Fuzzy Connections in realistic real-time facial animation

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Face Animation

- Anatomical synthesis: highly detailed biomechanics modeling of facial tissue (FEM, Multi-layer models… e.g. Koch et al., 1998; Badler, 2000).

- Exterior reproduction: highly detailed reproduction of the surface of the face, mainly in Computer Graphics (e.g. Lee et al., 1998; Guenter et al., 1998).

Our real-time approach

- Hybrid approach;
- Two-layers model.
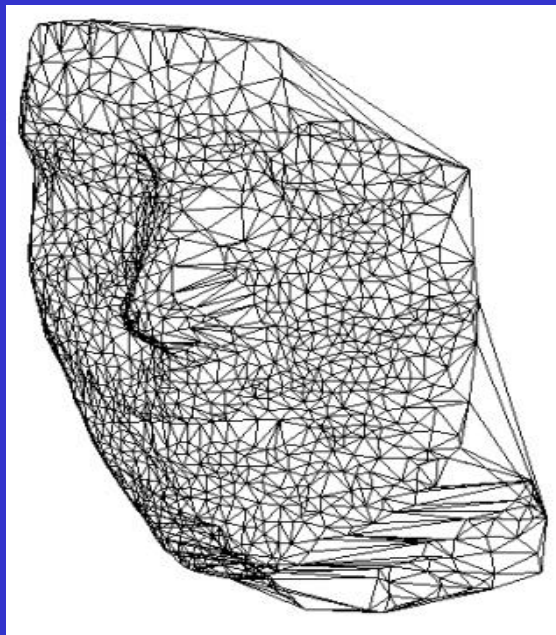- Upper topological mesh.
- Lower control mesh.
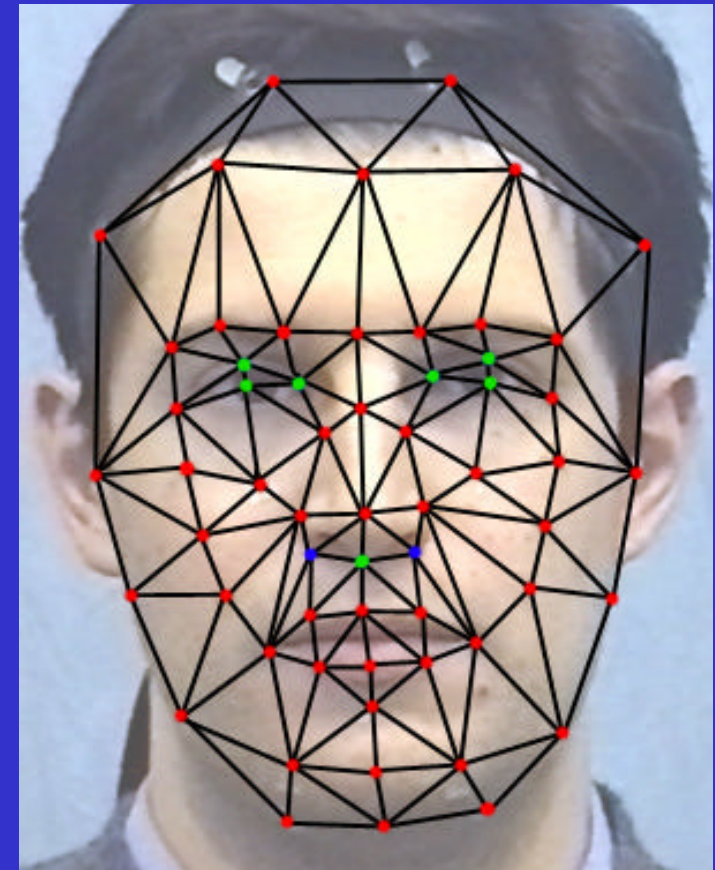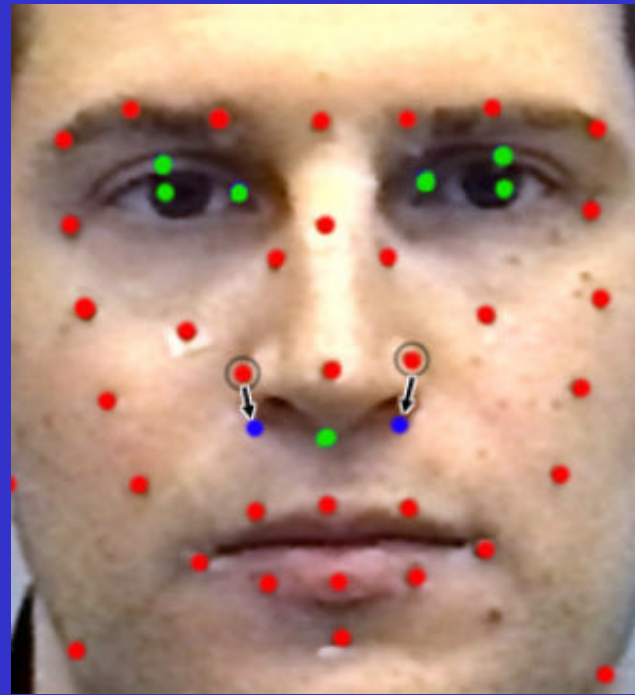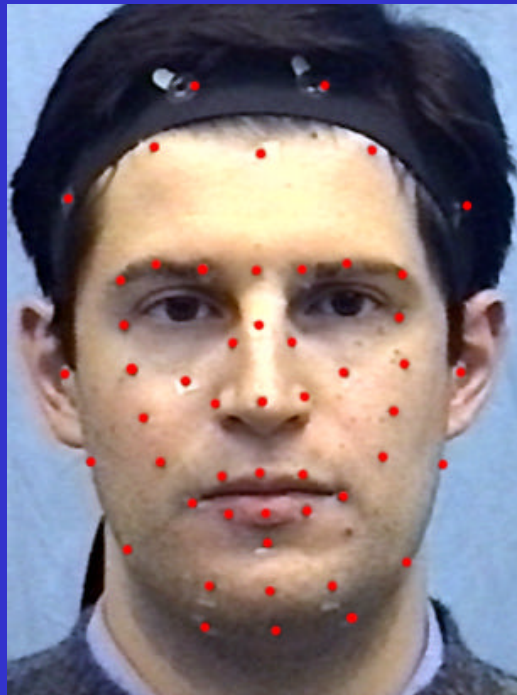
Two-layers animation
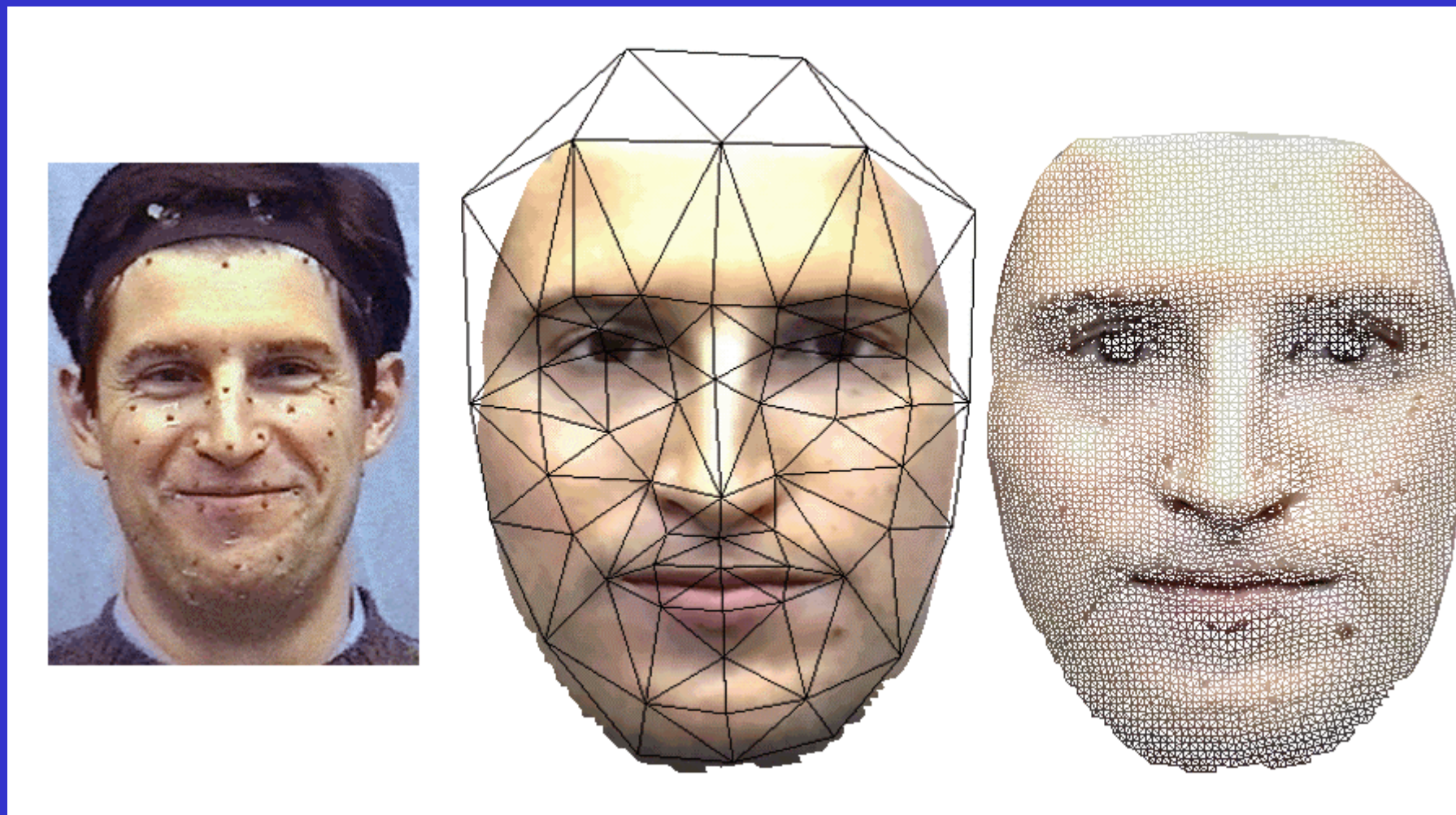
The deformation of the topological mesh is induced by a deformation of the control mesh.

