2D HUMAN POSE ESTIMATION CALIBRATION AND KEYPOINT VISIBILITY CLASSIFICATION

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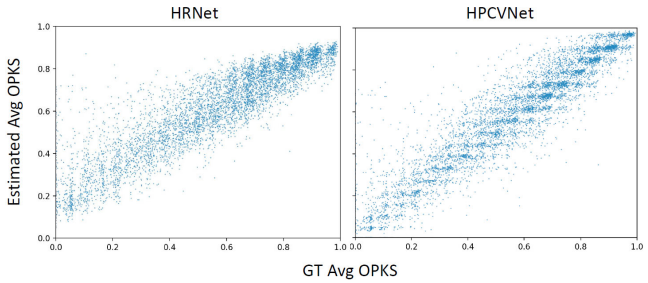
Motivation

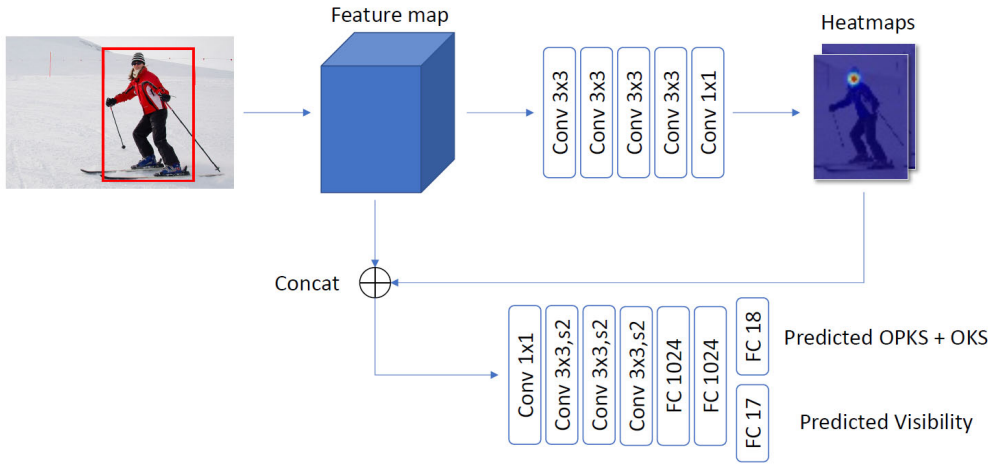
The confidence scores of 2D pose estimation are widely utilized in various fields, including multi-view 3D human pose estimation, skeleton-based human tracking, human action recognition, human re-identification, etc. Despite widespread use, confidence scores from 2D pose estimation methods are unreliable in indicating the accuracy of estimation results, particularly in occlusion situations, i.e., keypoints with high confidence scores may have low accuracy and vice versa.



The correlation between estimated accuracy and confidence score

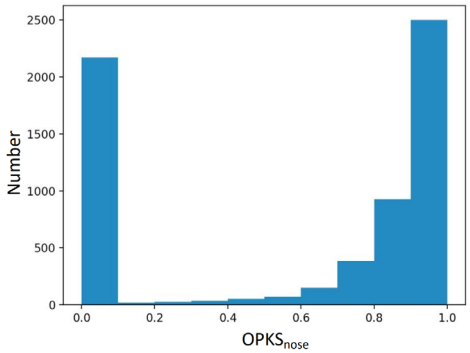
OPKS v.s. Confidence Score

Method



Object Per Keypoint Similarity(OPKS)

$$\mathbf{OPKS}_i = e^{-\frac{d_i^2}{2s^2\kappa_i^2}}\delta(v_i > 0)$$



The distribution of OPKS of nose

Visibility Prediction

	Acc	Precision	Recall	F1 Score
HPCVNet	89.4	87.6	97.0	92.1

The accuracy, precision, recall and F1 score of visibility classification.

We find it hard for the network to converge with only the score branch introduced above. The reason is illustrated in the figure on the left, which shows the majority of the ground truth OPKS scores are around 0 or 1, and only a small fraction lie in-between.

Experiment

Method	AP↑	AP.5	AP.75	AP(M)	AP(L)	AR↑	AR.5	AR.75	AR(M)	AR(L)
HRNet[14]	76.5	93.5	83.7	73.9	80.8	79.3	94.5	85.8	76.2	84.1
HRNet + OKS-Net[15]	77.5(1.0 ↑)	93.7	85.0	74.7	82.0	79.7	94.6	86.0	76.7	84.5
HRNet + HPCVNet	77.6(1.1 ↑)	93.7	85.0	74.5	81.9	79.7	94.7	86.1	76.5	84.6
ResNet50[1]	73.6	92.5	81.4	70.7	78.2	76.6	93.6	83.4	73.4	81.5
ResNet50 + HPCVNet	73.8(0.2 ↑)	92.6	81.7	70.6	78.4	76.6	93.4	83.3	73.3	81.4
Hourglass[20]	74.4	92.5	81.6	71.3	79.3	77.4	93.2	83.9	73.8	82.9
Hourglass + HPCVNet	75.1(0.7 ↑)	93.0	82.4	71.9	79.8	78.1	93.9	84.3	75.0	83.6

Experiments on COCO val dataset with ground truth bounding boxes. The flip test is enabled.

	HRNet	OKS-Net	HPCVNet
OKS Corr Coe	0.61	0.69	**0.71**

The correlation coefficient of estimated OKS and ground truth OKS.

	HRNet	HPCVNet
Avg. OPKS Corr Coe	0.897	**0.932**

The correlation coefficient of estimated average OPKS and ground truth average OPKS.