TIME READER

Introduction to Computational and Biological Vision

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PROJECT'S GOAL

Reading the time of an analog clock

APP'S BENEFITS

- Matching pictures with the time being taken from a video or CCTV if consisting a clock in the background. The app can help organize the pictures in a chronological order and therefore, help the officers, or whoever in need, to be more efficient.
- Find irregularities in CCTV videos, and detect if the camera was being tampered.
- Kids nowadays are not exposed to analog clocks, and therefore lack the skill of reading an analog clock. With the app, kids will be able to read time.
- The app can be used as an educational resource for people to self educate how to read an analog clock.
- Helping people with dysgraphia to read time.

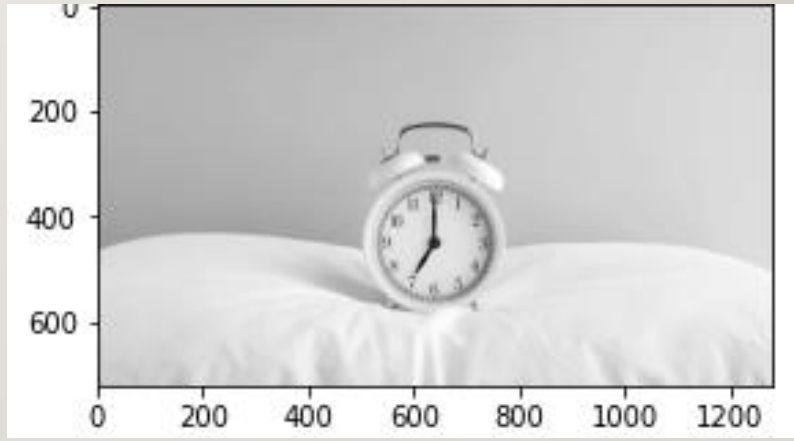
SO… HOW DOES IT WORKS ?

CALCULATION STEPS:

- Image processing
- Clock detection
- Image cropping & resizing
- Hands detection
- Hands filtering and classifying
- Time calculation

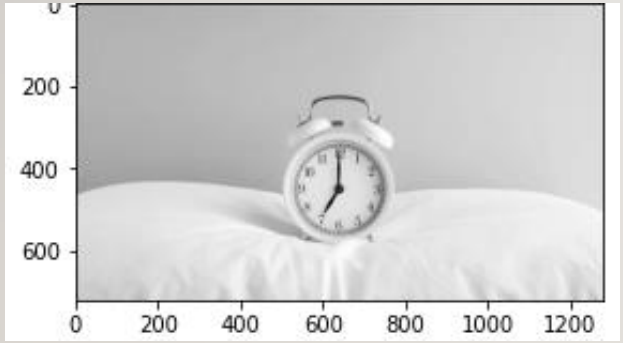
IMAGE PROCESSING

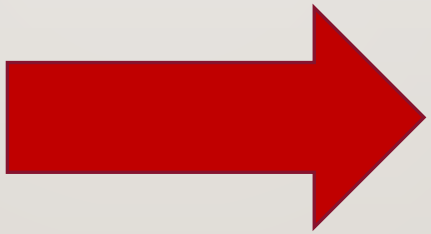
Reading an image, and converting it to a grayscale representation.



CLOCK DETECTION

Detecting the frame of the clock.





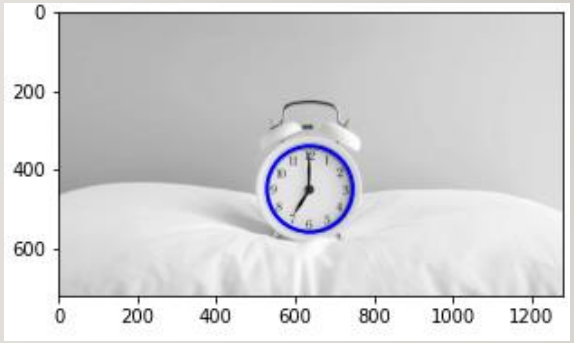
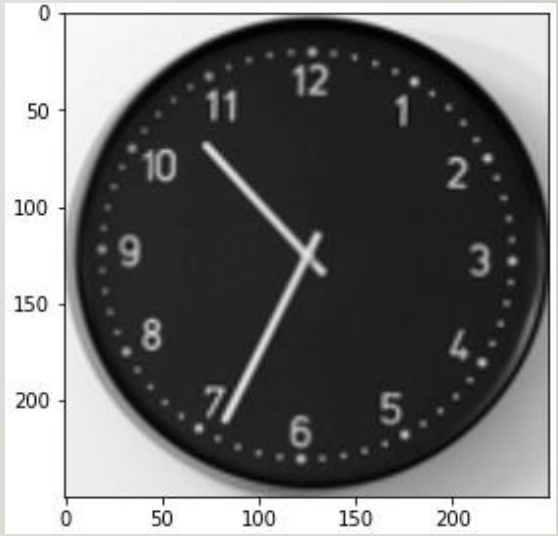


