Dime cómo te sientas y el Computer Vision + Python te dirán cómo puedes mejorar

Detecting bad posture with your webcam + Python + OpenCV

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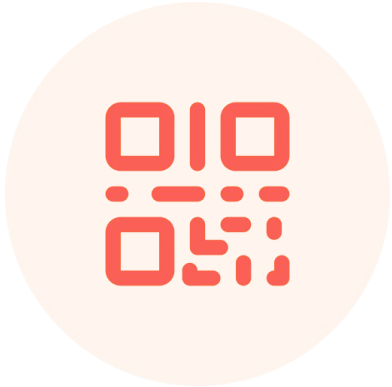

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¿Quién es Teo Restrepo?

- PhD Applied Mathematics
- Trabajé como Quant ~ (Data Scientist en Finanzas)
- Bancolombia
- LaHaus - Head of ML ~ 3 años
- Machine Learning @LaHaus
  - Recomendaciones
  - Lead Scoring
  - Inventory Quality
    - Imágenes
    - Duplicados
  - SEO

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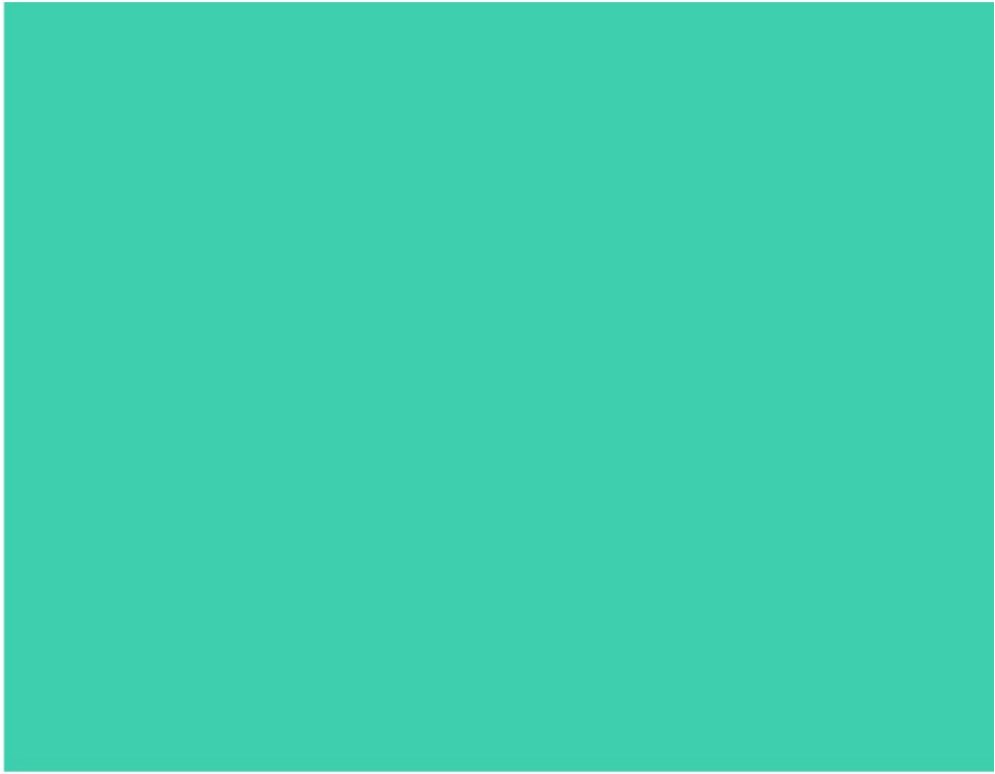
Outline

- Motivation / Problem
- An idea for a solution
- Computer vision concepts
- Implemented solution
- References



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Motivation

Most of us adopt a bad posture whenever we sit in front of a computer...

This is called slouching

This can have terrible consequences for out health and well being!

www.alliedtravelcareers.com › blog ▾ Traducir esta página

8 Negative Effects of Bad Posture - Allied Travel Careers

13 nov. 2019 - Because the body is in a slouched position in **bad posture**, this position puts extra pressure and stress on the upper body. Lower back pain is the ...

health.usnews.com › Wellness ▾ Traducir esta página

10 Ways Poor Posture Can Harm Your Health | Wellness | US ...

1 feb. 2018 - She was right. "**Poor posture** can have many negative **effects** on your health," says Dr. Kenton Fibel, a family medicine physician specializing in ...

www.thebackstore.com › blog › 5-... ▾ Traducir esta página

5 Dangers of Poor Posture — and How to Fight Back | Blog

While most people are aware of the common problems of **poor posture**, such as neck and back pain, they don't realize that the issues can extend much further. In ...

