Human Pose Estimation

Group: 13

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Motivation/Objective



- Human Pose Estimation is a popular topic among researcher's groups.
- What is the need for Human Pose Estimation?
- Diverse applications in Visual Media
- Activity Recognition, Video-Surveillance, Clothing Parsing,
 Motion Tracking, Training Robots, VAI Fitness Coach.
- Human pose estimation can be achieved by joint localization, using Deep Learning Models, and henceforth Predicting the activity from 410 different classes.
- Dataset is reduced to 14, 20 and 50 classes amid lack of resources.

Challenges



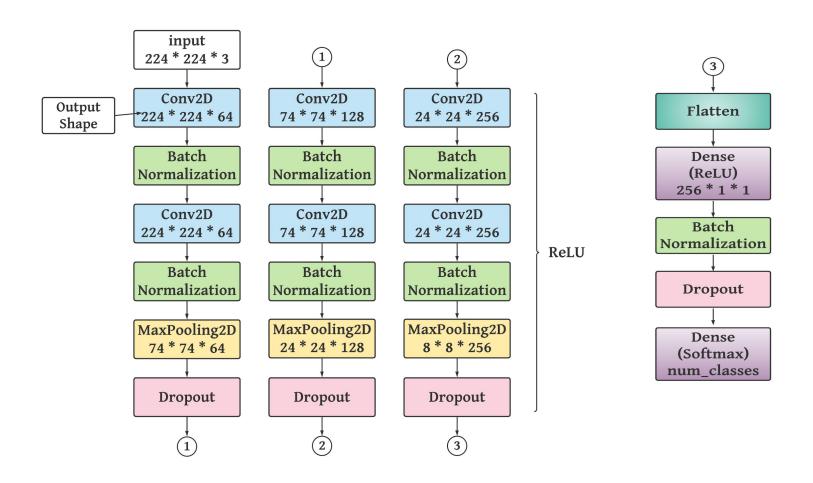






Best CNN Variant

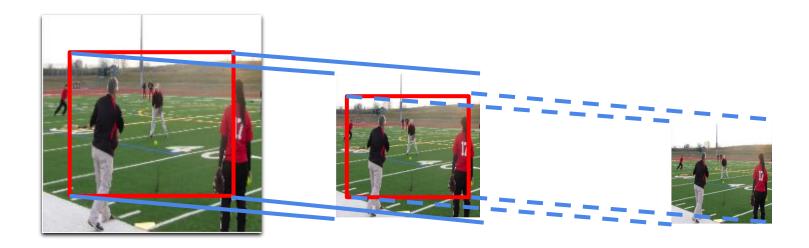




CNN Model Working



Proposed CNN model reduces image size after each pooling layer.



After final pool layer, model flatten() the results and dense layer architecture can be imposed. For compiling 'adam' optimizer with categorical cross-entropy and accuracy metrics is used.

Xception VGG19 VGG16 ResNet-50 224 x 224 RGB image 3x3 conv, 32 /2 3x3 conv, 64 3x3 conv, 64 7x7 conv, 64 /2 3x3 conv, 64 3x3 conv, 64 3x3 conv, 64 3x3 max pool, /2 max pool, /2 max pool, /2 3x3 sconv, 128 1x1 conv, 64 3x3 conv, 64 1x1 conv, 256 1x1 conv, 128/2 3x3 sconv, 128 3x3 conv, 128 3x3 conv, 128 3x3 max pool, /2 3x3 conv, 128 3x3 conv, 128 1x1 conv, 64 3x3 conv, 64 Filter Concat max pool, /2 max pool, /2 1x1 conv, 256 3x3 sconv, 256 3x3 conv, 256 3x3 conv, 256 1x1 conv, 256/2 3x3 sconv, 256 1x1 conv, 64 3x3 conv, 64 3x3 conv, 256 3x3 conv, 256 3x3 max pool, /2 1x1 conv, 256 3x3 conv, 256 3x3 conv, 256 Filter Concat 1x1 conv, 128/2 3x3 conv, 256 3x3 conv, 128 1x1 conv, 512 3x3 sconv, 728 max pool, /2 max pool, /2 1x1 conv, 728 /2 3x3 sconv, 728 1x1 conv, 128 3x3 conv, 512 3x3 conv, 512 3x3 conv, 128 3x3 max pool, /2 1x1 conv, 512 3x3 conv, 512 3x3 conv, 512 Filter Concat 3x3 conv, 512 3x3 conv, 512 1x1 conv, 128 3x3 conv, 128 1x1 conv, 512 3x3 sconv, 728 3x3 conv. 512 3x3 sconv, 728 max pool, /2 max pool, /2 3x3 sconv, 728 3x3 conv, 128 1x1 conv, 512 3x3 conv, 512 3x3 conv, 512 Filter Concat 3x3 conv, 512 3x3 conv, 512 1x1 conv, 256/2 3x3 conv, 256 3x3 sconv, 728 3x3 conv, 512 3x3 conv, 512 1x1 conv, 1024 1x1 conv, 1024/2 3x3 sconv, 1024 3x3 conv, 512 1x1 conv, 256 3x3 max pool, /2 3x3 conv. 256 max pool, /2 max pool, /2 1x1 conv, 1024 Filter Concat 4096 fc, ReLU 4096 fc, ReLU 3x3 conv, 256 3x3 sconv, 1536 4096 fc, ReLU 4096 fc, ReLU 1x1 conv, 1024 3x3 sconv, 2048 1000 fc, softmax 1000 fc, softmax 1x1 conv, 256 3x3 conv, 256 global avg pool 1x1 conv, 1024 1000 fc, softmax 1x1 conv, 256 3x3 conv, 256 1x1 conv, 1024 1x1 conv, 256 1x1 conv, 1024 1x1 conv, 512/2 3x3 conv, 512 1x1 conv, 2048 1x1 conv, 512 3x3 conv, 512 1x1 conv. 2048 1x1 conv, 512 3x3 conv, 512 1x1 conv, 2048 7x7 avg pool

