute3D.
- 3DF Samantha, by 3Dflow srl.
- Automatic Camera Tracking System (ACTS) A structure-from-motion system for Microsoft Windows, by State Key Lab of CAD&CG, Zhejiang University.
- VisualSfM: A Visual Structure from Motion System, by Changchang Wu
- SFMToolkit a complete photogrammetry solution based on open-source software
- MetalO Toolbox SfM for augmented reality on mobile devices.
- Catena Python Abstract Workflow Framework with SfM components.

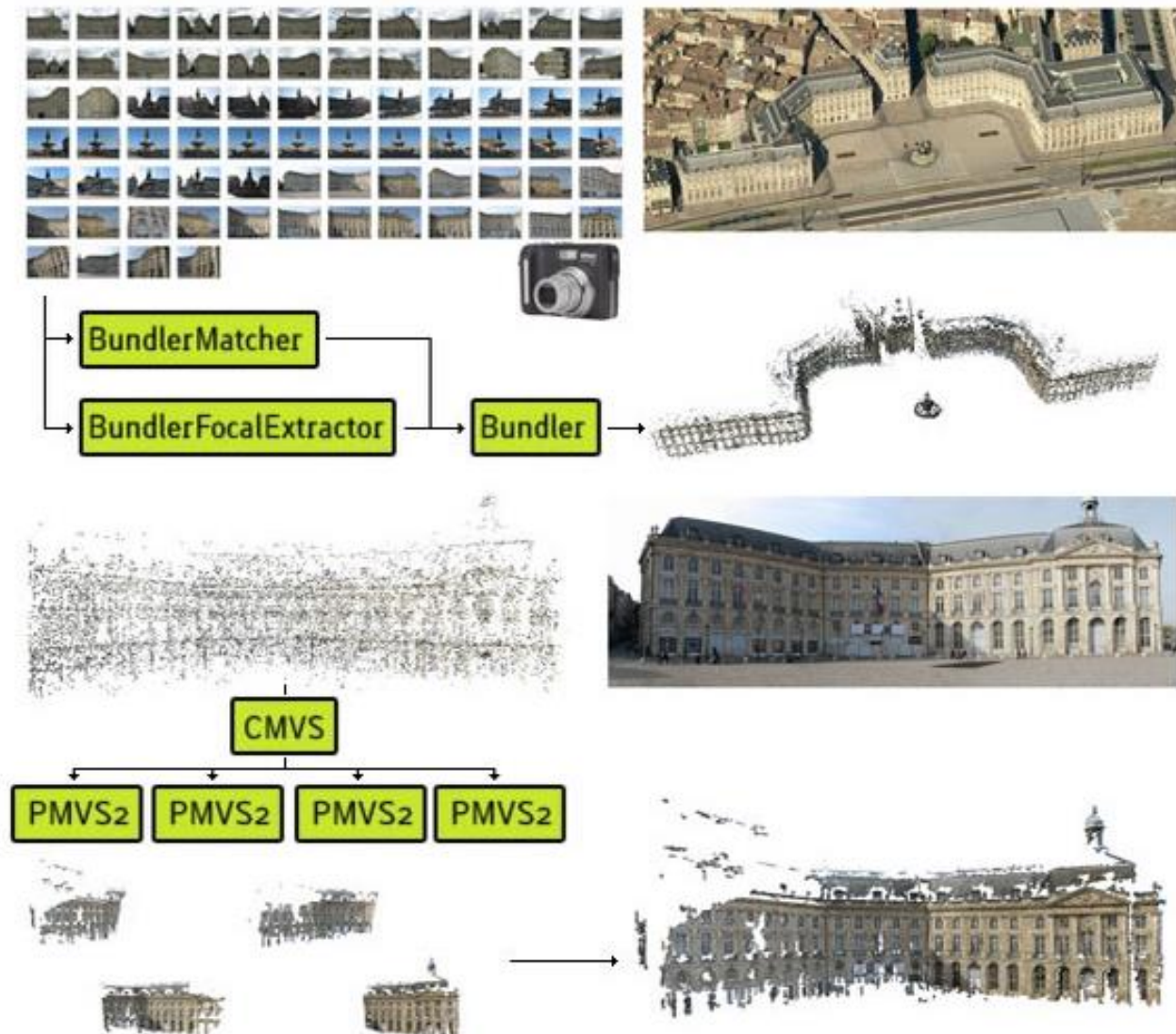
SfM

BigSfM: Reconstructing the World from Internet Photos



Cornell University
Department of Computer Science

SfM Toolkit





123D Catch

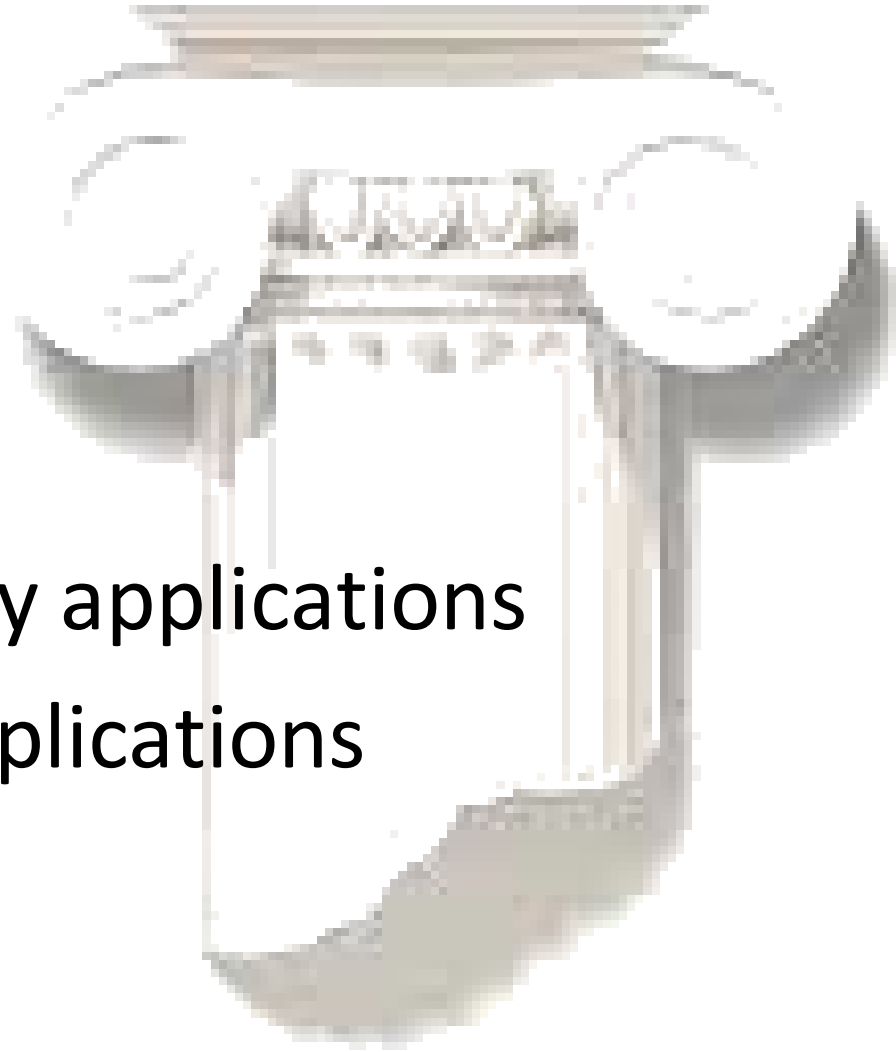


123D Catch



Alternative products

- ***Virtual***
 - Restoration
 - Reconstruction
 - Visits
 - ...
- Augmented Reality applications
- Serious Games applications
- 3D printing