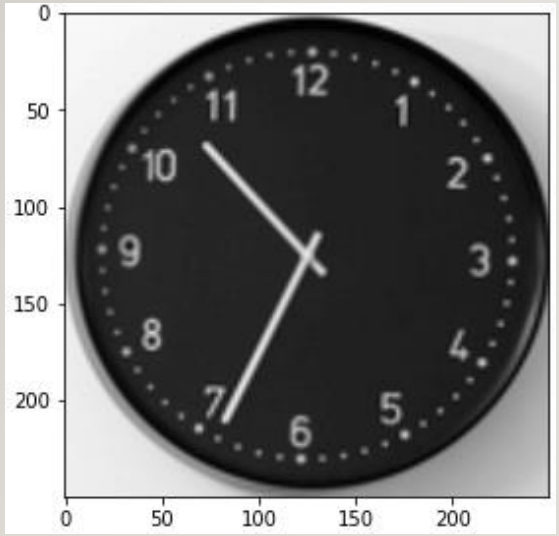
IMAGE CROPPING & RESIZING

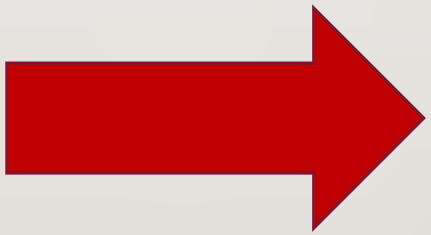
Centralize the middle of the clock to be the middle of the image, and resize it to a uniform size

