

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



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)



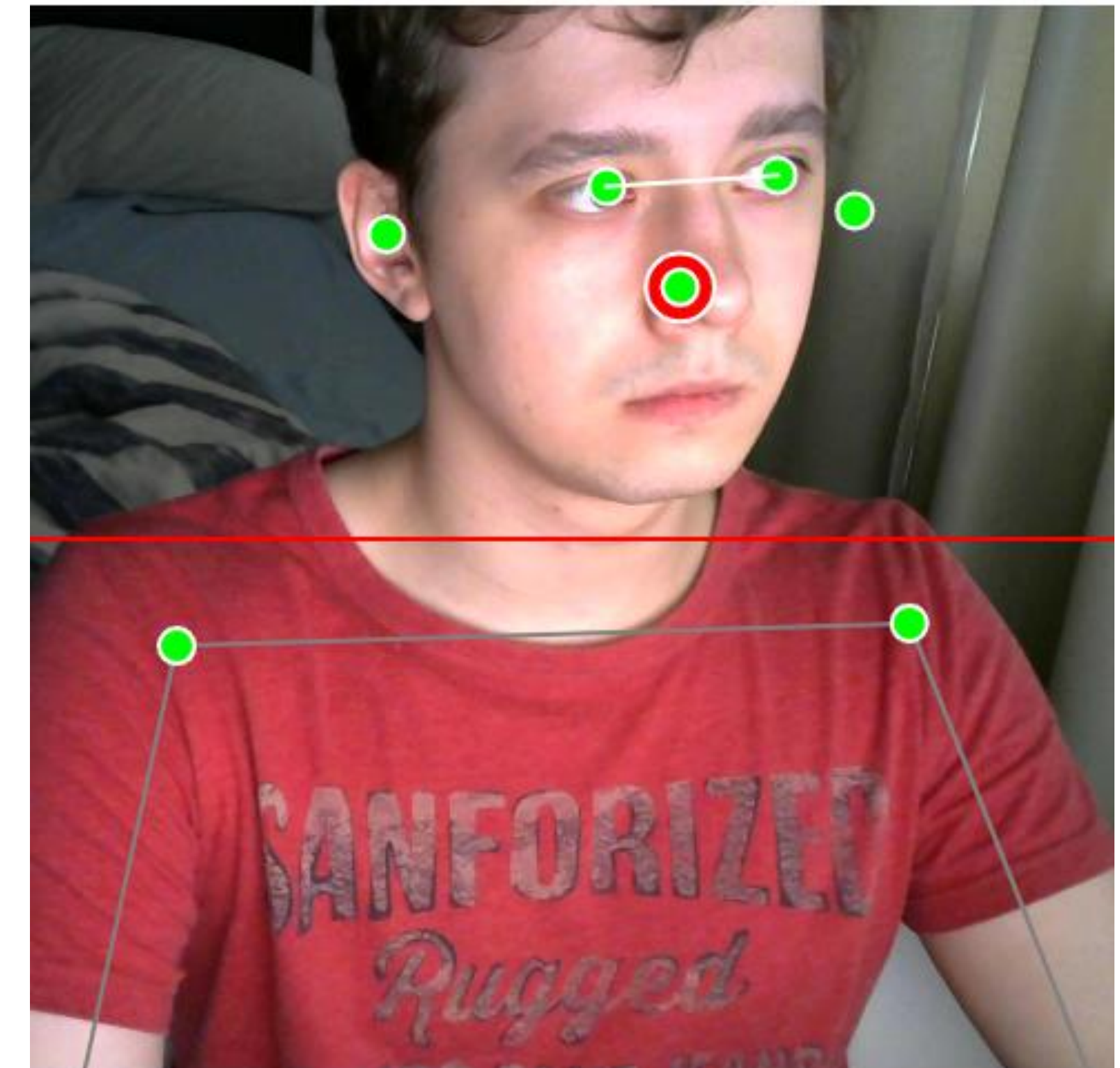
ml5.js (Pre-Trained Models + API)

DETECTION PRINCIPLES

- A simple horizontal line acting as a *point of reference*, to detect vertical slouching.
- Angle between two lines, to detect side slouching

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

- 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°)



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

THANKS FOR YOUR ATTENTION!