Analysis of Body Pose using Machine Learning

Kamasali Gayathri

Department of Computer Science, Sri Venkateswara University, Tirupati

***Abstract*—** *Human pose estimation localizes body key points to accurately recognizing the postures of individuals given an image. This step is a crucial prerequisite to multiple tasks of computer vision which include human action recognition, human tracking, human-computer interaction, gaming, sign languages, and video surveillance. Here we present a Human pose estimation which localizes body to accurately recognizing the postures of individuals given an image. A single or multi-person pose estimation based on the number of people needed to be tracked. Then gradually the approaches used in human pose estimation are described before listing some applications and also flaws facing in pose estimation. Here we used to use image dataset the Machine learning techniques are used to estimate the human body pose. With the recent and high accurate network named as open neural network exchange are utilized to estimate the body pose. Based on Machine learning techniques to analysis the body pose is a main objective of the system. A center of attention is given on briefly discussing researches with a significant effect on human pose estimation and examine the novelty, motivation, architecture, the procedures (working principles) of each model together with its practical application and drawbacks, datasets implemented, as well as the evaluation metrics used to evaluate the model. This review is presented as a baseline for newcomers and guides researchers to discover new models by observing the procedure and architecture flaws of existing researches.*

I. INTRODUCTION

Human pose estimation is one of the challenging fields of study in computer vision which aims in determining the position or spatial location of body key points (parts/joints) of a person from a given image or video. Thus, pose estimation obtains the pose of an articulated human body, which consists of joints and rigid parts using image-based observations. Human pose estimation refers to the process of inferring poses in an image and these estimations are performed in either 3D or 2D. Here we present a Human pose estimation which localizes body to accurately recognizing the postures of individuals given an image. A single or multi-person pose estimation based on the number of people needed to be tracked. Then gradually the approaches used in human pose estimation are described before listing some applications and also flaws facing in pose estimation. Here we used to use image dataset the Machine learning techniques are used to estimate the human body pose. Where the recent and high accurate network named as open neural network exchange are utilized to estimate the body pose. Solving the problems and challenges related to human pose estimation has been advanced and progressed remarkably with the help of deep learning and publicly available datasets. This survey provides a summary of these works comprehending up to date information and points the future research directions. Like some remarkable surveys, this paper also provides a general concept of human pose estimation. It can be used as a guideline for people who are new to this concept and helps them to define noble models by combining the network structures of the existing models. Additionally, it helps researchers to compare their work with significant models based on deep learning.

II. LITERATURE REVIEW

Plant Disease Detection and Classification by Deep Learning.

M. H. Saleem, J. Potgieter (2019)

In this article, the paper demonstrated the Machine Learning (ML) models for the detection and classification of plant diseases but, after the advancements in a subset of ML, that is, Deep Learning (DL), this area of research appears to have great potential in terms of increased accuracy. Many developed/modified DL architectures are implemented along with several visualization techniques to detect and classify the symptoms of plant diseases. Moreover, several performance metrics are used for the evaluation of these architectures/techniques. This review provides a comprehensive explanation of DL models used to visualize various plant diseases.

A Comparative Study of Fine-Tuning Deep Learning Models for Plant Disease Identification.

E. C. Too, L. Yujian, S. Njuki (2019).

In this article, the paper analyses the fine-tuning and evaluation of state-of-the-art deep convolutional Neural Networks for image-based plant disease classification. An empirical comparison of the deep learning architecture is done. The architectures evaluated include VGG 16, Inception V4, ResNet with 50, 101 and 152 layers and DenseNets with 121 layers.

The data used for the experiment is 38 different classes including diseased and healthy images of leafs of 14 plants from plant Village. Fast and accurate models for plant disease identification are desired so that accurate measures can be applied early. Thus, alleviating the problem of food security. In our experiment, DenseNets has tendency's to consistently improve in accuracy with growing number of epochs, with no signs of overfitting and performance deterioration. Moreover, DenseNets requires a considerably a smaller number of parameters and reasonable computing time to achieve state-of-the-art performances. It achieves a testing accuracy score of 99.75% to beat the rest of the architectures.

A Database of Leaf Images-Practice Towards Plant Conservation with Plant Pathology.