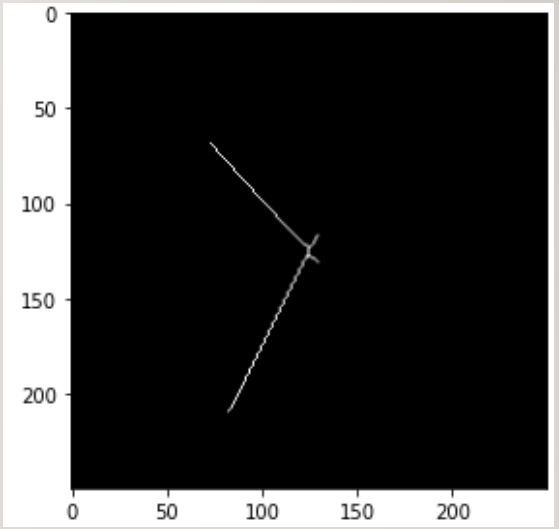


HANDS DETECTION

Extracting the hands contours of the clock

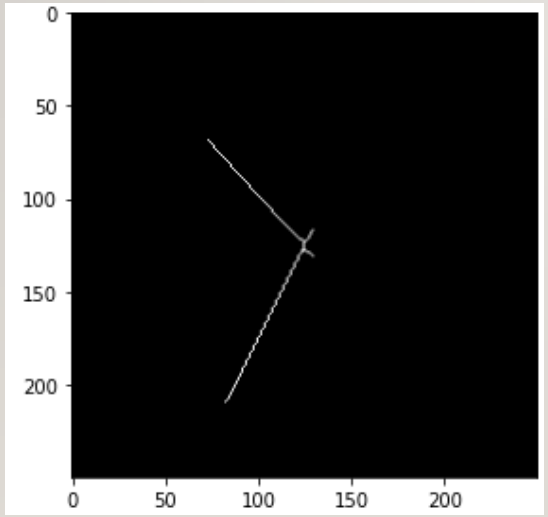


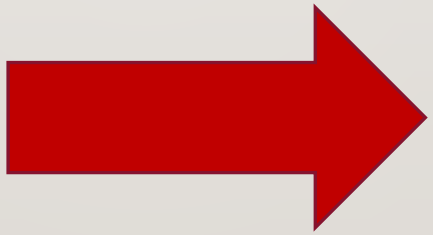


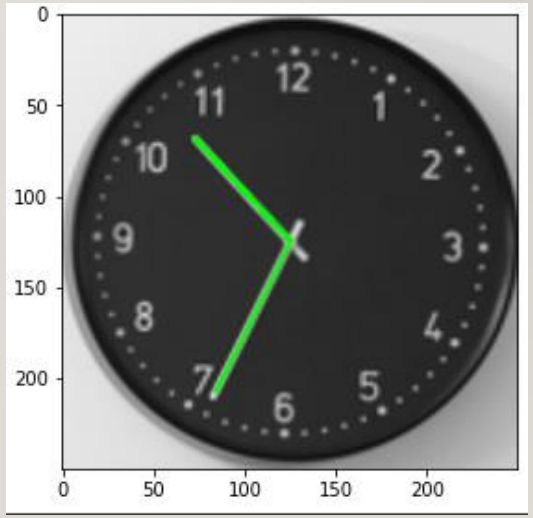


HANDS FILTERING AND CLASSIFYING

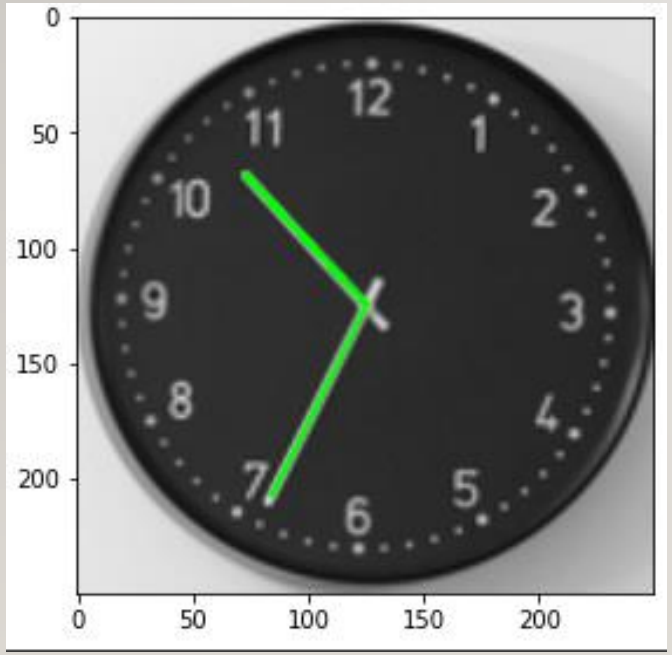
- Centralize the lines.
- Filtering lines by angle and size.
- Classifying and matching the hours, minutes and seconds hands to the appropriate line.