Acquisition of topological mesh

Construction of the control mesh

51 Markers are positioned on the subject (MPEG-4):

- *Difficulty in applying them:*
    Around th eyes and inside the lips.
    Base of the nose (visibility from the cameras).
- *To identify a local reference system (optional):*
    Elastic band with four markers.

● Acquired markers (51)
● Virtual markers anchored to the head (7)
● Virtual markers anchored to real ones (2)
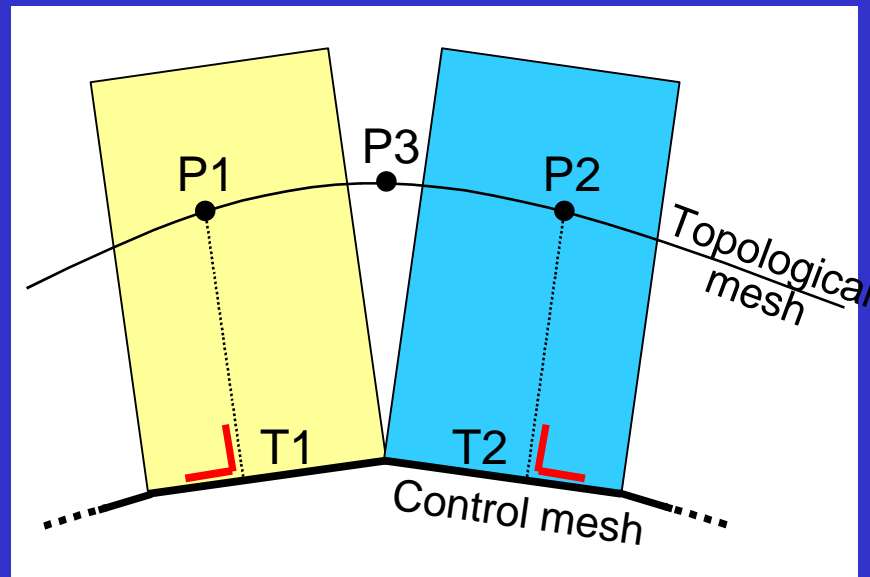   For a total of 60 markers

Where is the problem in the connection?

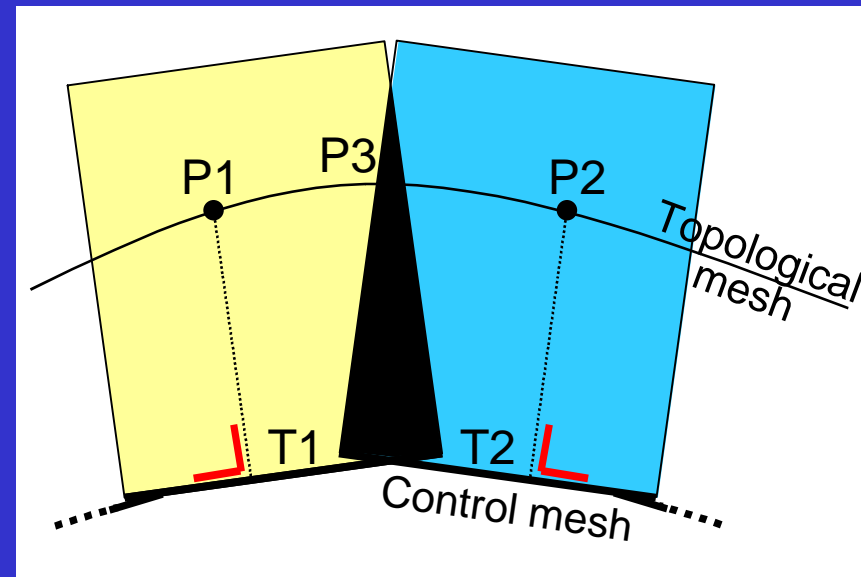$\forall\ P_i$ of the topological mesh:
1) Determine the triangle onto which P_i is projected.
2) Compute the intrinsic coordinates of P_i .