S. S. Chouhan, A. Kaul (2019)

In this article, the paper analyses the study of plant growth and its management. Twelve economically and environmentally beneficial plants have been selected for this purpose. Leaf images of these plants in healthy and unhealthy conditions have been acquired and alienated among two separate classes. We have collected about 4503 images of which contain 2278 images of healthy leaf and 2225 images of the diseased leaf. Further, we hope that this study can be beneficial for researchers and academicians in developing methods for plant identification, plant classification, plant growth monitoring, leaf disease diagnosis, etc. Finally, the anticipated impression is towards a better understanding of the plants to be planted and their appropriate management.

Multilayer Convolution Neural Network for The Classification of Mango Leaves Infected by Anthracnose Disease.

U. P. Singh, S. S. Chouhan, S. Jain (2019)

In this article, the paper proposed the multilayer convolutional neural network (MCNN) is proposed for the classification of the Mango leaves infected by the Anthracnose fungal disease. This paper is validated on a real-time dataset captured at the Shri Mata Vaishno Devi University, Katra, J&K, India consists of 1070 images of the Mango tree leaves. The dataset contains both healthy and infected leaf images. The results envisage the higher classification accuracy of the proposed MCNN model when compared to the other state-of-the-art approaches.

Factors Influencing the Use of Deep Learning for Plant Disease Recognition.

J. G. A. Barbedo (2018)

In this article, we present an investigation into the main factors that affect the design and effectiveness of deep neural nets applied. An in-depth analysis of the subject, in which advantages and shortcomings are highlighted, should lead to more realistic conclusions on the subject. The arguments used throughout the text are built upon both studies found in the literature and experiments carried out using an image database carefully built to reflect and reproduce many of the conditions expected to be found in practice. This database, which contains almost 50,000 images, is being made freely available for academic purposes.

Deep Learning Models for Plant Disease Detection and Diagnosis

K. P. Ferentinos (2018)

In this article, the paper implemented the convolutional neural network models were developed to perform plant disease detection and diagnosis using simple leaves images of healthy and diseased plants, through deep learning methodologies. Training of the models was performed with the use of an open database of 87,848 images, containing 25 different plants in a set of 58 distinct classes of [plant, disease] combinations, including healthy plants. Several model architectures were trained, with the best performance reaching a 99.53% success rate in identifying the corresponding [plant, disease] combination (or healthy plant). The significantly high success rate makes the model a very useful advisory or early warning tool, and an approach that could be further expanded to support an integrated plant disease identification system to operate in real cultivation conditions.

Tomato Crop Disease Classification Using Pre-Trained Deep Learning Algorithm.

A. K. Rangarajan, R. Purushothaman (2018)

In this article, the paper demonstrated the images of tomato leaves (6 diseases and a healthy class) obtained from Plant Village dataset is provided as input to two deep learning-based architectures namely AlexNet and VGG16 net. In order to counteract the problem early diagnosis of diseases using a fast reliable non-destructive method will benefit the farmers. The role of number of images and significance of hyper parameters namely mini batch size, weight and bias learning rate in the classification accuracy and execution time have been analyzed.

Detection of Plant Leaf Diseases Using Image Segmentation and Soft Computing Techniques.

V. Singh and A. K. Misra (2017)

In this article, we present an algorithm for image segmentation technique which is used for automatic detection and classification of plant leaf diseases. It also covers survey on different diseases classification techniques that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection in plant leaf disease, is done by using genetic algorithm.

Using Deep Learning for Image-Based Plant Disease Detection

S. P. Mohanty, D. P. Hughes (2016)

In this article, we present the public dataset of 54,306 images of diseased and healthy plant leaves collected under controlled conditions, we train a deep convolutional neural network to identify 14 crop species and 26 diseases (or absence thereof). The trained model achieves an accuracy of 99.35% on a held-out test set, demonstrating the feasibility of this approach. Overall, the approach of training deep learning models on increasingly large and publicly available image datasets presents a clear path toward smart phone-assisted crop disease diagnosis on a massive global scale.

Plant Disease Detection Using Image Processing.

S. D. Khirade and A. B. Patil (2015)

In this article, the paper discussed the methods used for the detection of plant diseases using their leaves images. This paper also discussed some segmentation and feature extraction algorithm used in the plant disease detection. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and also require the excessive processing time. Hence, image processing is used for the detection of plant diseases. Disease detection involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification. The experimental result shows the better results, when compared to the other system.

