Report 8

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Introduction

This report would focus on using Hough Transform, threshold, canny, and blur to further filter the video frame for future analysis.

Setup

Setup path to include our files. import them. use `autoreload` to get changes in as they are made.

```
In [21]: import os
         import sys
         import cv2
         from matplotlib import pyplot as plt

         # load our code
         sys.path.insert(0, os.path.abspath('../'))
         from preProcess import preprocess
         # specific to jupyter notebook
         from jupyter_help import cvplt, cvplt_sub
         #Import image processing function from optimization
         from optimization import fast_tracker

         # load any changes as we make them
         %load_ext autoreload
         %autoreload 2
```
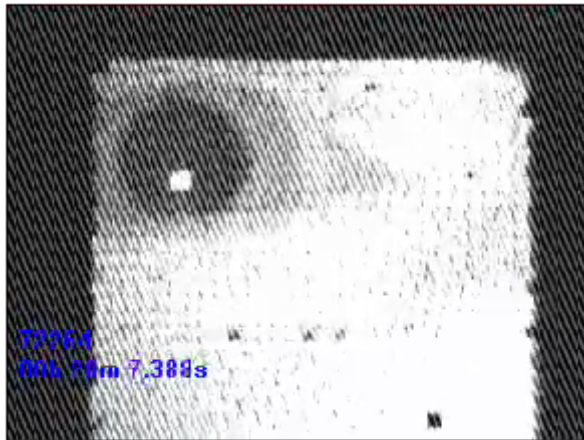
```
The autoreload extension is already loaded. To reload it, use:
  %reload_ext autoreload
```

Load

Get the original picture

```
In [11]:  #This image would be auto-generated by the program to ensure eye-open.
          vid_fname = "../input/chosen_pic.png" # path relative to this document
          cvplt(frame)
```

```
In [15]:  # intiail bounding box
          CPI = CPI = [[52, 144], [38, 142]]
          #Call the function that does the preprocessing.
          setup = preprocess(None, CPI, None, frame)
          #The function also runs blur, threshold, and canny.
          result = setup.start()
          #belo shows all the possible outcomes with different values of threshold
```

```
Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 50


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 60


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 70


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 80


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 90


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 100


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 110


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 120


Maximum coordinates:
```

[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 130

Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 140

Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 150

Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 160

Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
50 170

Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 180

Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 190

Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
50 200

Maximum coordinates:
[None, None, None, None, None]

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Maximum Votes:
[0, 0, 0, 0, 0]
55 55


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
55 65


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 75


Maximum coordinates:
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Maximum Votes:
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55 85


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 95


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 105


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 115


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
55 125


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
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```
[0, 0, 0, 0, 0]
55 135


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
55 145


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 155


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 165


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 175


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
55 185


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
55 195


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
60 60


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
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60 70


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 80


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 90


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 100


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 110


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 120


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 130


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 140


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 150
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```
Maximum coordinates:
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Maximum Votes:
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60 160


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
60 170


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 180


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 190


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
60 200


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 65


Maximum coordinates:
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Maximum Votes:
[0, 0, 0, 0, 0]
65 75


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 85
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Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 95


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 105


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 115


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 125


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 135


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 145


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 155


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 165
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Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 175


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 185


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
65 195


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 70


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 80


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 90


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 100


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 110


Maximum coordinates:
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[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 120


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 130


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 140


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 150


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 160


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 170


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 180


Maximum coordinates:
[None, None, None, None, None]
Maximum Votes:
[0, 0, 0, 0, 0]
70 190


Maximum coordinates:
[None, None, None, None, None]
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Maximum Votes:
[0, 0, 0, 0, 0]
70 200