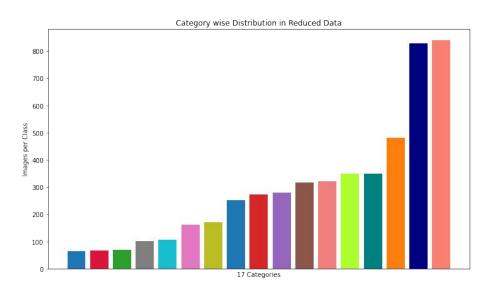
Baseline Models:

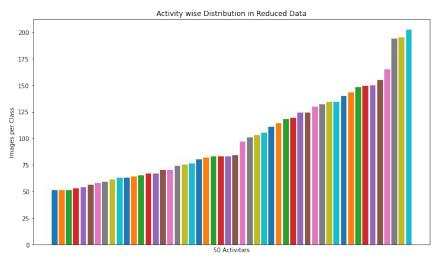


Dataset Description



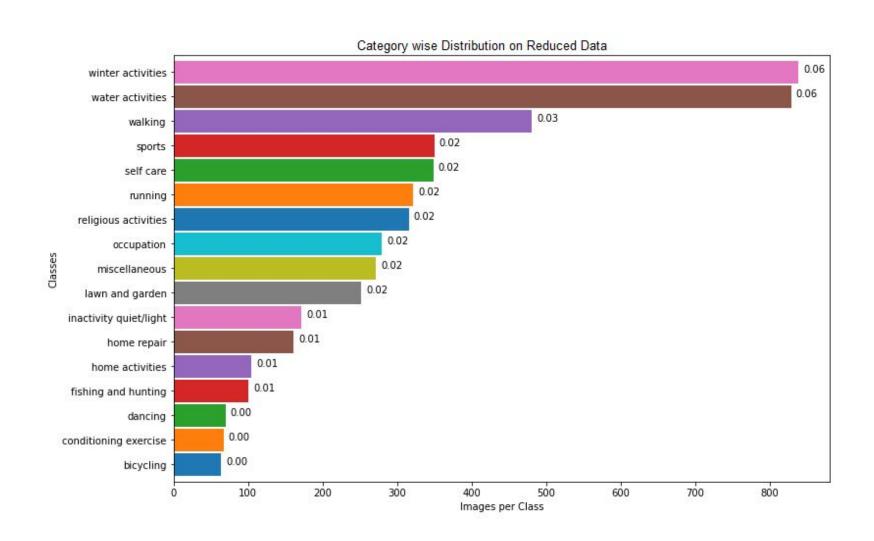
- The dataset used is MPII Human Pose Dataset.
- Dataset contains 25k images, with 20 categories and 397 activities.
- Due to computational challenges we reduce the dataset to 17 categories and three sets containing 14, 20 and 50 activities.





Category wise Distribution





Visualising Results





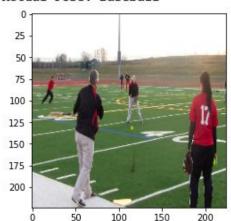


Original Joints on image

Predicted Joints on image

Joints Detection using Regression

Predicted Pose: Baseball Actual Pose: Baseball



Predicted Pose: Excercising & cardio Actual Pose: Bicycling



Classifications

Results



Classification Results

	CNN 1	CNN 2	CNN 3	VGG16	VGG19	Xception	ResNet50
14 Classes	69.69%	83.37%	69.10%	86.79%	90.33%	71.23%	91.04%
20 Classes	73.47%	79.48%	72.88%	81.18%	83.14%	91.18%	62.56%
50 Classes	57.75	73.57%	65.74%			82.18%	46.36%

Metrics used: Validation accuracy

Results



Regression Results

	CNN	ResNet50
PCP Metric	82.71%	86.36%
PCKh Metric	88.22%	88.84%

PCP: A limb is considered detected if the distance between the two predicted joint locations and the true limb joint locations is less than half of the limb length.

PCKh: A detected joint is considered correct if the distance between the predicted and the true joint is within a certain threshold. **PCKh** is when the threshold = 50% of the head bone link

Contributions



Palak Tiwari (MT20103): Literature surveys, Data augmentation, Data analysis, Xception model, Resnet50 for both classification and regression, visualisation of final output values for data augmentation models, report writing, baselines, results and analysis plotting and explaining.

Deepankar Kansal (MT20007): Literature surveys, Data preprocessing (reducing data for compatibility with google colab), CNN variants (2), Regression models (CNN), VGG19 for classification task, visualisation of final predicted output values for reduced data models, report writing, adding images to the report for better understanding, methodology.

Mohd. Naki (2018052): Literature surveys, CNN variants (1), VGG16 for classification, PCP and PCKh metrics and other evaluation results, report writing, adding visualising results in code files, literature review writing.



Thank you