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I wish...

there was a device to help me correct my posture...

Upright GO Original | Posture Trainer and Corrector for Back | Strapless,

US$ 79.95

US$ 1
= $4.000 COP
= $22 MXN
= $100 ARS

An Idea

Detecting when I slouch =

1. Measuring the vertical position of my face

2. Detecting when it deviates from a reference position

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CV: Computer vision (*visión artificial*)

- Subfield of AI that develops computerized methods to gain **high-level understanding** of images and videos

- **Extracting meaningful information** from images and videos that can be used to **drive decisions**

- **CV Prototypical tasks**
  - Classification
  - Object Detection
  - Landmark extraction
  - Recognition
  - Segmentation
  - Optical flow measurement

Computer Vision tasks 1/6: Object Classification

- Given an image of a single object ...
- tell me **what** the object is

- `def classify(x: Image) -> String`

x = 

`y = classify(x) = “hotdog”`

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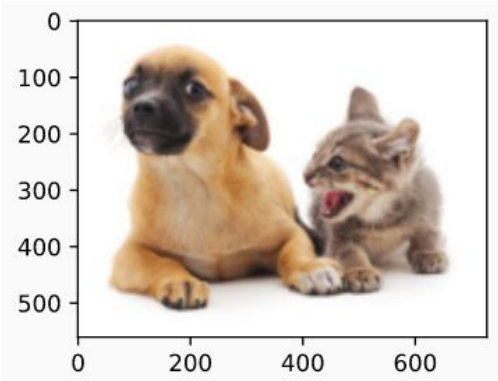
Computer Vision tasks 2/6: Object detection

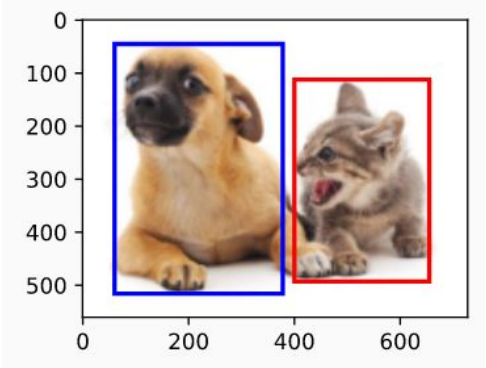
- Given an image of many objects tell me
- **1. WHAT they are, and**
- **2. WHERE (in the picture)** they are

```
def detect(x: Image) -> Array[LabeledBoundingBox]
```

x =



y = detect(x) =




```
= [LabeledBBox(what="dog", coords=[ 60,  45, 378, 516]),
   LabeledBBox(what="cat", coords=[400, 120, 700, 490])]
```

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Si modelamos la tarea de detección en imágenes como una función que recibe un objeto de tipo Imagen como entrada y retorna un valor u objeto Y, ¿cuál sería el tipo de Y?

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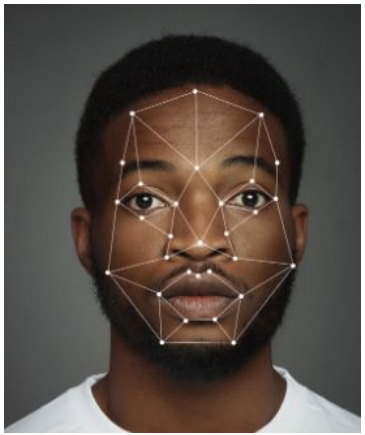
Computer Vision tasks 3/6: Face landmark detection

- Given an image of a *face* detect key points within it.

  e.g eye corners, nose, lips, etc…

- `def face_lm_detect(x: Image) -> Array[LabeledPoint]`

x =



```
y = face_lm_detect(x) =
    [LabeledPoint("left-cheek", coords=[60, 45]),
     LabeledPoint("left-eye"  , coords=[50, 50]), …
     # and many more ]
```

Applications:

- emotion detection
- recognition
- human/computer interfacing

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¿Cuál de las siguientes no es una aplicación de la tarea *face landmark detection*?

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Computer Vision tasks 4/6: Recognition

- Given an picture of a person and a database of people
- tell me **who** is in the picture

```
def recognize(x: Image, db: PeopleDB)-> PersonId|Null
```

x =

```
y = recognize(x)
  = PersonId(1233123)
    # Barack Obama
```


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Computer Vision tasks 5/6: Segmentation

- Given an picture of size (M, N) ...
- produce a “map” (of the same size) labeling each pixel with an “object” class

```
def segment(x: Image[M,N])-> PixelLabeling[M,N]
```

x =

y =segment(x) =

Application: self-driving cars!