Here is what happens close to the border of a control triangle:

P1 $\perp$ T1 $\in$ T1   P3 $\perp$ T1 $\notin$ T1
P2 $\perp$ T2 $\in$ T2   P3 $\perp$ T2 $\notin$ T2
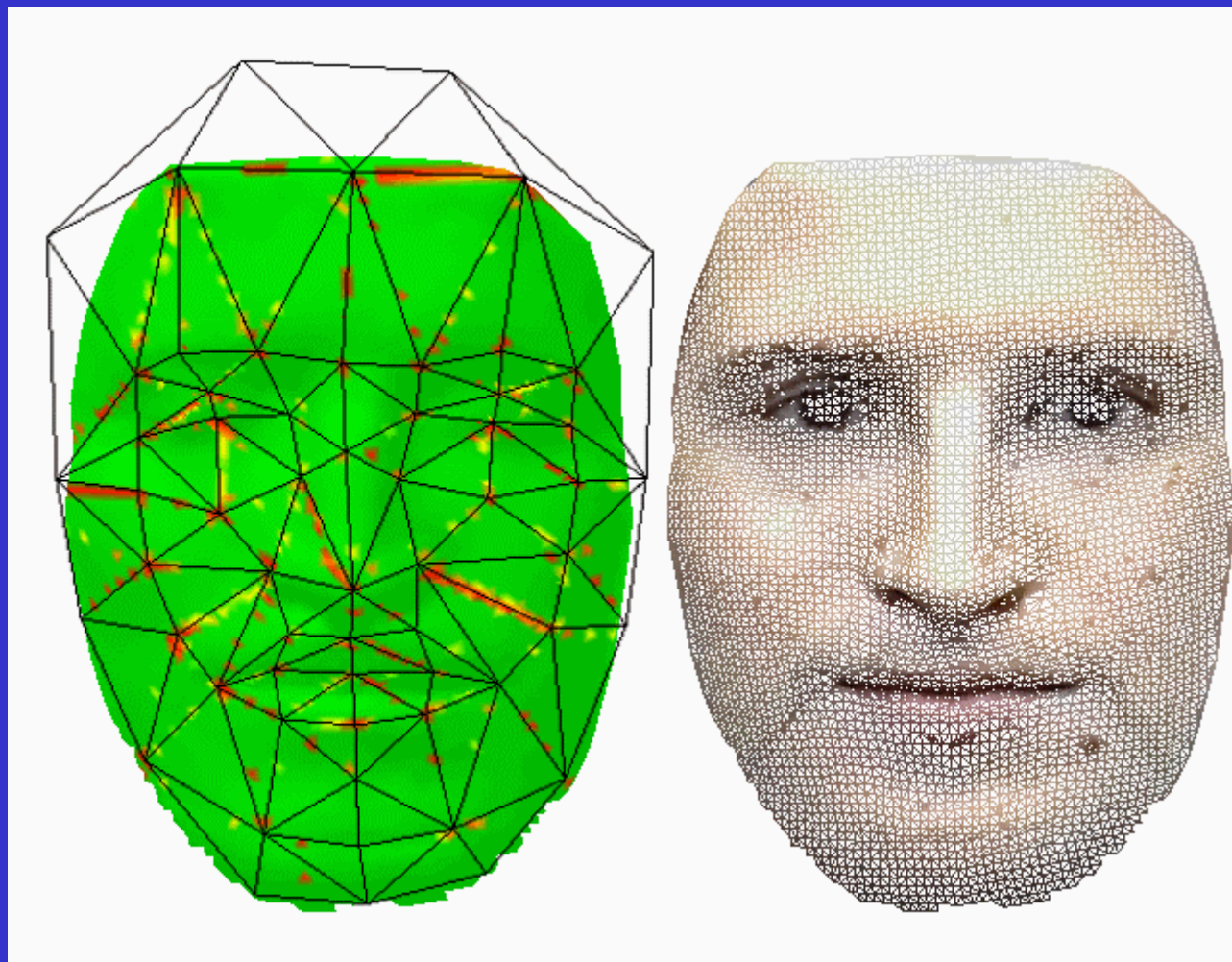
No projection for P3.