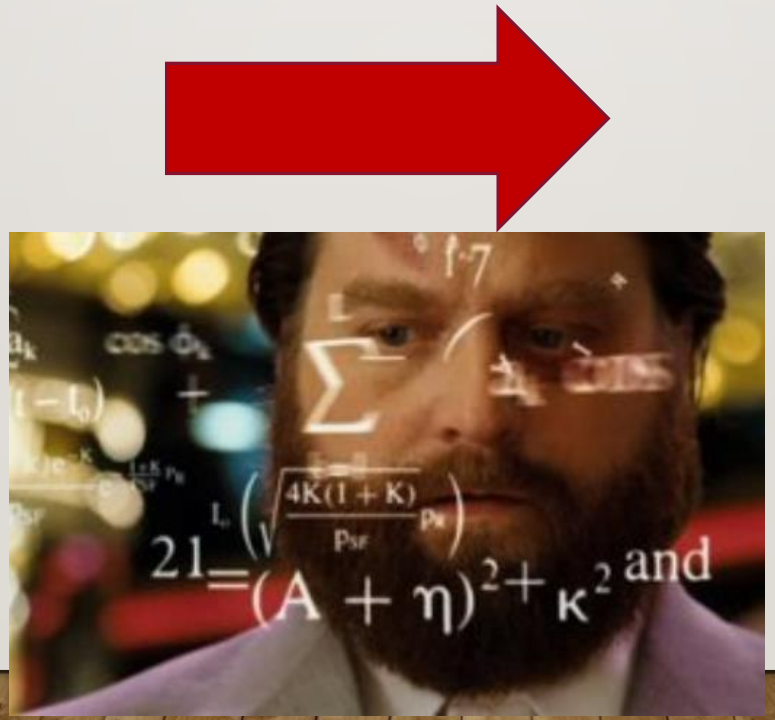


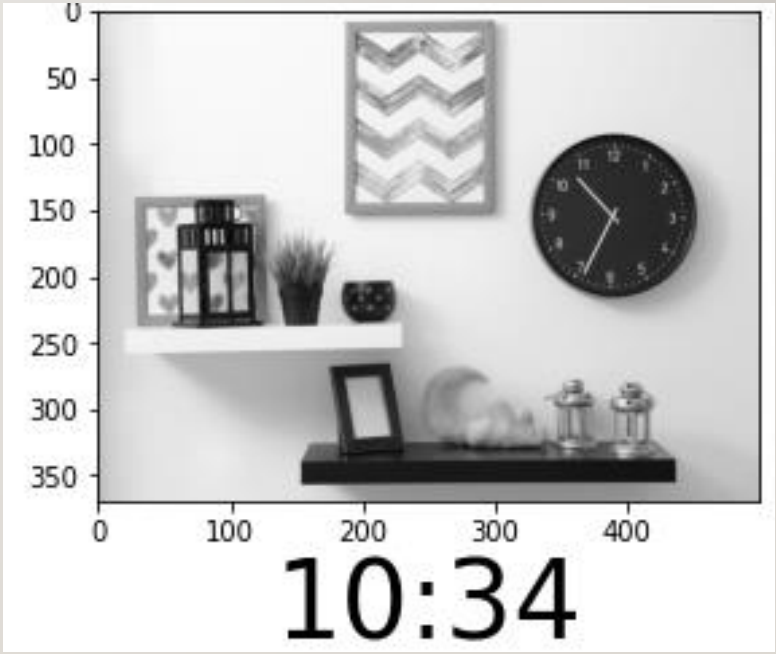




TIME CALCULATION







DIFFICULTIES AND SOLUTIONS

- Why not using only the hours hand? Given that the whole information is theoretically represented in the hour hand by itself.

NUMBER OF HANDS SOLUTION

Detecting the hand might result with a small deviation.

While a small deviation in the minutes hand doesn't impact the result in a drastic error, when discussing the hour hand, even the slightest deviation of a $1°$ will cause a 2 minutes error.

