



ROYAL INSTITUTE
OF TECHNOLOGY

Tivoli Technical Platform

July, 2014



- Project with Liquid Media and DART
- Children with communicative disabilities
- Games controlled through signing

► tivoli

- Real-time recognition of isolated signs
- Signer independent
- Robust
- Limited vocabulary
- Only 3 to 5 active signs at a time

We can apply such system in

- Human-computer interaction
- Human behavior analysis
- Sign language recognition



- Manual features
 - Hands
- Non-manual features
 - Mouth
 - Eyes
- Fingerspelling

$$\left\{ \begin{array}{l} \{LH_{position}, LH_{shape}\}_0 \rightarrow \dots \rightarrow \{LH_{position}, LH_{shape}\}_K \rightarrow \dots \rightarrow \{LH_{position}, LH_{shape}\}_N \\ \{RH_{position}, RH_{shape}\}_0 \rightarrow \dots \rightarrow \{RH_{position}, RH_{shape}\}_K \rightarrow \dots \rightarrow \{RH_{position}, RH_{shape}\}_N \end{array} \right\}$$

+

{ Gestures Vocabulary }

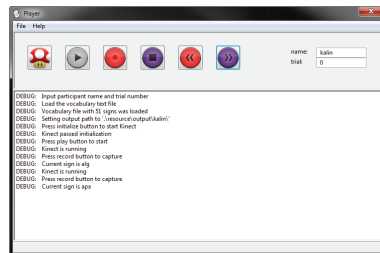
=

[Gesture Meaning]

https://www.youtube.com/watch?v=_eMq6yRZ600

- Video-based
 - Lighting conditions
 - Skin color
 - Background
- Depth-based
 - RGB-D data
 - Skeleton tracking
 - Face tracking

- Prompts (video and text)
- Rich control
- Raw Kinect data
- Automatic segmentation



Objects (17)	Colors (10)	Animals (13)	Attributes (11)
car, tractor, boat, book, ball, doll, computer, flashlight, guitar, watch, necklace, hat, key, patch, scissors, frame, drums	blue, brown, green, yellow, purple, orange, red, pink, black, white	moose, monkey, bear, dolphin, elephant, horse, camel, rabbit, cat, crocodile, lion, mouse, tiger	angry, happy, sad, small, dotted, striped, checkered, narrow, large, thick, tired

- 51 signs
- 4 groups

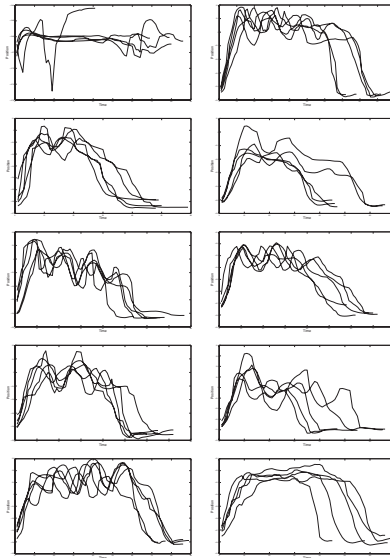
Experienced

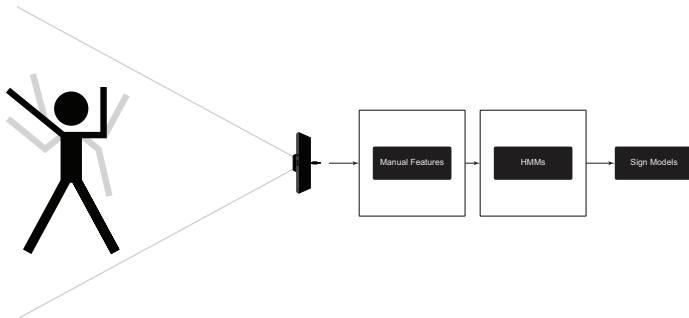
- 7 signers
- 1785 instances

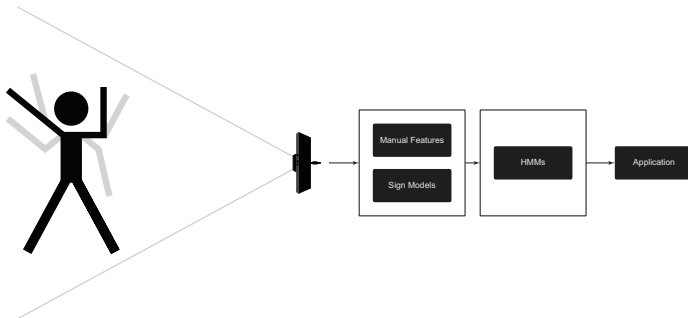
Unexperienced

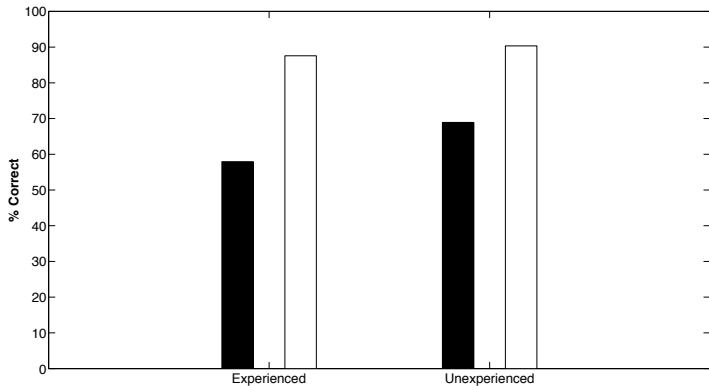
- 10 signers
- 2550 instances

► book ► guitar ► moose









Flexible, but “robot-like”

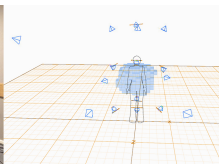
► rigid

High quality, but very time-consuming

► soft

Double sensor system

- Optical motion capture (16 cameras)
 - 100 Hz
 - 70 markers
- Gloves with bend sensors
- Hand model



▶ clown

▶ dolphin

▶ gorilla

▶ sentence