Problem Definition: Plant disease, especially crop plants, is a major threat to global food security since many diseases directly affect the quality of the fruits, grains, and so on, leading to a decrease in agricultural productivity. Farmers have to observe and determine whether a leaf was infected by naked eyes. This process is unreliable, inconsistent, and error prone. Identification of plant disease is very difficult in agriculture field. If identification is incorrect then there is a huge loss on the production of crop and economical value of market. Leaf disease detection requires huge amount of work, knowledge in the plant diseases, and also require the more processing time. So, we can use image processing for identification of leaf disease in MATLAB. Identification of disease follows the steps like loading the image, contrast enhancement, converting RGB to HSI, extracting of features and deep learning technique. Agriculture has special importance in that it is a major source of food and clothing and is an important economic source for countries. Agriculture is affected by a variety of factors, biotic such as diseases resulting from bacteria, fungi, and viruses and non-biotic such as water and temperature and other environmental factors. Therefore, the development of a computer-based system that detection the diseases of plants is very helpful for farmers. The proposed plant disease detection system consists of five phases, in a series of processing that include first use pre-processing techniques such cropping, resizing, fuzzy histogram equalization, next segmented and extract a set of color and texture feature and used to great the knowledge base that used as training data for support vector machine classifier.

Drawbacks

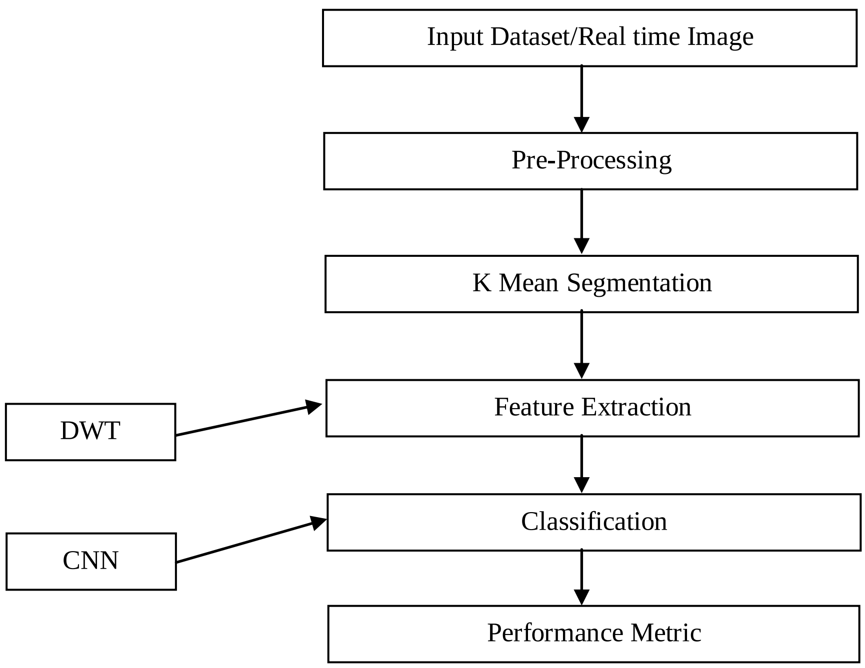
- The most of existing methods has ignored the poor-quality images like images with noise or poor brightness.
- Less accuracy compared to proposed method.
- Lot of Noises Obtained in the plant diseases.

III. PROPOSED WORK

Plant diseases are the main cause of quantity and quality losses in agricultural production. These losses negatively impact the production cost as well as the profit of the stakeholders in agriculture. However, a tool for quick and accurate recognition remains scarce. The welfare and livelihoods of farmers as well as the food supply and the nutrition security of a nation are severely threatened should any kinds of disease outbreaks happen. Traditionally, farmers and plant pathologists use their eyes to detect diseases and make decisions based on their experiences, which is often not accurate and sometimes biased since in the early stage many types of diseases appear to be the same. Also, their experiences need to be passed down generations by generations. This approach leads to the unnecessary use of pesticides, which in turn results in higher production cost. Based on these pieces of evidence, the need for an accurate disease detector associated with a reliable database to help farmers is necessary, especially for the case of young and inexperienced ones. Advances in computer vision pave the way for this with the state-of-the-art Deep learning (DL) or machine learning (ML) algorithms. There is also a need for an early disease detection system to protect the crop in time. In our proposed method, the specialized deep learning models were developed, based on specific convolutional neural networks architectures, for the detection and classification of plant diseases through leaves images of healthy or diseased plants. Our detector applied to the images captured in-place by various camera devices/images taken from dataset and also collected from various resources. Our experimental results and comparisons between various deep-architectures with dwt feature extractors that demonstrated how our deep-learning-based detector is able to successfully recognize different categories of diseases in various plants using CNN classification and segmented the leaves using k mean clustering technique to identify the diseases.