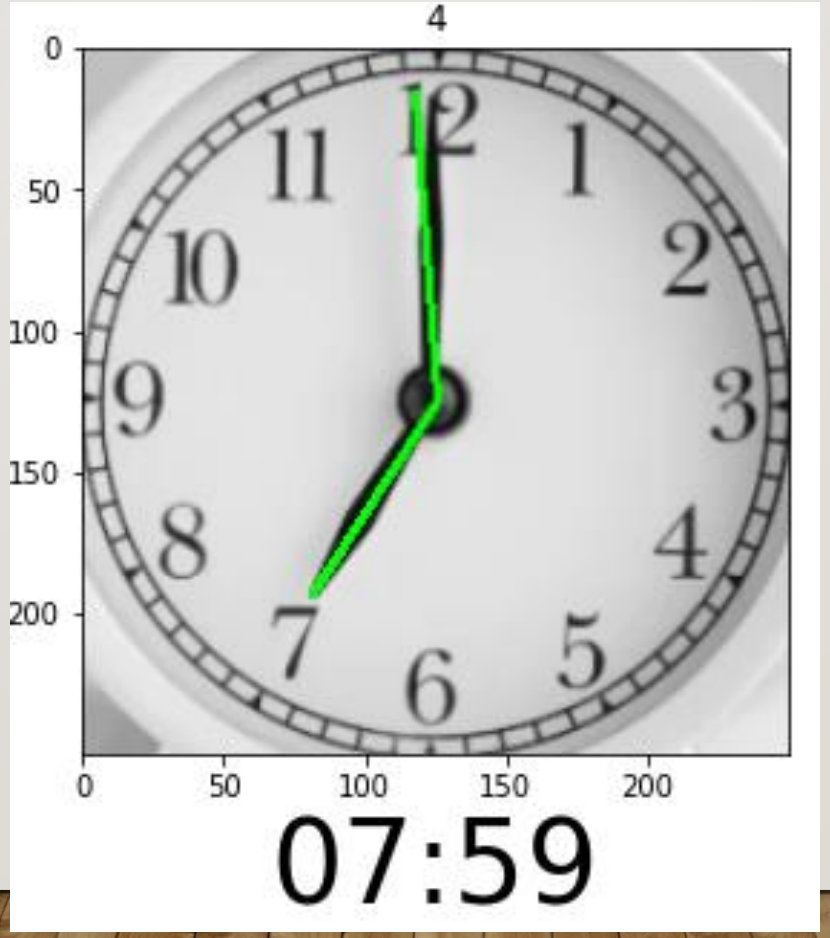
It is clear that it is easier, and therefore faster, to calculate only one hand, but we were chasing a more accurate results and therefore there was no escape from the full computation.

This is why, when calculating the time, we calculated the minutes and second hands as well.

DIFFICULTIES AND SOLUTIONS

- Why not using only the hours hand? Given that the whole information is theoretically represented in the hour hand by itself.
- How to deal with a deviation that causes the minutes hand to occur on the wrong side of the '12' spot?

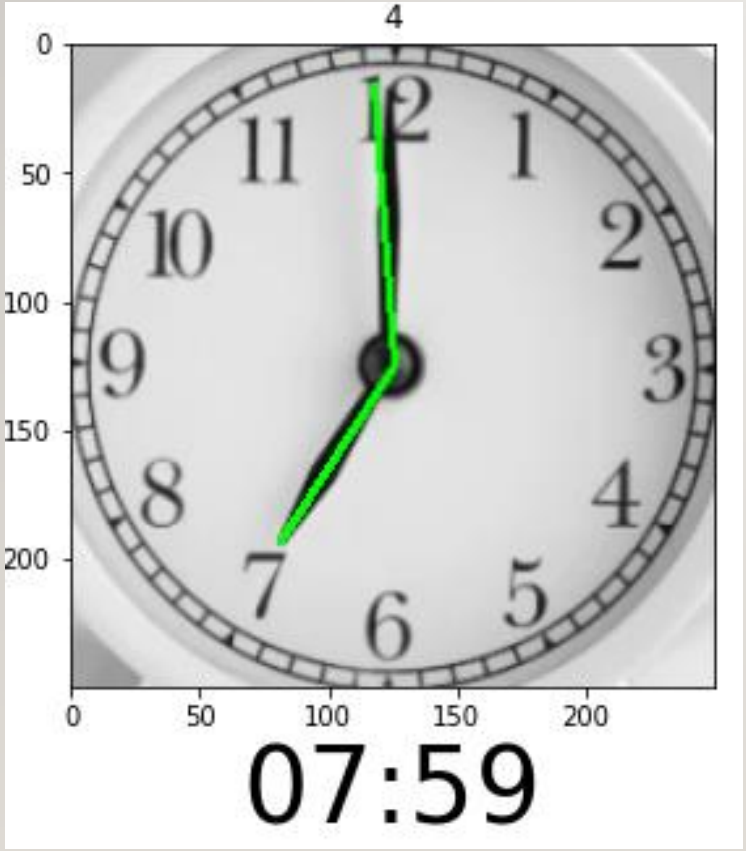
FOR EXAMPLE



DEVIATION SOLUTION

HoughLinesP method can result with a small deviation. Usually, when considering the minutes hand as well, the deviation is negligible. But there is a case when the minutes hand might appear on the ‘wrong’ side of the ‘12’ spot.

