

Hand Gesture Recognition Using a Skeleton-based Representation with a Random Regression Forest

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Overview

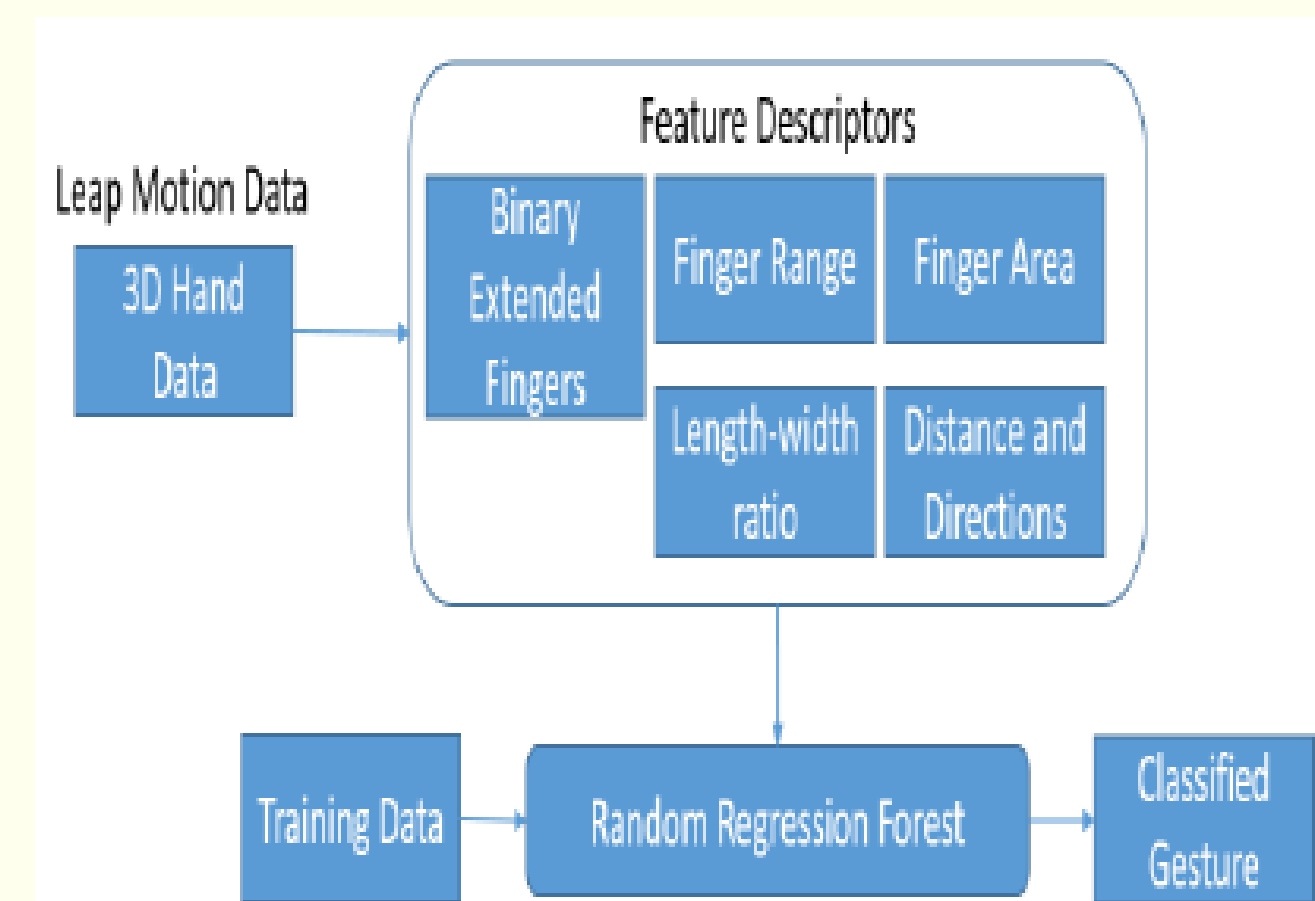


Figure 1. Gesture recognition overview.