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Si el input para la tarea de Image Segmentation es una imagen de dimensiones (M, N), entonces la salida será un arreglo de dimensiones:

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Computer Vision tasks 6/6: Optical Flow measurement

- Given a **video**....
- tell me how fast the objects in it are **moving**

```
def measure_flow(frame1: Image, frame2: Image)
    -> FlowField[M,N]
```

Demo: https://www.youtube.com/watch?v=LjjJQ81RbX0

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Implemented solution: SlouchDetect

Key ingredients:

- **Python bindings to OpenCV library**
  - Capture images directly from webcam
  - Face detection functionality
- **Pygame library**
  - show an annotated image from camera feed + annotations
  - play an alert sound when slouching

SlouchDetect: pseudo-code

```
while True:
    image = capture_img( camera )

    face_bbox = detect_face_with_open_cv2( image )

    face_y = measure_face_vertical_position( face_bbox )

    if first_iteration:
        reference_y = face_y
    else:
        slouching_y = face_y - reference_y

        if slouching_y > THRESHOLD:
            sound_alert()
```


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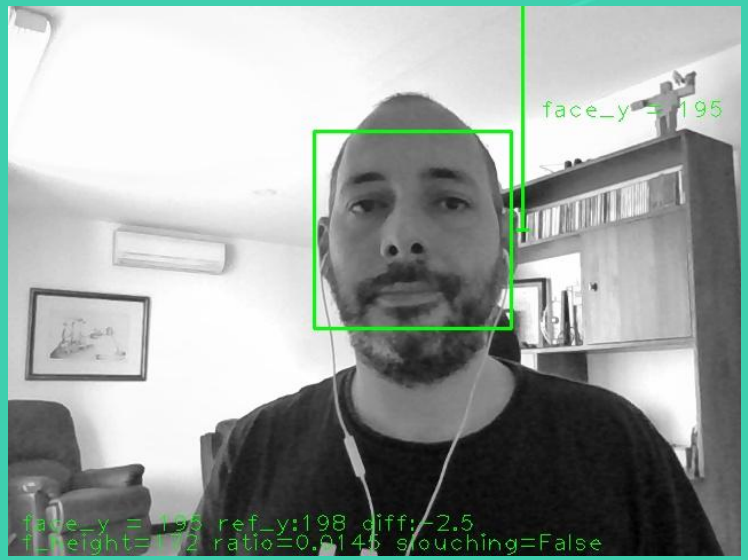
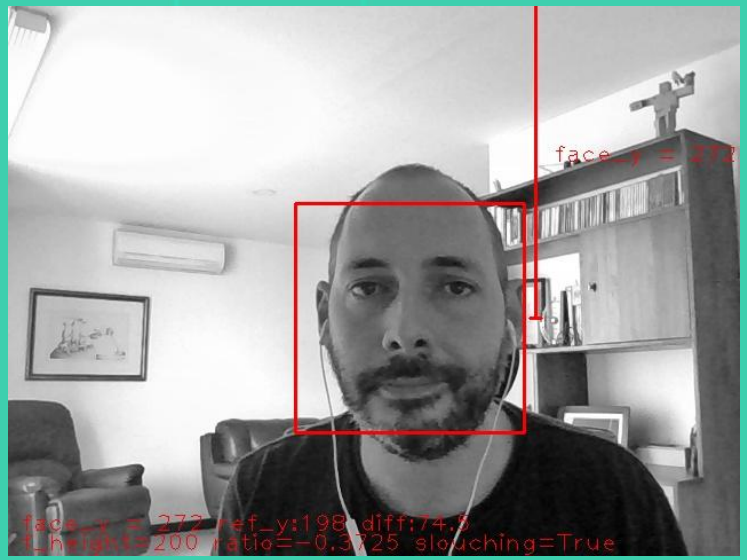
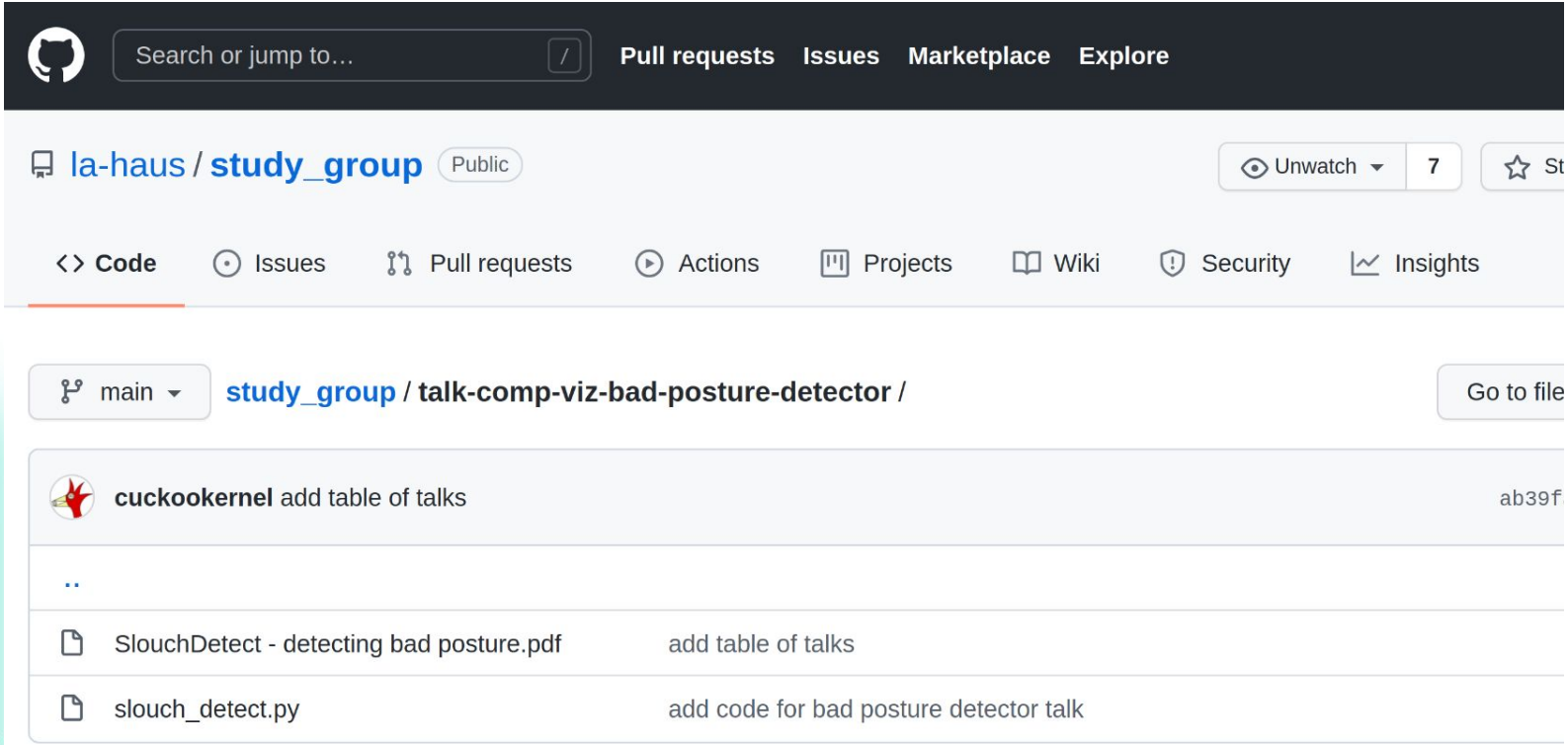
Visualizing SlouchDetect