Like the human brain when we read the time, we can tell if there is a mistake or not according to the hour hand’s angle. We therefore added a case for this situation that considers the angle of the hours as well for computing the minutes and not just the hours.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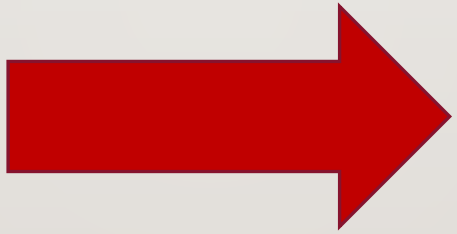
200
07:59

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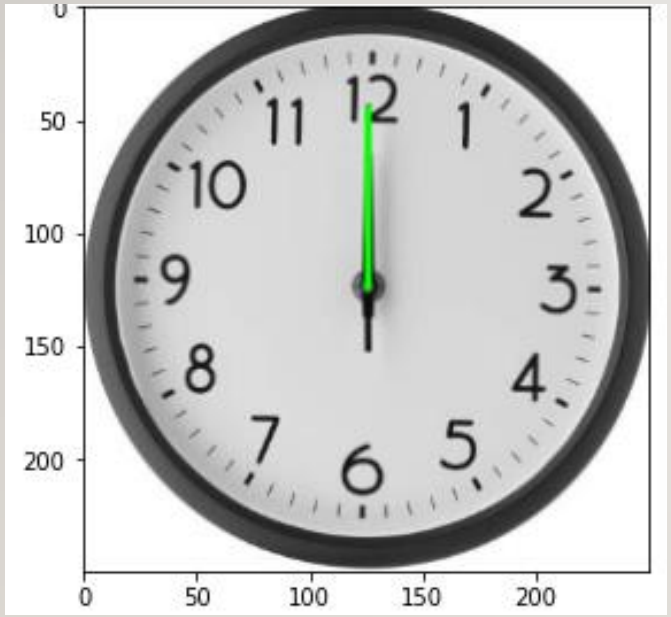
DIFFICULTIES AND SOLUTIONS

- Why not using only the hours hand? Given that the whole information is theoretically represented in the hour hand by itself.
- How to deal with a deviation that causes the minutes hand to occur on the wrong side of the '12' spot?
- How to read time of a clock with a different number of hands? And what if one is on top of another?

NUMBER OF HANDS SOLUTION

As calculated, the clock's hands are represented by lines. For every clock we detected the number of lines and therefore we used a different method for time calculation. When the clock has 3 hands, we computed the seconds hand as well.

When there is only one hand in the picture, we assume that the minutes and the hours are on top of one another, and therefore we calculate the same angle for both.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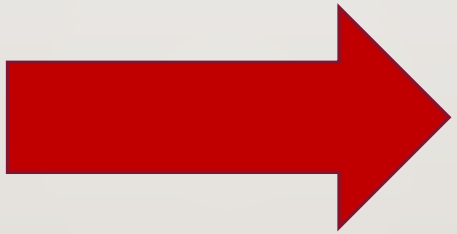

