REAL TIME
HUMAN POSE ESTIMATION

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PROJECT SYNOPSIS

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ABSTRACT

Real Time Human Pose Estimation is a task of using machine learning model to estimate the pose of a person from an image or a video by estimating the spatial locations of key body joints that is called keypoints.

This step is a crucial prerequisite to multiple tasks of computer vision which include human action recognition, human tracking, human-computer interaction, gaming, and video surveillance. Therefore, we present this synopsis to fill the knowledge gap and shed light on 2D human pose estimation.

A brief introduction is followed by classifying it as 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 flaws facing in pose estimation.

A centre of attention is given on detecting the pose in browser using free open source in built TensorFlow libraries i.e., p5.js, ml5.js.

Following with, the motivation, the acknowledgement, the procedures (working principles) of the model together with its application and drawbacks. We present a detailed analysis based on experiments, practical experience and better performance on academic benchmarks of diverse real-world images.

MOTIVATION

The main motivation behind this project synopsis is identifying the difficulties faced on detecting individual body joints involving multi-person such as the number of people in the image, the interaction between these people, irregular scale for each individual.

On the other hand, the goal of our Human Pose Estimation machine learning models is to track, building and detect the 17 pose keypoints. And further that keypoints can be used for personal training yoga application, Motion capture application, Athlete pose detection to improve their technique and achieve better results and several other such real-life applications.

ACKNOWLEDGEMENT

This project consumed a huge amount of work, research and dedication. Still, implementation would not have been possible if we did not have the support from our team members, organizations and free open source in built Tensor Flow libraries.

Therefore, we would like to extend sincere gratitude to all of them. First of all, we are thankful to our teachers for their logistical support and for providing necessary guidance concerning project implementation. We are also grateful to them for provision of expertise, and technical support in the implementation. Without their supervision, knowledge and experience, the Project would lag in quality of outcomes, and thus their support has been essential.

We would like to express our sincere thanks towards researchers who devoted their time and knowledge in the implementation of Human Pose Detector along with their research paper.

Nevertheless, we express our gratitude toward our families and colleagues for their kind cooperation and encouragement which help us in completion of this project.

OBJECTIVES

The aim is to deliver the basic use cases of the Pose Net model for real-time human pose estimation using a webcam feed as the data. Now, the challenge is to create an advanced webcam filter that has detection functionalities that rival advanced tools like the Snapchat camera.

We selected the pose net model for our purpose and learned about its pros and cons over other models. Our aim is to set up the PoseNet model along with TensorFlow.js in a React project from the TensorFlow library.

The main objective of human pose estimation is to localize human anatomical keypoints or joints. (For Example. head, shoulder, elbow, wrist, etc.) A web application that knows how to estimate what pose a participant found at (stand, squat, pushup). Count how many repeats a participant has done.

The objective is to introduce human pose estimation model, then classified pose estimation based on tracing the number of people as a single or multi-person. Furthermore, approaches used in pose estimation and discuss its applications.

INTRODUCTION

Pose estimation is a computer vision technique that predicts and tracks the location of a person or object. This is done by looking at a combination of the pose and the orientation of a given person/object.

There is total 17 keypoints that are used by algorithm to estimate the pose of human body. Human pose estimation is one of the challenging fields of study which aims in determining the position or spatial location of body parts/joints of a person.

Human pose estimation and gesture recognition are attractive research topics in computer vision and robotics owing to their many applications, including human computer interaction, game control and surveillance.

Pose estimation can be done either in 2D or in 3D. 2D pose estimation predicts the key points from the image through pixel values. Whereas 3D pose estimation refers to predicting the three-dimensional spatial arrangement of the key points as its output.

Human pose estimation methods can be classified into two categories: model-based and learning-based approaches. In model-based approaches, prior knowledge of a human body model is required, and in learning-based approaches human poses are directly estimated from input images with various machine learning algorithms.

Planning of work

These are steps that should be followed to achieve the real time human pose estimation in browser using different libraries.

1. Setting up dependencies

First, we need to install the dependencies needed for project.

```
import * as tf from "@tensorflow/tfjs";
import * as posenet from "@tensorflow-models/posenet";
import Webcam from "react-webcam";
```

2. Setup webcam and canvas

Next, we're going to set up our webcam and a canvas to view the webcam.

```
const webcamRef = React.useRef(null);
const canvasRef = React.useRef(null);
```

3. Detecting the webcam

Next, we need to create a function that grabs the video properties and handles the video adjustments.

4. Loading the PoseNet model

In this step, we're going to load the pre-trained PoseNet Model that we installed and imported earlier.