P1 $\perp$ T1 $\in$ T1   P3 $\perp$ T1 $\in$ T1
P2 $\perp$ T2 $\in$ T2   P3 $\perp$ T2 $\in$ T2

Two projected points for P3.

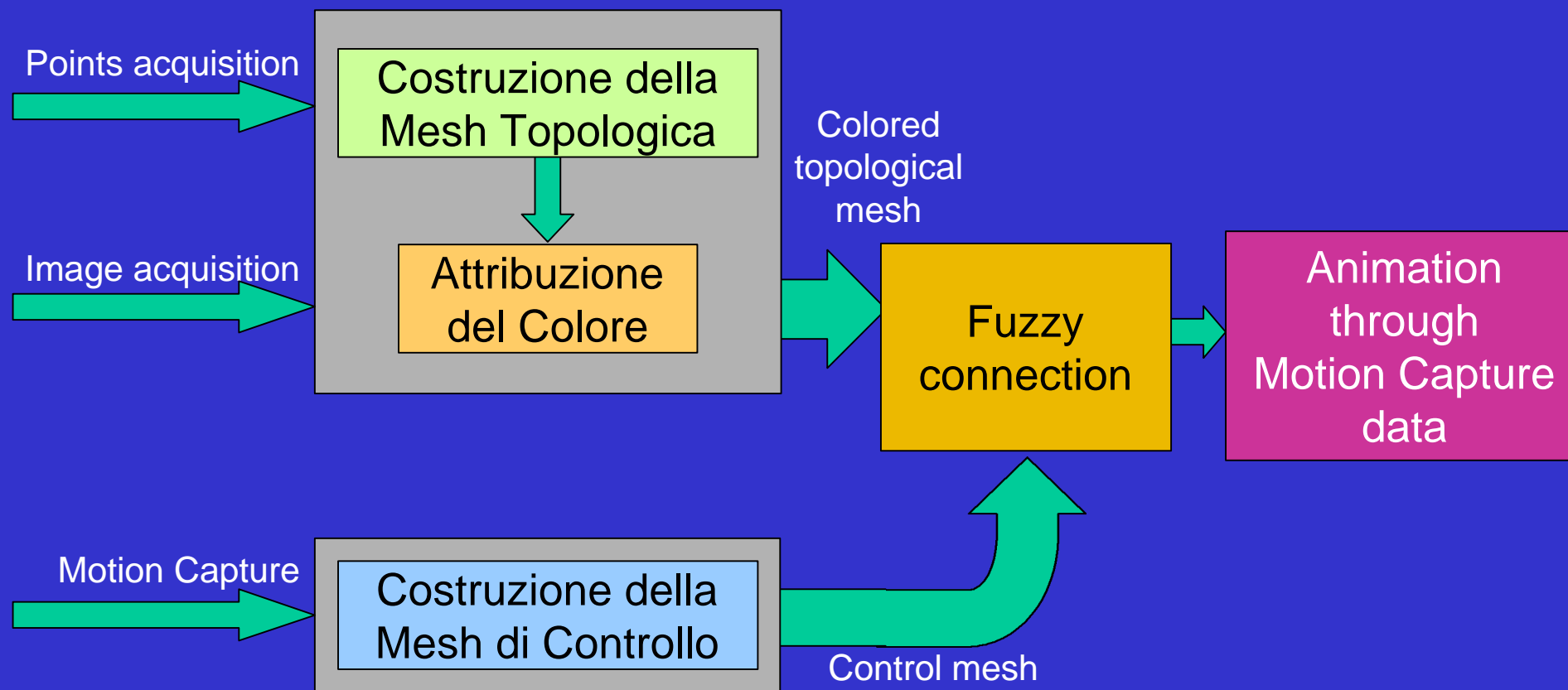**Here is where fuzzy assignment comes into play.**

Fuzzy association

Rigid association   Fuzzy association

General schema of the system

Points acquisition →

Image acquisition →

Costruzione della Mesh Topologica

↓

Attribuzione del Colore

Colored topological mesh →

Motion Capture →

Costruzione della Mesh di Controllo

Control mesh →

Fuzzy connection

→ **Animation through Motion Capture data**

Results are available at MAVR's home page:

http://www.inb.mi.cnr.it/borghese.html