Censorship for Automatic Privacy Guarantee

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A Quick Reminder

- As stated in our midterm presentation, we will be working in the theme of "Censorship for Automatic Privacy Guarantee".
- For this work we grabbed two datasets, one of a parking lot with the objective of automatically censoring license plates, and footage of people passing in the streets in order to censor the faces.
- In this presentation we shall discuss the steps taken in order to solve the problems, and give context to the tools used.

Part 1: License Plate Detection - The Dataset

We used a dataset of a fixed camera located at a parking lot.

Figure: An example of an image of our dataset.

Part 1: License Plate Detection - Gray Thresholding

The first step taken in order to begin working the image is to convert the image into the gray color space.

Figure: An image of our dataset in the gray color space.

Part 1: License Plate Detection - Black Hat

The first morphological operation applied was the black hat. This morphological operation computes the difference the closing morphological operation and the gray image. It is often used to highlight a dark object against a white background.

Figure: An image of our dataset with the Black Hat morphological operation applied.

Part 1: License Plate Detection - Scharr Filter

In order to highlight the edges of the license plate characters we applied a Scharr Filter, in our case it's a gradient in the x-direction of the image.

Figure: Sharr filter applied.

Part 1: License Plate Detection - Gaussian Blur

In order to simplify the morphology of the image and facilitate edge detection, we applied the Gaussian blur. This filter makes the image smoother, that is, reduces noise.

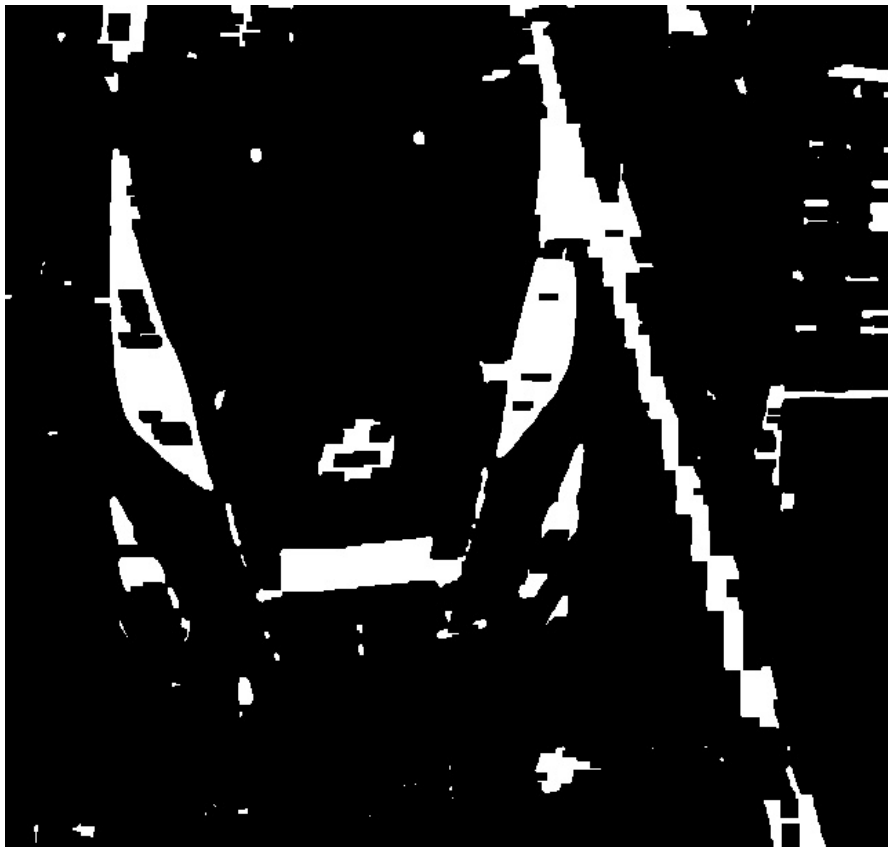

Figure: Gaussian Blur applied.

Part 1: License Plate Detection - Opening.

The next step is to apply the opening operation. The opening consists of an erosion operation followed by a dilation. This operation removes small objects if isolated.