Virtual restoration



3D Virtual Reconstruction



3D Virtual Reconstruction



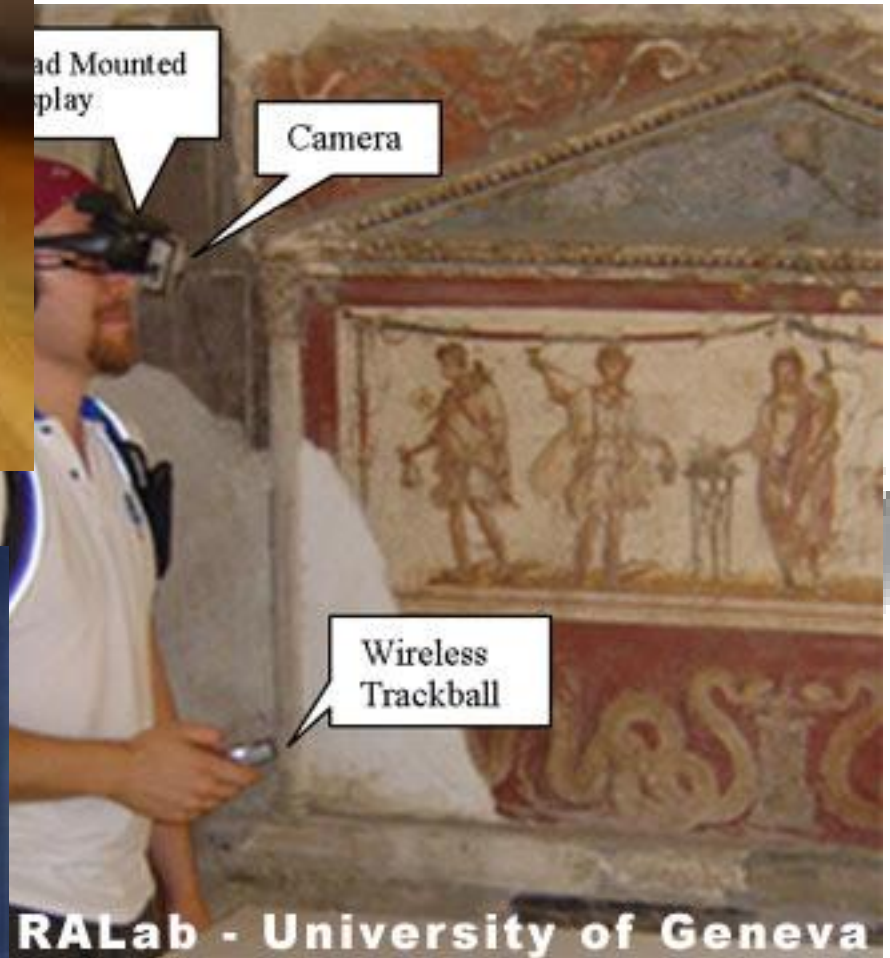
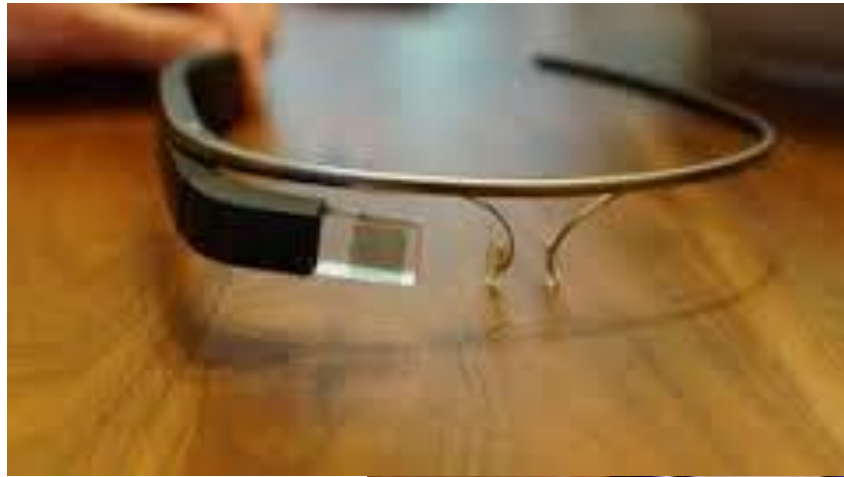
Augmented Reality



© M. Roussou, MakeBelieve



Immersive environments



welcome to the
FOUNDATION OF THE HELLENIC WORLD

Serious Games



© RomaNova project



© Dr. F. Liarokapis, SGI & Coventry Univ.