Advantages

- High accuracy is obtained and time consumption for detecting.
- More datasets are included.
- High performances.



IV. IMPLEMENTATION

4.1 Input Data

The samples are collected from various places in An Giang province, which is known as one of the places with the largest productions of mango in Vietnam. The leaves were collected when blobs started to appear, they were taken from the tree and their images were taken in the same day. The images are captured using a camera in the resolution of 3096 × 3096 pixels with no background. To collect the image in the plant format to detect the disease in the given input data.

4.2 Preprocessing

Since the leaves have different sizes, it is necessary to perform rescaling to ensure the training and testing image have the same dimension. Rescaling is performed to compress the original images to lower resolution ones, 256 × 256 pixels to be exact. First, the original image is segmented and converted to binary one to find the minimum bounding box. The vertical size of the bounding box was used to rescale to 256 pixels to ensure the top and bottom leaf fit exactly to the top and bottom of the scaled image. The horizontal size of the bounding box will be used to shift the leaf image into the exact center of the scaled image. The results can be found in the system. Due to various contrasts in the leaf region, the contrast enhancement method is used to change pixel intensities which benefit in case of providing more information in some areas of an image. Many contrast enhancement methods have been widely applied to improve the quality of the image.

4.2.1 Image Acquisition

First we need to select the plant which is affected by the disease and then collect the leaf of the plant and take a snapshot of leaf and load the leaf image into the system or otherwise to import the plant image to detect the disease from the data.

4.2.2 Converting RGB to HSI

The RGB image is in the size of M-by-N-by-3,where the three dimensions account for three image planes(red, green, blue).if all the three components are equal then conversion is undefined. Generally, the pixel range of RGB is [0,255] in the pixel range is [0, 1].Conversion of pixel range can be done by calculating of the components; Hue, Saturation, Intensity.

4.3 Segmentation

Segmentation means representation of the image in more meaningful and easier to analyze way. In segmentation a digital image is partitioned into multiple segments can defined as super-pixels. Image segmentation is the process of separating or grouping an image into different parts. There are currently many different ways of performing image segmentation, ranging from the simple thresholding method to advanced color image segmentation methods. These parts normally correspond to something that humans can easily separate and view as individual objects. Computers have no means of intelligently recognizing objects, and so many different methods have been developed in order to segment images. The segmentation process is based on various features found in the image. This might be color information, boundaries or segment of an image. Segmentation of leaf image is important while processing image from that Segmentation means partitioning of image into various part of same features or having some similarity. The segmentation can be done using various methods like k-means clustering.

4.3.1 k-means clustering

This algorithm is used to cluster/divide the object based on the feature of the leaf in to k number of groups. This is done by using the Euclidean distance metric. Using k-means algorithm at first random two centers or pixels chosen from the infected leaf. The centers represent the faulty and faultless regions of the leaf. It based on similar kind of featured weights. It is to identify the infected cluster by a specific type of disease, of the sample leaf. Now for all the pixels the nearest center is calculated and assigned to the corresponding centers. At this stage, the new two centers calculated using the assigned pixels and the algorithm goes back to the previous step. This iterative process followed until the centers stabilize.

- User should select the value of k. k means the number of clusters/groups, i.e. the image is divided in to k number of clusters.
- Every pixel is assigned to its nearest centroid (k).
- The position of centroid is changed by means of data values assigned to the group. The centroid moves to the centre of its assigned points. Out of these three clusters classification is done for only one cluster which has affected area.

