SLOUCHING DETECTION

POSENET

- Basic PoseNet Implementation (easy to launch)
- Comparison to OpenPose (*failed to train*)
- Advanced techniques to detect slouching

The main task is to detect whether there is an issue with *slouching*.
PoseNet architecture is readily available.

17 Pose Keypoints
Returned by PoseNet

right eye   left eye
right ear   left ear
nose

right shoulder   left shoulder

right elbow   left elbow

right wrist   left wrist

right hip   left hip

right knee   left knee

right ankle   left ankle

TECHNOLOGY STACK

```
                          sketch.js:30
▼ [{…}] ⓘ
  ▼ 0:
    ▼ pose:
      ▼ keypoints: Array(17)
        ▼ 0:
            part: "nose"
          ▶ position: {x: 333.86939183466853,…
            score: 0.9998891353607178
          ▶ __proto__: Object
        ▶ 1: {score: 0.9985862970352173, part…
        ▶ 2: {score: 0.9994685053825378, part…
        ▶ 3: {score: 0.987489640712738, part:…
        ▶ 4: {score: 0.27920833230018616, par…
        ▶ 5: {score: 0.15140201151371002, par…
        ▶ 6: {score: 0.9321960210800171, part…
        ▶ 7: {score: 0.08810921758413315, par…
        ▶ 8: {score: 0.026458490639925003, pa…
        ▶ 9: {score: 0.012835525907576084, pa…
        ▶ 10: {score: 0.0021892657969146967, …
        ▶ 11: {score: 0.0009441504953429103, …
        ▶ 12: {score: 0.0039046627935022116, …
        ▶ 13: {score: 0.0037153097800910473, …
        ▶ 14: {score: 0.00886093731969595, pa…
        ▶ 15: {score: 0.0013940914068371058, …
        ▶ 16: {score: 0.000588216062169522, p…
          length: 17
        ▶ __proto__: Array(0)
        score: 0.32336704771595953
      ▶ __proto__: Object
    ▶ skeleton: []
```

PoseNet (Coordinates + Confidence Level)

p5.js (Graphics)

ml5.js (Pre-Trained Models + API)

DETECTION PRINCIPLES

- A simple horizontal line acting as a *point of reference,* to detect vertical slouching.

- Angle between two lines, to detect side slouching

$$\text{atan2}(y, x) = \begin{cases} 2\arctan\left(\dfrac{y}{\sqrt{x^2+y^2}+x}\right) & \text{if } x > 0 \text{ or } y \neq 0, \\ \pi & \text{if } x < 0 \text{ and } y = 0, \\ \text{undefined} & \text{if } x = 0 \text{ and } y = 0. \end{cases}$$

- A reference body part can be changed within a line of code

- Coordinates of different body parts are obtained via PoseNet

- To be helpful, a sound is played if the permissible angle exceeds certain threshold (30°)

slouchAngle
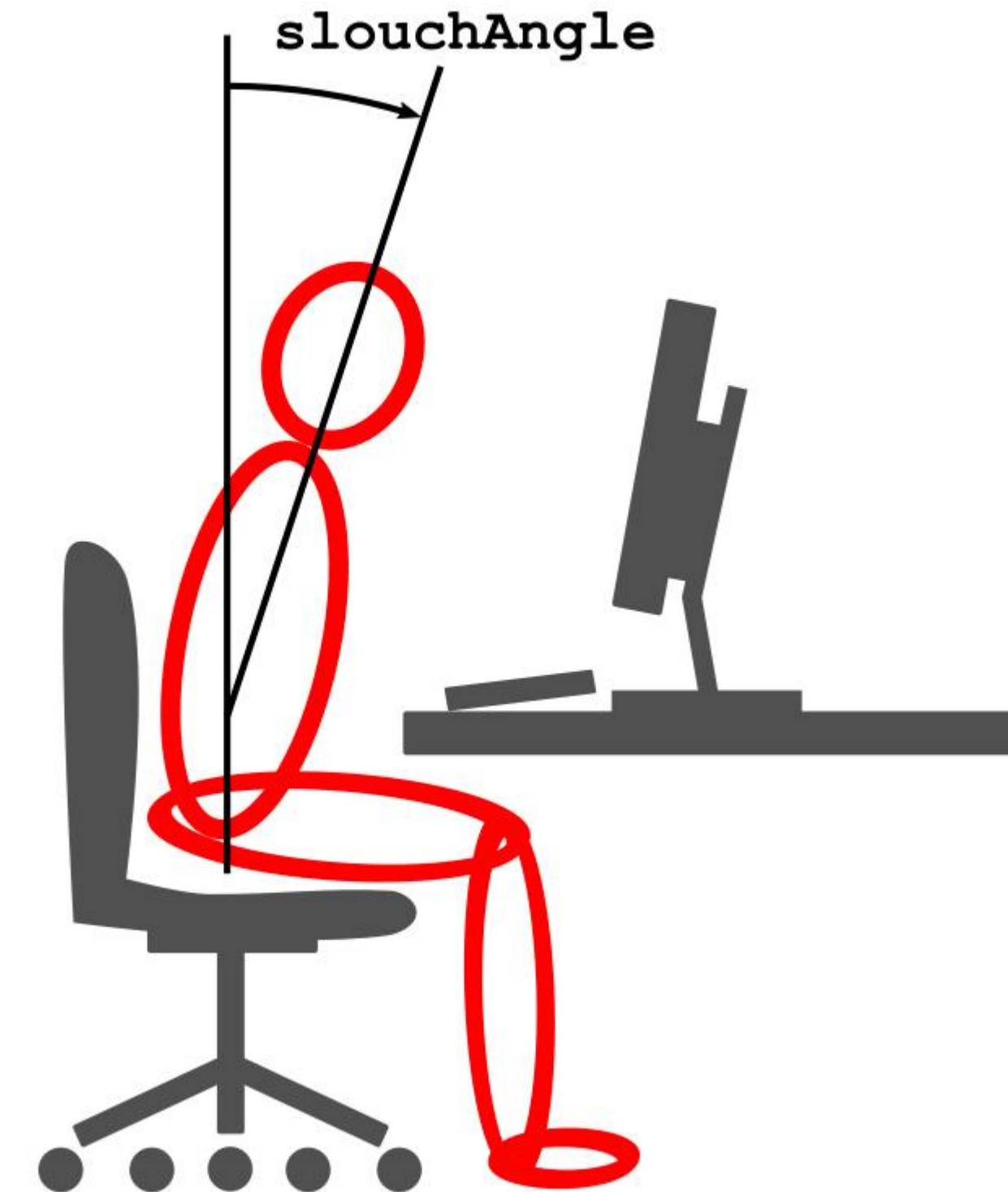
NB! This PoC does not take movements into account, position is assumed to be static.

THANKS FOR YOUR ATTENTION!