3D printing

3DPRINTSONDEMAND

HOME

SERVICES

MATERIALS



12
Mar

Make your own 3D-printed quadcopter

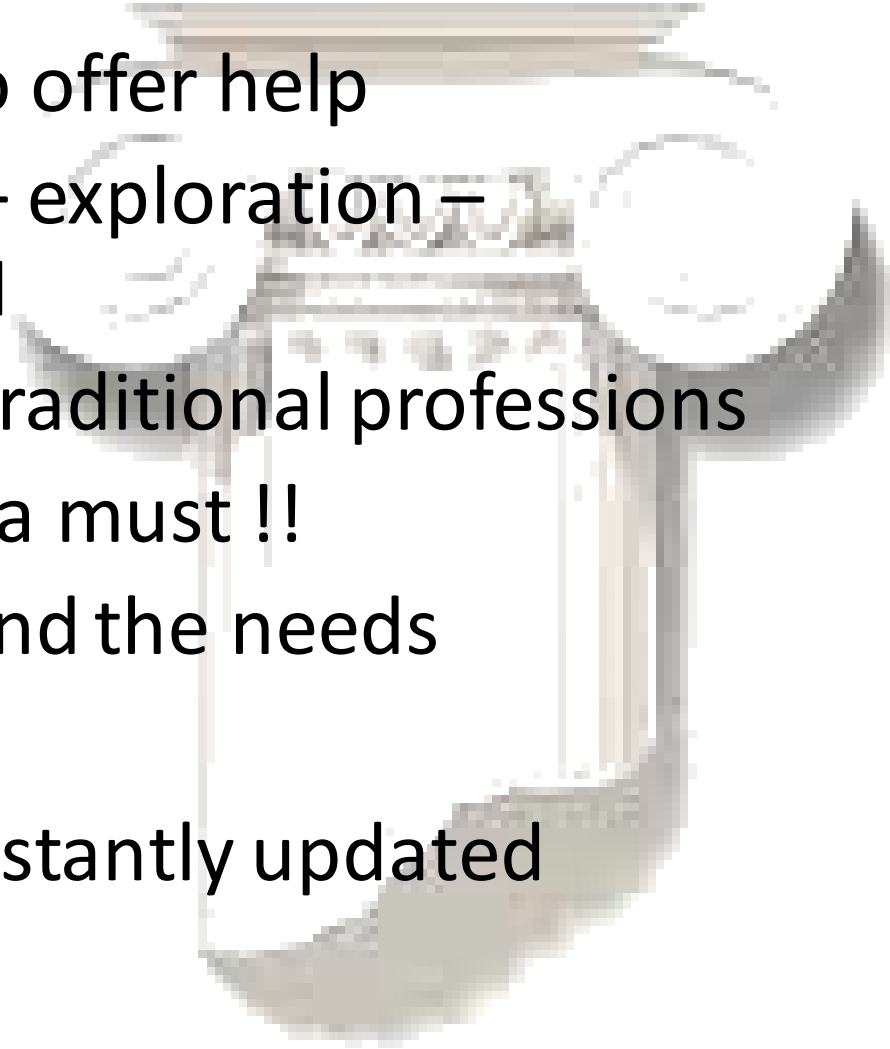
Posted by: 3DPRINTSONDEMAND



...receiving our... is a very important task, one which possibilities have been greatly enriched with technology

Concluding Remarks

- ICT definitely able to offer help
- 3D documentation – exploration – understanding of CH
- Hand-in-hand with traditional professions
- Interdisciplinarity is a must !!
- ICT should understand the needs
- Bridge the gap !
- Specs should be constantly updated



Digital Products

CIPA ICT

Texture

UAV

Digital Data

Multicopter

LBS

Oblique Images

Range Cameras

Cloud

Underwater Scanning

Digital Cameras

Modelling

Laser

Virtual Reality

Range Images

Cultural Heritage

Laser Scanning

Augmented Reality

ICOMOS

Structured Light

Images

Processing

Orthophoto

Thank you very much for you patience !!