4.4 Feature Extraction

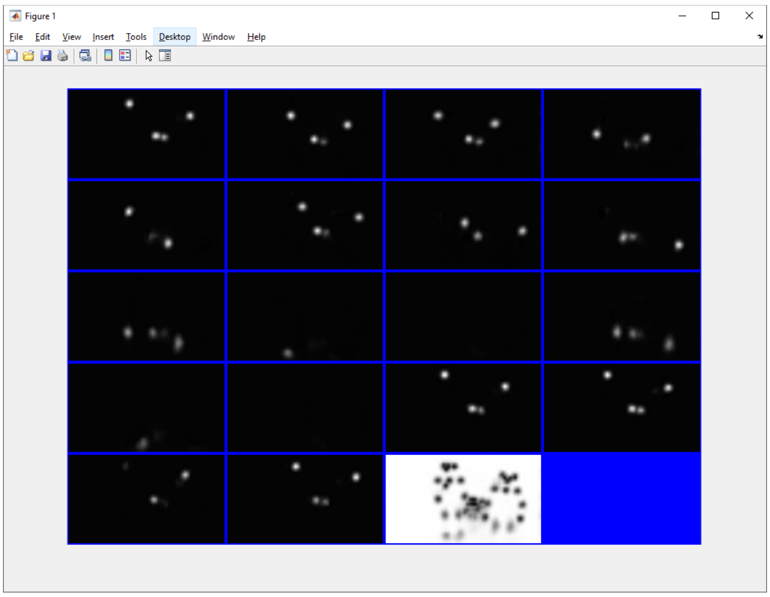
The feature extraction is done in Images. The feature extraction from image is added in the suggested system. A new automatic method for disease symptom segmentation in digital photographs of plant leaves. The diseases of different plant species have mentioned. Classification is done for few of the disease names in this system. The disease recognition for the leaf image is performed in this work. Feature extraction plays an important role for classification of an image. In many applications feature extraction of image is used. Color, texture, morphology, edges etc. are the features which can be used in plant disease classification, texture means how the color is distributed in the image, the roughness, hardness of the image. In this paper considers color, texture and morphology as a feature for disease detection. They have found that morphological result gives better result than the other features. It can use for identify the infected plant leaf of classification plant image. A Feature Extraction can be obtained in the DWT model.

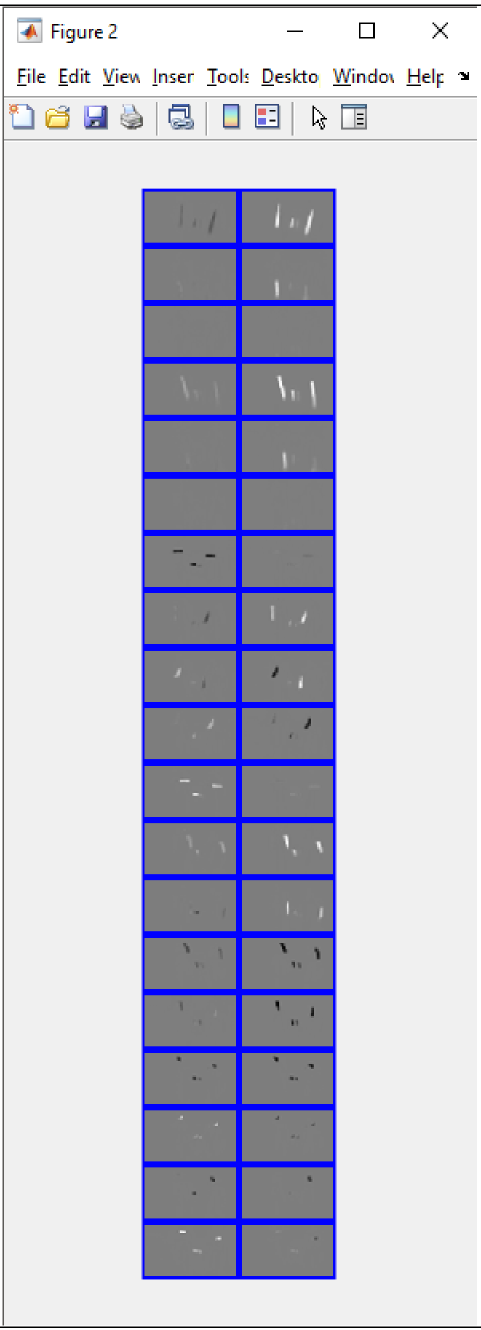
4.4.1 DWT

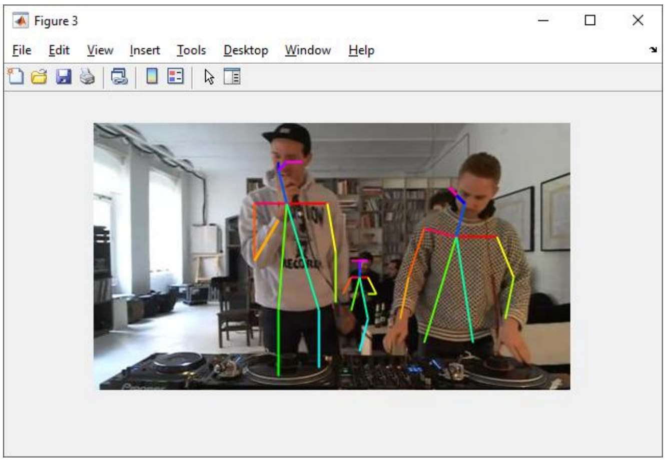
DWT means Discrete Wavelet Transforms. DWT provides both frequency and local resolution. In Fourier analysis, the Discrete Fourier Transform (DFT) decompose a signal into sinusoidal basis functions of different frequencies. No information is lost in this transformation; in other words, we can completely recover the original signal from its DFT (FFT) representation. In wavelet analysis, the Discrete Wavelet Transform (DWT) decomposes a signal into a set of mutually orthogonal wavelet basis functions. These functions differ from sinusoidal basis functions in that they are spatially localized – that is, nonzero over only part of the total signal length. Furthermore, wavelet functions are dilated, translated and scaled versions of a a common function φ, known as the mother wavelet.