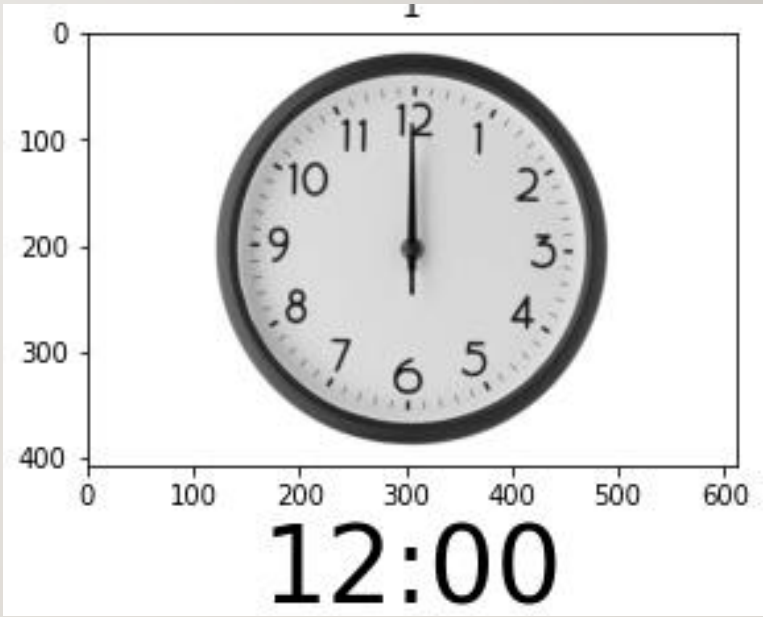
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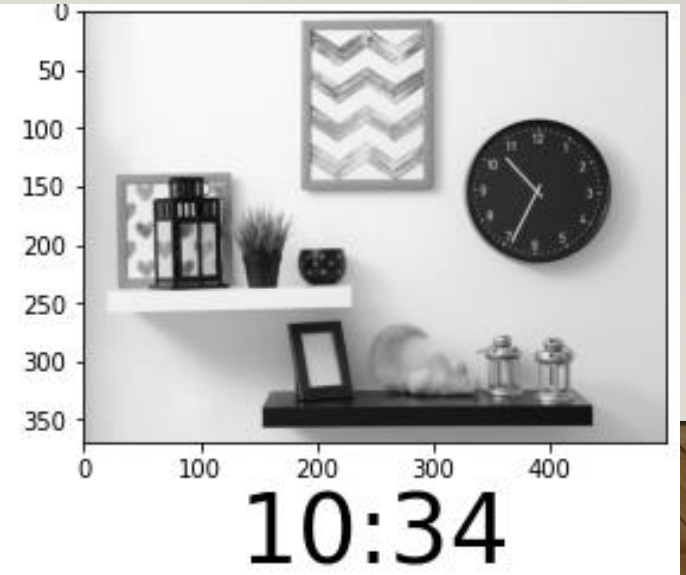
12:00

RESULTS AND CONCLUSIONS

We managed to read time from a diverse variety of images:

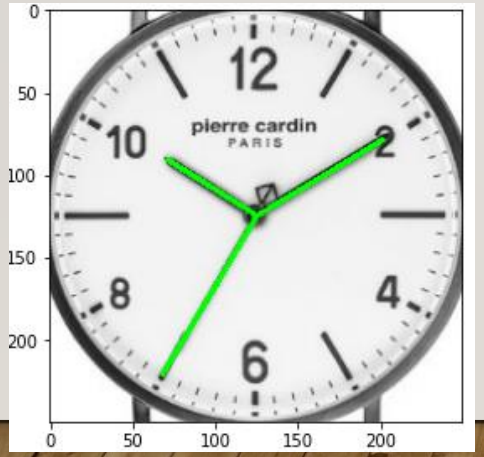
- Wall, hand & pocket clocks.
- Clocks with 2 or 3 hands.
- Clocks with one hand above the other.
- Clocks that are in the background of the image, which consists of other objects as well.
- Different sizes of clocks.
- Different sizes of images.
- Clocks with or without numbers.