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 75


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 85


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 95


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 105


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 115


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 125


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 135


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
```

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[28, 25, 24, 24, 22]
75 145


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 155


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 165


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 175


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 185


Maximum coordinates:
[(46, 39, 5), (46, 33, 5), (47, 39, 5), (45, 33, 5), (47, 33, 5)]
Maximum Votes:
[28, 25, 24, 24, 22]
75 195


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 80


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 90


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
```

```
80 100


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 110


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 120


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 130


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 140


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 150


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 160


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 170


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 180
```

```
Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 190


Maximum coordinates:
[(47, 36, 5), (45, 36, 5), (44, 36, 5), (51, 34, 5), (43, 37, 5)]
Maximum Votes:
[28, 28, 28, 28, 27]
80 200


Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 85


Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 95


Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 105


Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 115


Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 125


Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 135
```

Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 145

Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 155

Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 165

Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 175

Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 185

Maximum coordinates:
[(48, 35, 5), (47, 35, 5), (49, 35, 5), (44, 35, 5), (43, 35, 5)]
Maximum Votes:
[37, 36, 36, 34, 32]
85 195

Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 90

Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 100

```
Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 110


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 120


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 130


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 140


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 150


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 160


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 170


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 180


Maximum coordinates:
```

```
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 190


Maximum coordinates:
[(46, 42, 13), (47, 41, 13), (55, 43, 5), (38, 39, 5), (48, 49, 9)]
Maximum Votes:
[35, 33, 32, 31, 31]
90 200


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 95


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 105


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 115


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 125


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 135


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 145


Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
```

Maximum Votes:
[32, 31, 30, 28, 28]
95 155

Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 165

Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 175

Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 185

Maximum coordinates:
[(56, 40, 5), (56, 45, 5), (56, 44, 5), (52, 42, 9), (56, 41, 5)]
Maximum Votes:
[32, 31, 30, 28, 28]
95 195

Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 100

Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 110

Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 120

Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:

```
[37, 36, 32, 32, 31]
100 130


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 140


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 150


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 160


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 170


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 180


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 190


Maximum coordinates:
[(47, 50, 5), (37, 47, 5), (33, 27, 5), (56, 46, 5), (32, 27, 5)]
Maximum Votes:
[37, 36, 32, 32, 31]
100 200


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
```

```
105 105


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 115


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 125


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 135


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 145


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 155


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 165


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 175


Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 185
```

```
Maximum coordinates:
[(33, 25, 5), (57, 46, 5), (34, 25, 5), (45, 43, 17), (37, 48, 5)]
Maximum Votes:
[42, 36, 35, 35, 29]
105 195


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 110


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 120


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 130


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 140


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 150


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 160


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 170
```

```
Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 180


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 190


Maximum coordinates:
[(35, 24, 5), (34, 24, 5), (46, 42, 17), (54, 43, 9), (57, 47, 5)]
Maximum Votes:
[40, 39, 35, 31, 30]
110 200


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 115


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 125


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 135


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 145


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 155
```

```
Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 165


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 175


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 185


Maximum coordinates:
[(36, 24, 5), (57, 48, 5), (36, 22, 5), (37, 24, 5), (55, 44, 9)]
Maximum Votes:
[33, 32, 31, 31, 31]
115 195


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 120


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 130


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 140


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 150


Maximum coordinates:
```

```
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 160


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 170


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 180


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 190


Maximum coordinates:
[(52, 40, 13), (56, 44, 9), (38, 25, 5), (34, 60, 5), (58, 48, 5)]
Maximum Votes:
[32, 31, 30, 29, 28]
120 200


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 125


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 135


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 145


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
```

```
Maximum Votes:
[29, 28, 26, 25, 25]
125 155


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 165


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 175


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 185


Maximum coordinates:
[(53, 41, 13), (56, 45, 9), (34, 61, 5), (53, 42, 13), (58, 49, 5)]
Maximum Votes:
[29, 28, 26, 25, 25]
125 195


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 130


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 140


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 150


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
```

```
[31, 29, 28, 27, 23]
130 160


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 170


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 180


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 190


Maximum coordinates:
[(57, 23, 5), (56, 50, 5), (54, 42, 13), (58, 23, 5), (49, 41, 17)]
Maximum Votes:
[31, 29, 28, 27, 23]
130 200


Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
135 135


Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
135 145


Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
135 155


Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
```