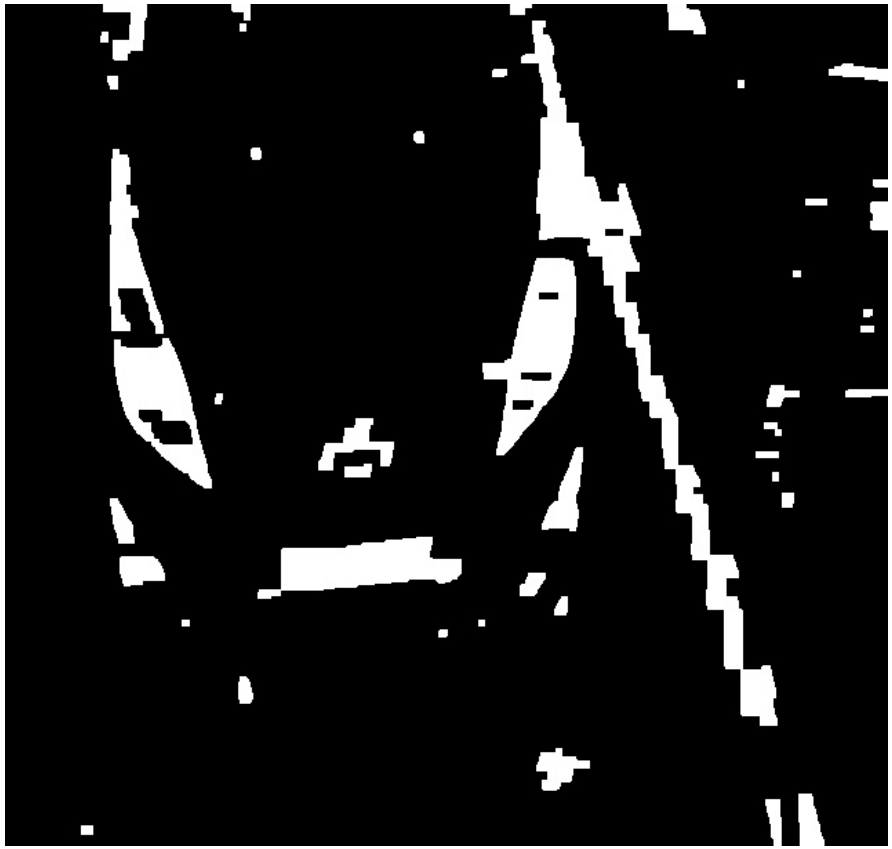

Figure: Opening Morphological operation applied.

Part 1: License Plate Detection - Closing

The next step is to apply the closing operation. The closing consists of an dilation operation followed by a erosion. This operation close small holes in the foreground. This operation was done while a light mask was applied.

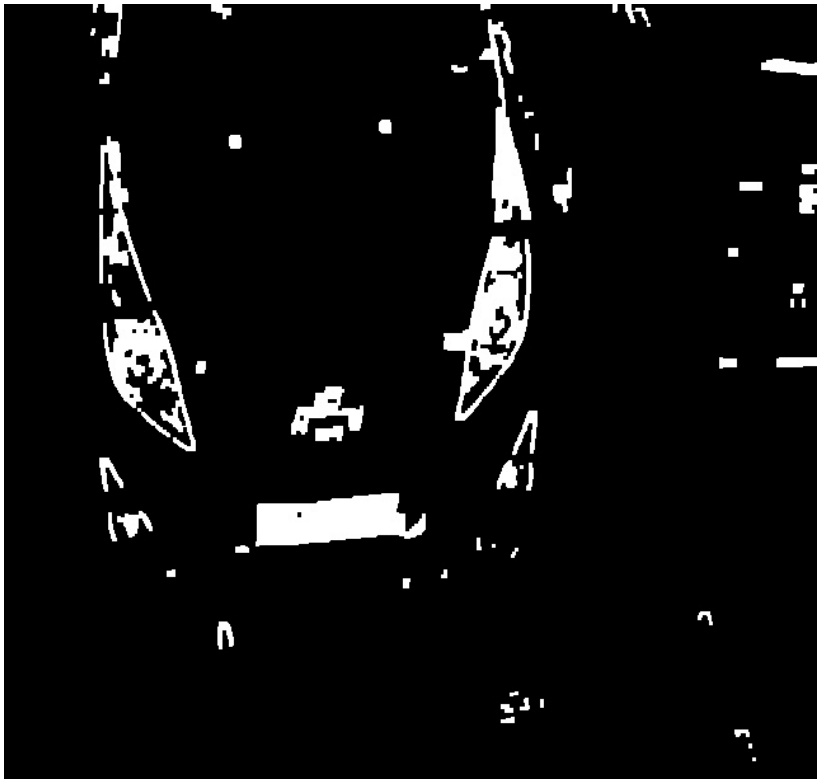

Figure: Closing Morphological operation applied.