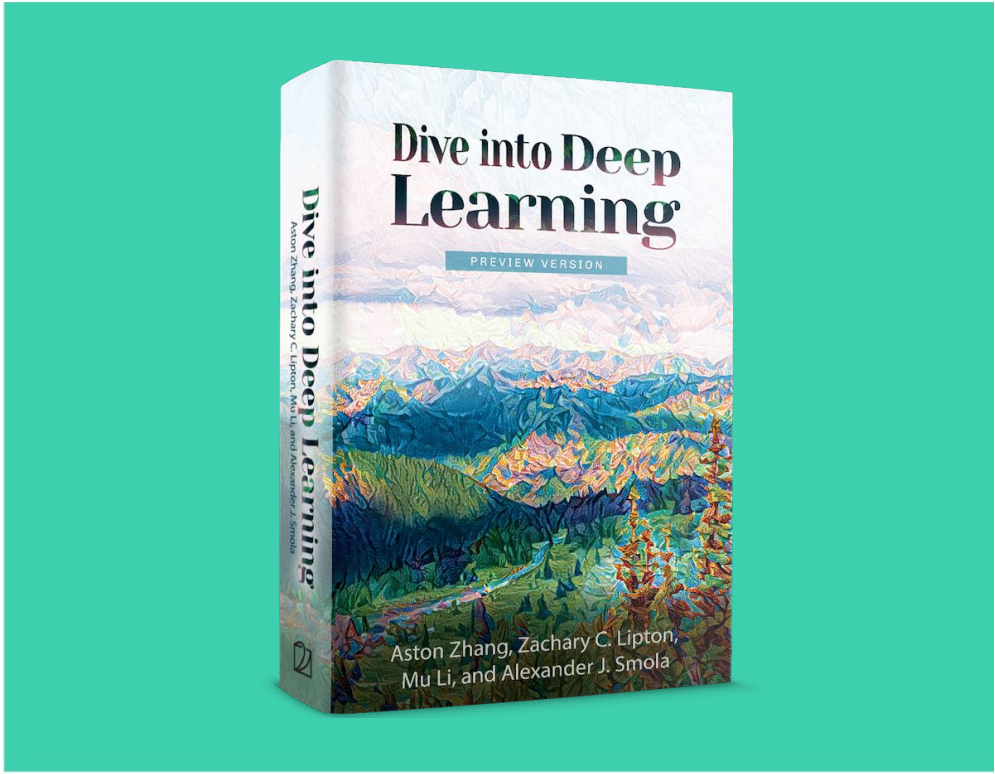
SlouchDetect: the actual code

Check it out here on github:[la-haus/study_group/talk-comp-viz-bad-posture…]



Tutorials, MOOCs

- Interactive book / tutorial on deep learning https://d2l.ai
- Convolutional neural networks https://www.coursera.org/learn/convolutional-neural-networks?specialization=deep-learning
- https://www.udacity.com/course/computer-vision-nanodegree--nd891



Quirky applications

- AWS service that guesses a person's age from a picture:
- Measuring pulse from a regular video
- AI discovers the heart beat in your faces (Blog)
- AI Baby Monitor that detects breathing

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¿Cuál de las siguientes no es o no contiene una aplicación de CV como parte de su implementación?

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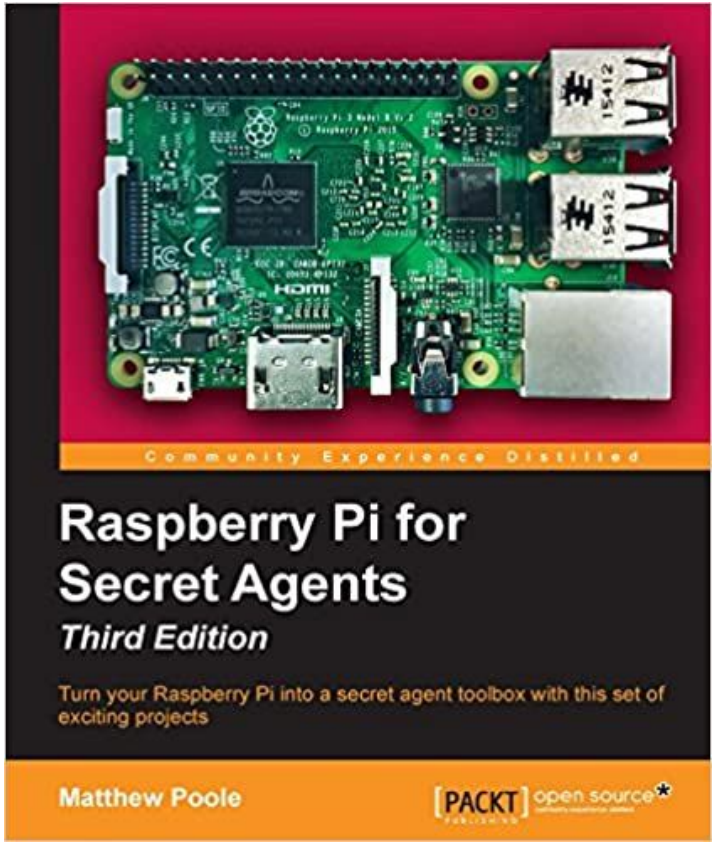
A cool book:



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Open CV

- https://opencv.org/
- OpenCV Python Tutorials
- Face detection via Cascade Classifiers in OpenCV

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Según Teo, ¿cuál sería el concepto más importante de las ciencias de la computación y también de las matemáticas?

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