135 165

Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
135 175

Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
135 185

Maximum coordinates:
[(62, 23, 5), (50, 41, 17), (58, 50, 5), (59, 24, 5), (54, 42, 13)]
Maximum Votes:
[29, 29, 28, 27, 27]
135 195

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 140

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 150

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 160

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 170

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 180

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 190

Maximum coordinates:
[(51, 40, 17), (64, 23, 5), (51, 41, 17), (61, 24, 5), (63, 23, 5)]
Maximum Votes:
[33, 30, 30, 28, 26]
140 200

Maximum coordinates:
[(52, 40, 17), (52, 41, 17), (64, 24, 5), (63, 25, 5), (66, 24, 5)]
Maximum Votes:
[33, 33, 28, 27, 26]
145 145

Maximum coordinates:
[(52, 40, 17), (52, 41, 17), (64, 24, 5), (63, 25, 5), (66, 24, 5)]
Maximum Votes:
[33, 33, 28, 27, 26]
145 155

Maximum coordinates:
[(52, 40, 17), (52, 41, 17), (64, 24, 5), (63, 25, 5), (66, 24, 5)]
Maximum Votes:
[33, 33, 28, 27, 26]
145 165

Maximum coordinates:
[(52, 40, 17), (52, 41, 17), (64, 24, 5), (63, 25, 5), (66, 24, 5)]
Maximum Votes:
[33, 33, 28, 27, 26]
145 175

Maximum coordinates:
[(52, 40, 17), (52, 41, 17), (64, 24, 5), (63, 25, 5), (66, 24, 5)]
Maximum Votes:
[33, 33, 28, 27, 26]
145 185

Maximum coordinates:
[(52, 40, 17), (52, 41, 17), (64, 24, 5), (63, 25, 5), (66, 24, 5)]
Maximum Votes:
[33, 33, 28, 27, 26]
145 195

```
Maximum coordinates:
[(67, 24, 5), (53, 40, 17), (53, 41, 17), (68, 24, 5), (66, 24, 5)]
Maximum Votes:
[36, 31, 29, 26, 24]
150 150


Maximum coordinates:
[(67, 24, 5), (53, 40, 17), (53, 41, 17), (68, 24, 5), (66, 24, 5)]
Maximum Votes:
[36, 31, 29, 26, 24]
150 160


Maximum coordinates:
[(67, 24, 5), (53, 40, 17), (53, 41, 17), (68, 24, 5), (66, 24, 5)]
Maximum Votes:
[36, 31, 29, 26, 24]
150 170


Maximum coordinates:
[(67, 24, 5), (53, 40, 17), (53, 41, 17), (68, 24, 5), (66, 24, 5)]
Maximum Votes:
[36, 31, 29, 26, 24]
150 180


Maximum coordinates:
[(67, 24, 5), (53, 40, 17), (53, 41, 17), (68, 24, 5), (66, 24, 5)]
Maximum Votes:
[36, 31, 29, 26, 24]
150 190


Maximum coordinates:
[(67, 24, 5), (53, 40, 17), (53, 41, 17), (68, 24, 5), (66, 24, 5)]
Maximum Votes:
[36, 31, 29, 26, 24]
150 200


Maximum coordinates:
[(68, 24, 5), (69, 24, 5), (67, 25, 5), (54, 40, 17), (35, 65, 5)]
Maximum Votes:
[29, 27, 27, 26, 26]
155 155


Maximum coordinates:
[(68, 24, 5), (69, 24, 5), (67, 25, 5), (54, 40, 17), (35, 65, 5)]
Maximum Votes:
[29, 27, 27, 26, 26]
155 165
```

```
Maximum coordinates:
[(68, 24, 5), (69, 24, 5), (67, 25, 5), (54, 40, 17), (35, 65, 5)]
Maximum Votes:
[29, 27, 27, 26, 26]
155 175


Maximum coordinates:
[(68, 24, 5), (69, 24, 5), (67, 25, 5), (54, 40, 17), (35, 65, 5)]
Maximum Votes:
[29, 27, 27, 26, 26]
155 185


Maximum coordinates:
[(68, 24, 5), (69, 24, 5), (67, 25, 5), (54, 40, 17), (35, 65, 5)]
Maximum Votes:
[29, 27, 27, 26, 26]
155 195


Maximum coordinates:
[(70, 25, 5), (69, 25, 5), (50, 39, 21), (68, 25, 5), (58, 43, 13)]
Maximum Votes:
[25, 25, 24, 23, 23]
160 160


Maximum coordinates:
[(70, 25, 5), (69, 25, 5), (50, 39, 21), (68, 25, 5), (58, 43, 13)]
Maximum Votes:
[25, 25, 24, 23, 23]
160 170


Maximum coordinates:
[(70, 25, 5), (69, 25, 5), (50, 39, 21), (68, 25, 5), (58, 43, 13)]
Maximum Votes:
[25, 25, 24, 23, 23]
160 180


Maximum coordinates:
[(70, 25, 5), (69, 25, 5), (50, 39, 21), (68, 25, 5), (58, 43, 13)]
Maximum Votes:
[25, 25, 24, 23, 23]
160 190


Maximum coordinates:
[(70, 25, 5), (69, 25, 5), (50, 39, 21), (68, 25, 5), (58, 43, 13)]
Maximum Votes:
[25, 25, 24, 23, 23]
160 200


Maximum coordinates:
```