Part 1: License Plate Detection - Region Selection

Finally, all that is left to do is to select the region of the image which corresponds to the license plate and censor it. For that purpose, the following steps are employed:

1. Find the contours of the different objects.
2. Compute the perimeter and approximate the number of sides of each shape.
3. Compute the bounding rectangle, and with it, compute the aspect ratio ($A.R = \frac{Width}{Height}$)
4. If the aspect ratio falls within a certain threshold, apply the censorship to the region.

Part 1: License Plate Detection - Results

After all this process, the final results can be obtained. Our algorithm was able to successfully censor properly 541 images out of 558 in the dataset, which corresponds to an accuracy of $\approx 96,7\%$

Figure: The final Result.

Part 2: Censorship of faces - The Dataset

In this case we used a dataset of a fixed camera pointing to a street.

Figure: Example of one frame of a video of our dataset.

Part 2: Censorship of faces - Background Subtraction

To identify the people walking on the streets we used a Background Subtraction, this operation calculates the foreground mask performing a subtraction between the current frame and a background model, containing the static part of the scene. Since the only moving object will be people, we can track them trough this operation.

Figure: Background Subtraction applied to one frame of a video of our dataset.

Part 2: Censorship of faces - Identifying people

To identify the people positions on the image we found the contours and iterated trough them to calculate the bounding boxes of them.

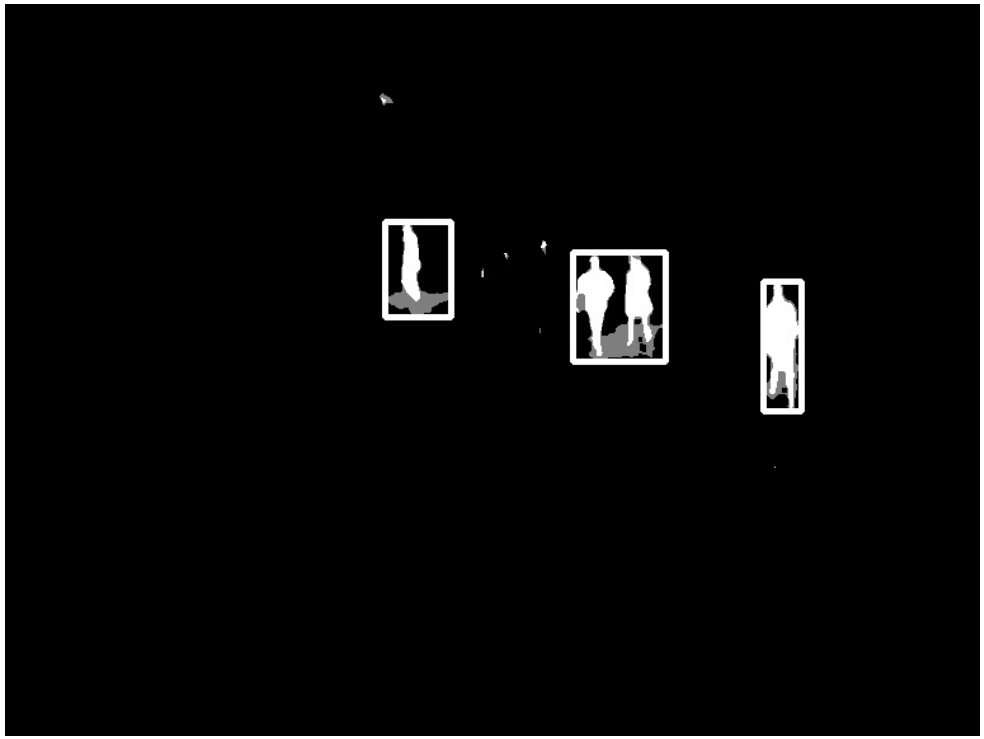

Figure: Detection of bounding boxes on one frame of a video of our dataset.

Part 2: Censorship of faces - Identifying and blur of faces

To only censor the face of people, we used the top 20% of the bounding box of the y-axis and we narrowed the x-axis by 15% on each side. Then we applied a blur on this area.

Figure: Detection and blur of faces on one frame of a video of our dataset.

Conclusion

- After all the work and carefully analyzing the produced results the group considers that the implemented solutions are adequate, and actually solve the problem.
- Another point that the group considers to be a positive is the fact that we didn't deviate much from the requirements previously set in midterm presentation.
- There are some ways our work could improve/evolve.

Questions?

Thank you!