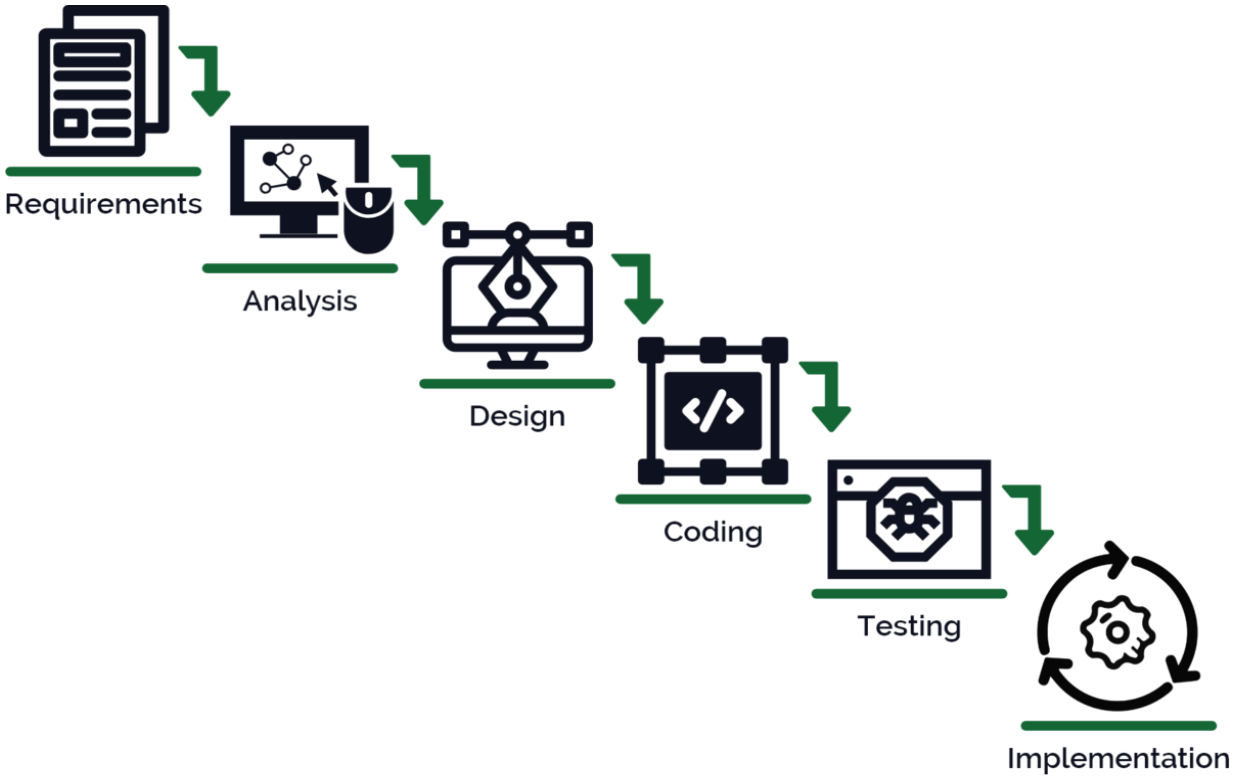
5. Drawing Utilities from TensorFlow

In this step, we are going to start drawing the pose estimation key points on our canvas in order to demonstrate that our model works well.

6. Draw functions

Here, we're going to implement a function called draw Result that shows the pose estimation results on the canvas.

Project Life Cycle:



Figma design for the web browser:

Figma is a powerful design tool that helps us to create anything i.e., websites applications. Here is a link of user interface design for the website that we will create to detect the pose.

https://www.figma.com/proto/IwBTcGW9T4qGUhQMAbepp8/Human-Pose-Estimation?node-id=210%3A67&scaling=contain&page-id=0%3A1

System Description

FACILITIES REQUIRED:-

1. Hardware Requirements:-

- Laptop or PC
- i3 Processor System Or higher
- 4GB RAM or higher
- 100GB ROM or higher
- ANDROID DEVICE
- CPU enabled system(e.g. NVIDIA)

2. Software Requirement:-

- Web Browser
- Windows 7 or higher
- Text Editor (Visual Code or Sublime Text)

3. Technology Used:-

a) Computer Vision, Machine Learning

b) Web technologies (Html, Css, JavaScript)

c) Java Script Libraries are as follows

- Tensor Flow
- Ml5.js
- P5.js

Applications

One of the clearest areas in which pose estimation is applicable is in tracking and measuring human movement. Using human pose estimation to track human movement could also power several other experiences such as

1. **AI-powered sports coaches and Personal Trainers**
    - Zenia is an AI-powered yoga app that uses HPE to guide you towards achieving a proper posture during your yoga workouts.
2. **Workplace activity monitoring**
    - Pose estimation is highly valued in surveillance systems in the big data.
3. **Crowd counting and tracking**
    - E.g., for retail outlets measuring foot traffic
4. **Athlete Pose Detection:**
    - Pose detection can help players to improve their technique and achieve better results.
5. **Augmented reality experiences**
6. **Animation And Gaming**
7. **Robotics**

Bibliography

1. S. C. Babu, "A 2019 guide to Human Pose Estimation with Deep Learning". AvailableOn:https://nanonets.com/blog/human-pose-estimation-2d-guide/

2. Dan oved, at google creative lab, real-time human pose estimation in the browser with tensorflow.js.
   Available On: https://blog.tensorflow.org/2018/05/real-time-human-pose-estimation-in.html

3. Journals & Magazines, Volume: 8. The progress of human pose estimation: a survey and taxonomy of models applied in 2d human pose estimation.
   Available On: https://ieeexplore.ieee.org/document/9144178

4. Nilesh Barla, A Comprehensive Guide to Human Pose Estimation
   Available On: https://www.v7labs.com/blog/human-pose-estimation-guide

5. A book by Lauren McCarthy, Getting Started with p5.js.