[(69, 26, 5), (52, 55, 5), (46, 56, 5), (52, 64, 5), (38, 57, 5)]
Maximum Votes:
[22, 21, 21, 21, 21]
165 165

Maximum coordinates:
[(69, 26, 5), (52, 55, 5), (46, 56, 5), (52, 64, 5), (38, 57, 5)]
Maximum Votes:
[22, 21, 21, 21, 21]
165 175

Maximum coordinates:
[(69, 26, 5), (52, 55, 5), (46, 56, 5), (52, 64, 5), (38, 57, 5)]
Maximum Votes:
[22, 21, 21, 21, 21]
165 185

Maximum coordinates:
[(69, 26, 5), (52, 55, 5), (46, 56, 5), (52, 64, 5), (38, 57, 5)]
Maximum Votes:
[22, 21, 21, 21, 21]
165 195

Maximum coordinates:
[(36, 67, 5), (35, 67, 5), (50, 56, 5), (42, 57, 5), (48, 65, 5)]
Maximum Votes:
[26, 23, 21, 21, 21]
170 170

Maximum coordinates:
[(36, 67, 5), (35, 67, 5), (50, 56, 5), (42, 57, 5), (48, 65, 5)]
Maximum Votes:
[26, 23, 21, 21, 21]
170 180

Maximum coordinates:
[(36, 67, 5), (35, 67, 5), (50, 56, 5), (42, 57, 5), (48, 65, 5)]
Maximum Votes:
[26, 23, 21, 21, 21]
170 190

Maximum coordinates:
[(36, 67, 5), (35, 67, 5), (50, 56, 5), (42, 57, 5), (48, 65, 5)]
Maximum Votes:
[26, 23, 21, 21, 21]
170 200

Maximum coordinates:
[(47, 57, 5), (39, 58, 5), (45, 66, 5), (39, 67, 5), (57, 55, 5)]

Maximum Votes:
[21, 21, 21, 21, 19]
175 175

Maximum coordinates:
[(47, 57, 5), (39, 58, 5), (45, 66, 5), (39, 67, 5), (57, 55, 5)]
Maximum Votes:
[21, 21, 21, 21, 19]
175 185