EXAMPLES



EXAMPLES


12
10
2
8
4
6
pierre cardin
PARIS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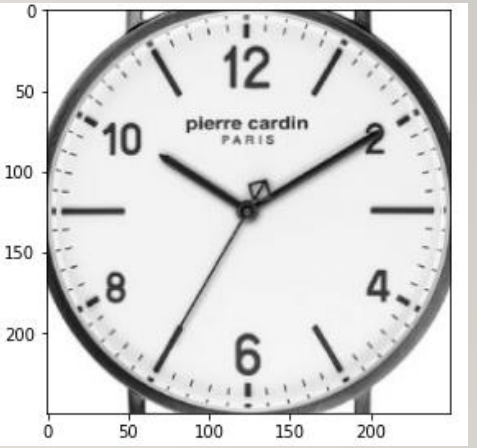
PARIS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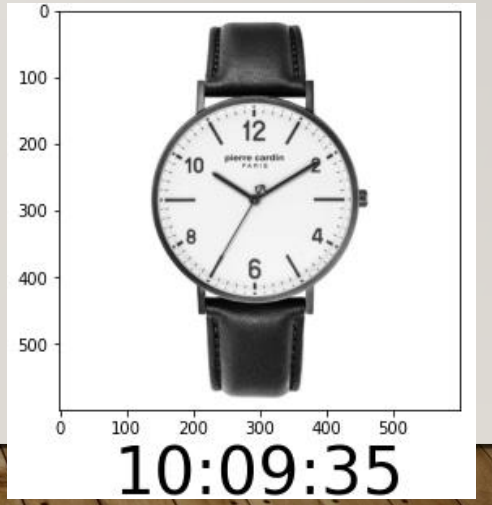
PARIS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pierre cardin
PARIS
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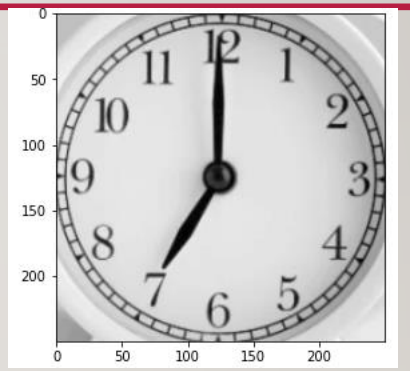
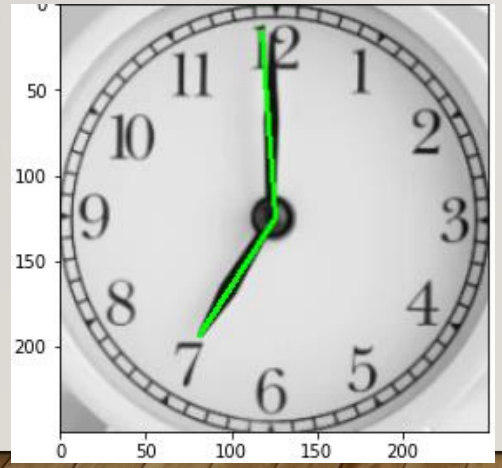
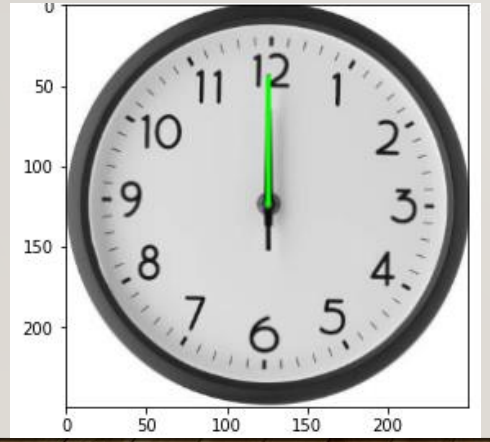
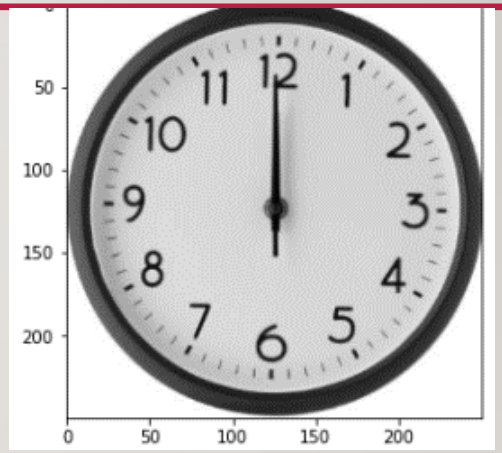
EXAMPLES

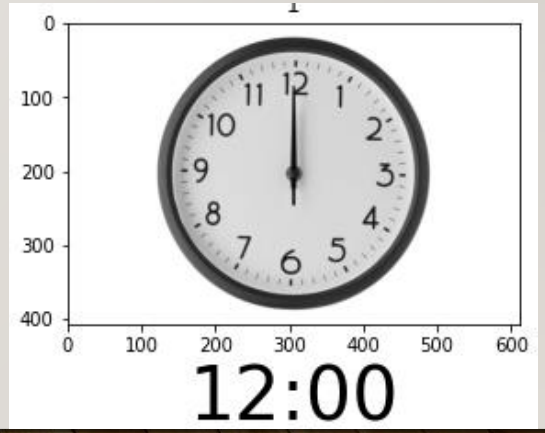




EXAMPLES







QUESTIONS ?