4.5 Classification

A classification can be obtained in the CNN models, namely AlexNet [30], VGG16 [31], ResNet (ResNet-50 variant). In this work, we kept the original architecture of these CNN and only modified the last fully-connected layer of them to four nodes, according to the four classes in our problem. We also perform transfer learning to fine-tune the models to enhance their performances. Transfer learning (TL) is a solution for the lack of training data in deep learning. TL means using the knowledge from a specific task to solve another correlated task. In deep learning, TL helps the model learn the features from a large dataset so that it performs better on a relevant dataset but may be smaller in size, and this method has shown effectiveness in image classification task. In our work, the models are first trained on the Plant Village dataset. This dataset has a huge amount of data and allows the convolutional layers of the models to learn similar features effectively. Based on the Plant Village dataset, pre-trained models are created, then the models are trained one more time on our dataset to calibrate the models. The cross-entropy is applied as a loss function to estimate the error prediction after the classification layer. An identification of variety of leaf diseases using various data mining techniques is the potential research area. The diseases of different plant species have mentioned. Classification is done for few of the disease names in this system. The concept CNN network for classification is used in this system. Finally, the Performance analysis can be obtained. The Experimental results show the better results, when compared to other system.







V. CONCLUSION

This study summarizes major image processing used for identification of leaf diseases are k-means clustering, deep learning. This approach can significantly support an accurate detection of leaf disease. There are five steps for the leaf disease identification which are said to be image acquisition, image pre-processing, segmentation, feature extraction, classification. By computing amount of disease present in the leaf, we can use sufficient number of pesticides to effectively control the pests in turn the crop yield will be increased. We can extend this approach by using different algorithms for segmentation, classification. By using this concept, the disease identification is done for all kinds of leafs and also the user can know the affected area of leaf in percentage by identifying the disease properly the user can rectify the problem very easy and with less cost. The approach developed outperformeddeep learning models such as VGG, AlexNet, ResNet-50 obtain the result. Furthermore, the MLP network is much smaller, therefore, leads to faster performance. This is preferable since we want to implement this algorithm on resource-constrained devices such as smartphones. The Experimental results obtain the better results, when compared to the other system.

REFERENCES

[1] H. Xu, E. G. Bazavan, A. Zanfir, W. T. Freeman, R. Sukthankar,and C. Sminchisescu, “Ghum&ghuml: Generative 3d humanshape and articulated pose models,” in CVPR, 2020.

[2] M. Dantone, J. Gall, C. Leistner, and L. Van Gool, “Human poseestimation using body parts dependent joint regressors,” in CVPR,2013.

[3] G. Gkioxari, B. Hariharan, R. Girshick, and J. Malik, “Using k-poselets for detecting people and localizing their keypoints,” in CVPR, 2014.

[4] A. S. Micilotta, E.-J. Ong, and R. Bowden, “Real-time upper bodydetection and 3d pose estimation in monoscopic images,” in ECCV,2006.

[5] A. Toshev and C. Szegedy, “Deeppose: Human pose estimationvia deep neural networks,” in CVPR, 2014.

[6] X. Chen and A. L. Yuille, “Articulated pose estimation by agraphical model with image dependent pairwise relations,” inNeurIPS, 2014.

[7] A. Newell, K. Yang, and J. Deng, “Stacked hourglass networks forhuman pose estimation,” in ECCV, 2016.

[8] J. Tompson, R. Goroshin, A. Jain, Y. LeCun, and C. Bregler,“Efficient object localization using convolutional networks,” inCVPR, 2015.

[9] S.-E. Wei, V. Ramakrishna, T. Kanade, and Y. Sheikh, “Convolu-tional pose machines,” in CVPR, 2016.

[10] T. Pfister, K. Simonyan, J. Charles, and A. Zisserman, “Deepconvolutional neural networks for efficient pose estimation ingesture videos,” in ACCV, 2014