Feature Descriptors

1. Extended Finger Binary Representation
2. Max Finger Range
3. Length-Width Ratio
4. Total Finger Area
5. Fingertip Directions and Distances

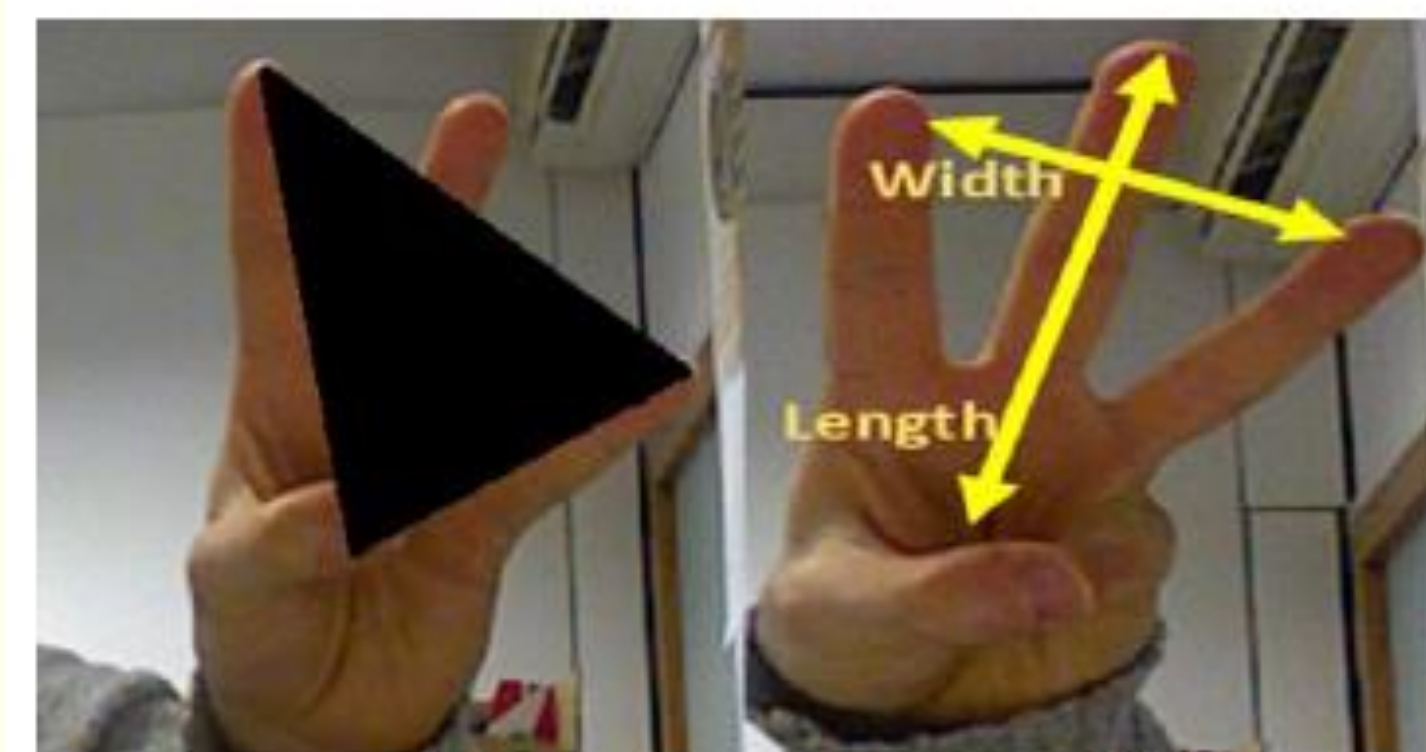


Figure 2. (a) Total finger area; (b) Finger length-width ratio.

New ASL Dataset



Figure 3. Samples from new dataset.

Table 1. New dataset features.

Feature	Data Type	Feature Type
Extended Fingers	Binary	Fingers (5)
Finger Directions	3D Vector	Fingers (5)
Fingertip Positions	3D Vector	Fingers (5)
Extended Fingertip Positions	3D Vector	Fingers (5)
Hand Direction	3D Vector	Hand
Palm Normal	3D Vector	Hand
Palm Position	3D Vector	Hand
Number of Fingers	Unsigned	Range (1-5)

Evaluation

Table 2. Comparison with Marin et al. [1][2].

Method	Classification
Marin et al. [1][2]	81.5%
Proposed w/binary rep.	100%
Proposed w/out binary rep.	81.71%

Table 3. Confusion Matrix of 24 letters of new ASL dataset.

	A	B	C	D	E	F	G	H	I	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	
A	139	1																							
B		139																							
C			139																						
D				138																					
E					1	139																			
F							1	139																	
G									137	3															
H											140														
I					2						137									1					
K												137										1	1	1	
L						1						139													
M													136								1			1	
N														138							1				
O															140										
P																140									
Q																	140								
R																		1			133		2		3
S						1															1	1			
T																						130	2	1	1
U																							134	2	1
V																							2	137	
W																									138
X																									140
Y																									

Conclusions

- Leap features are powerful descriptors
- Method outperforms state of the art
- New dataset w/classification rate of 98.36%

Acknowledgements

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References

1. Marin et al. "Hand gesture recognition with leap motion and Kinect devices," ICIP, 2014.
2. Marin et al. "Hand gesture recognition with jointly calibrated Leap motion and depth sensor," Multi. Tools and Apps., p.1-25, 2014.