COMPUTER VISION
#MP7
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Description:Visual target tracking using three different methods, i.e sum of squared difference(SSD), cross correlation(CC) and normalized cross correlation(NCC).

Algorithm:
Initialization-The template was first created by manually selecting a target in the first frame using opencv's selectionROI function which returns the starting coordinates and height and width of the selection. With the help of this information the pixels corresponding to these bounds were stored as the template.
Image Matching:
Sum of Squared Difference-This method uses the simple criteria of calculating the squared difference between each template sized kernel (which is the matching candidate) in the image and the given template. The sum of each of the squared differences are the scores for each matching candidate, the minimum if these scores give the starting coordinates for the target area.
Cross Correlation- In this method, all the matching candidates are found and the sum of each matching candidate with the template gives the score for that candidate. The maximum of the scores is the resulting starting coordinates of the target area.
Normalized Cross Correlation-This method calculates the difference between matching candidate and the mean of its intensity and the difference between the template and the template intensity mean given is used to calculate the cross correlation. The cross correlation is normalized with the square root of the product of sum of squares of the previously calculated centered matching candidate and template. This is the score for that candidate, the maximum of all the scores gives the starting coordinate of predicted target area.
Template Matching-Depending on which method for template matching is selected, the function iterates through all 500 images saved in a source directory. Each image is converted to the grayscale and passed to the corresponding template matching method which gives the starting coordinates of the predicted target area which is used to create a bounding box of preselected size. These altered images are saved in the destination directory and converted to an mp4 video.
Occlusion solution-This uses both SSD and NCC template matching methods and finds the average of resulting starting coordinates of the target area used to create a bounding box. This results in a target tracking algorithm which is able to bypass occlusion.

Result Analysis:
SSD-The overall performance of this method of template matching is quite good, it is able to track the target 65-70% of the time with the exception of some noisy results along with some tricky edge cases. When the target turns around and only the back of her head is visible i.e, the view of the target changes, the target is not identified accurately, however when it turns around,

the estimated target is in the general vicinity of the actual target. This method is able to correctly track the target when she tilts her head, i.e when the angle of the target changes. It isn't able to track the target in the case of occlusion where it incorrectly identifies some random background as the target.
CC-This method performs very poorly in tracking the target, the predicted target area is not accurately tracked and the bounding box can be seen jumping around throughout the video.
NCC-The result from the normalized cross correlation method is better than the SSD performance. It is able to roughly track the target when the angle of the target changes as well as accurately track the target when its view and scale changes. It also gets confused when tracking the target when there is occlusion.
OCCLUSION- The performance of this method is quite good apart from some noise here and there. It is able to overcome all cases of changing view, angle and scale of the target as well and occlusion.