Hand gestures are a promising, but unexplored way of interacting with digital devices. At present, gesture recognition systems are based on machine learning, probabilistic methods or specialized hardware, and not on understanding the configurations and transformations of the hand itself.

Using a webcam, our approach filters out most of the incoming information, keeping only the geometrical relations between the biological features that define the hand state: closed, partially open and open. Indeed, our system tracks the ends of tendons in the hand, which determine the range of motion of the fingertips and their relative positions.

**Challenges**

- Video stream
- Environment: background & lighting complexity
- Skin color range & color spaces
- Zero, one or two skin areas
- Different hands: orientations, poses & types

**Results**

- Pixel differences and then contours
- Among points (pink defects) find wrist & thumb
- Orientation and finger tips (+ tendon angles table)

**Implementation**

- Video Stream
- Video Frame
- Segmentation
- Motion Detection
- Skin Range
- Silhouettes
- Hand Detection
- Was hand detected?
- No
- Yes
- Hand gesture
- F1 F2 Diff
- T 40 -55 |15|
- I 72 -86 (+1)
- M 82 -98 (-1)
- R 91 -103 (+3)
- P 105 -119 (+1)

**Take-away Findings**

- Chirality (reflection symmetry) of the two helps us.
- Angles create a scale invariant template.
- The origin must be carefully selected, respecting the structure of the model: the center of the wrist, and not of the palm, is the morphological center of the hand.

“The purpose of this work is to present the hand not only to the eye [computer webcam], but to [our] understanding” (adapted from the Introduction of The Book of a Hundred Hands by George B. Bridgman)

**Hand References**

- Art vs. Computer Vision