Maximum coordinates:
[(47, 57, 5), (39, 58, 5), (45, 66, 5), (39, 67, 5), (57, 55, 5)]
Maximum Votes:
[21, 21, 21, 21, 19]
175 195

Maximum coordinates:
[(50, 57, 5), (48, 66, 5), (59, 55, 5), (37, 68, 5), (60, 55, 5)]
Maximum Votes:
[21, 21, 19, 19, 18]
180 180

Maximum coordinates:
[(50, 57, 5), (48, 66, 5), (59, 55, 5), (37, 68, 5), (60, 55, 5)]
Maximum Votes:
[21, 21, 19, 19, 18]
180 190

Maximum coordinates:
[(50, 57, 5), (48, 66, 5), (59, 55, 5), (37, 68, 5), (60, 55, 5)]
Maximum Votes:
[21, 21, 19, 19, 18]
180 200

Maximum coordinates:
[(48, 58, 5), (45, 67, 5), (37, 69, 5), (55, 57, 5), (38, 60, 5)]
Maximum Votes:
[21, 21, 20, 19, 19]
185 185

Maximum coordinates:
[(48, 58, 5), (45, 67, 5), (37, 69, 5), (55, 57, 5), (38, 60, 5)]
Maximum Votes:
[21, 21, 20, 19, 19]
185 195

Maximum coordinates:
[(50, 58, 5), (49, 67, 5), (57, 57, 5), (42, 68, 5), (55, 57, 5)]
Maximum Votes:

```
[21, 21, 19, 19, 18]
190 190


Maximum coordinates:
[(50, 58, 5), (49, 67, 5), (57, 57, 5), (42, 68, 5), (55, 57, 5)]
Maximum Votes:
[21, 21, 19, 19, 18]
190 200


Maximum coordinates:
[(48, 59, 5), (46, 68, 5), (58, 57, 5), (44, 68, 5), (53, 58, 5)]
Maximum Votes:
[21, 21, 19, 19, 18]
195 195


Maximum coordinates:
[(44, 69, 5), (51, 59, 5), (50, 68, 5), (60, 57, 5), (52, 59, 5)]
Maximum Votes:
[22, 21, 21, 19, 18]
200 200
```

In [18]:
```python
print(result)
#As shown in the result, the best performance threshold value is 105, 10
5
#It also shows the coordinates which is (33, 25, 5). However, since the
#Image is shrinked 2 unit, it won't be precise enough.
```

```
((105, 105), (33, 25, 5))
```

Demo

Show that image is truly the best filtering version.

In [25]:
```python
#We use the calculated threshold(105, 105)
threshold = result[0]
#Call the optimization and pass in the value
#The rest of parameters could be left unchanged.
ft = fast_tracker(frame, threshold)
#As observed, all the noise and outliers are removed completly.
cvplt_sub([frame, ft.prepossing()],1 ,2)
```
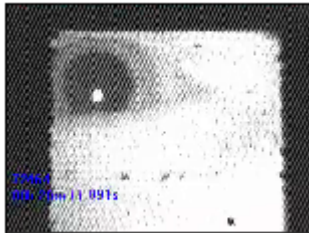
Analysis

Test the same parameter on another randomly chosen frame. Even though zero user input is needed to get this result, in some corner cases, it is still necessary for users to judge whether the other parameters in the optimization function are appropriate.

```
In [43]: vid_fname = "../input/run1.mov" # path relative to this document
         frame_number = 400

         # read in
         vs = cv2.VideoCapture(vid_fname)
         vs.set(1, frame_number)
         frame_2 = vs.read()[1]

         ft = fast_tracker(frame_2, threshold)
         #Proceed the frame optimization
         cvplt_sub([frame_2, ft.prepossing()],1 ,2)
```


Conclusion

As shown above, by implementing the "voting" feature of Hough Transform, one could get a rather refined picture absent of noises. Which could thereafter be implemented in KCF tracker as well as optical flow to improve precision.