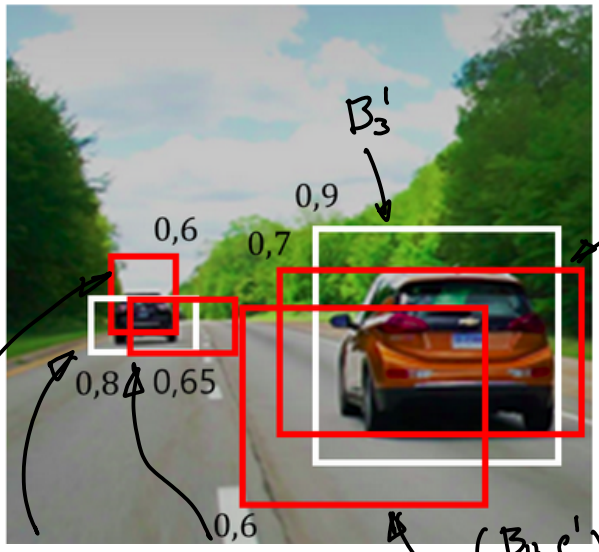
Handout On Bounding Box Selection Algorithm



B: $(B_1, 0.6), (B_2, 0.65), (B_3, 0.8)$

Given Image with 2 Objects, multiple Bounding Boxes. $B = \{(B_1, 0.6), (B_2, 0.65), (B_3, 0.8); (B_1', 0.6), (B_2', 0.7), (B_3', 0.9)\}$, e.g. (B_i, C_i)

Sol: Step1. Pick the B_i or B_i' with the Highest Confidence Level, so

$(B_3, C_3') = (B_3', 0.9)$

Step2. Find IOU.

$IOU_{B_3'B_1} = \phi$, Keep B_1 in the Collection

Similarly, $IOU_{B_3'B_2} = IOU_{B_3'B_3} = \phi$,

Keep B_2, B_3.

Since $IOU_{B_3'B_2'} = \Delta > IOU_{B_3'B_1'} = \Delta - \Delta'$

Delete B_2' from the collection.

$IOU_{B_3'B_1'} \neq \phi$, But Smaller Confidence

$C_1' < C_3'$, so B_3' is selected And placed in the final Collection, And Delete B_1'.

$B_{NMS} = \{(B_3', C_3')\}$

Step3, Select B_i or B_i' with the next highest Confidence C_i or C_i', from Updated Collection

$B = \{(B_1, C_1), (B_2, C_2), (B_3, C_3)\}$

So $(B_3, 0.8) = (B_3, C_3)$ is selected.

Step4. Compute $IOU_{3,1} = \Delta$, $IOU_{3,2} = \Delta + \Delta'$

$\because IOU_{3,2} > IOU_{3,1} \rightarrow$ Discard B_2,

And $\because C_1 < C_3$, Delete C_1, place B_1 into the final selection

$B_{NMS} = \{(B_3', C_3'), (B_3, C_3)\}$, Update the collection

$B = \{\phi\}$. Done //

Appendix A. Pseudo code

Algorithm 1 Non-Max Suppression

1: **procedure** NMS(B,c)
2: $B_{nms} \leftarrow \emptyset$ Initialize empty set
3: **for** $b_i \in B$ **do** => Iterate over all the boxes
4: $discard \leftarrow$ False Take boolean variable and set it as false. This variable indicates whether b(i) should be kept or discarded
5: **for** $b_j \in B$ **do** Start another loop to compare with b(i)
6: **if** same$(b_i, b_j) > \boldsymbol{\lambda_{nms}}$ **then** If both boxes having same IOU
7: **if** score$(c, b_j) >$ score(c, b_i) **then**
8: $discard \leftarrow$ True Compare the scores. If score of b(i) is less than that of b(j), b(i) should be discarded, so set the flag to True.
9: **if not** $discard$ **then** Once b(i) is compared with all other boxes and still the discarded flag is False, then b(i) should be considered. So add it to the final list.
10: $B_{nms} \leftarrow B_{nms} \cup b_i$
11: **return** B_{nms} Do the same procedure for remaining boxes and return the final list

https://towardsdatascience.com/non-maximum-suppression-nms-93ce178e177c

(END)