1. a)

fig 1

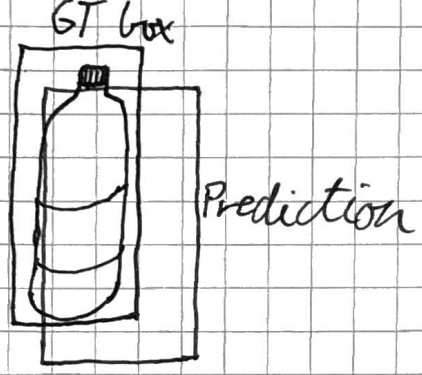
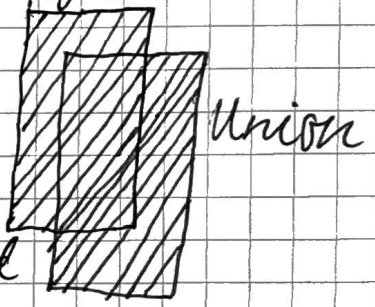


fig 2

fig 3



The intersection over union is a measure for how much a predicted boundary overlaps with the truth. It is defined as

$$IoU = \frac{\text{area of overlap}}{\text{area of union}}$$

where the overlap is shown in fig 2, the area where both boxes cover, and the union is shown in fig 3, where any box covers.

1. b) $$\text{precision} = \frac{\text{true positives}}{\text{true positives} + \text{false positives}} = \frac{\text{true positives}}{\text{all positives}}$$

$$\text{recall} = \frac{\text{true positives}}{\text{true positives} + \text{false negatives}} = \frac{\text{true positives}}{\text{all cases}}$$

True positive is a positive prediction on a positive case.

False positive is a positive prediction on a negative case.

False negative is a negative prediction on a positive case.

1. c) $\mu(r) = \max_{\hat{r} \geq r} \mu(\hat{r})$

$\mu_1(0,0) = 1,0$ $\mu_2(0,0) = 1,0$ $\mu_1(0,7) = 0,5$ $\mu_2(0,7) = 0,5$

$\mu_1(0,1) = 1,0$ $\mu_2(0,1) = 1,0$ $\mu_1(0,8) = 0,20$ $\mu_2(0,8) = 0,20$

$\mu_1(0,2) = 1,0$ $\mu_2(0,2) = 1,0$ $\mu_1(0,9) = 0,20$ $\mu_2(0,9) = 0,20$

$\mu_1(0,3) = 1,0$ $\mu_2(0,3) = 1,0$ $\mu_1(1,0) = 0,20$ $\mu_2(1,0) = 0,20$

$\mu_1(0,4) = 1,0$ $\mu_2(0,4) = 0,80$

$\mu_1(0,5) = 0,5$ $\mu_2(0,5) = 0,60$

$\mu_1(0,6) = 0,5$ $\mu_2(0,6) = 0,5$

$$mAP_1 = \frac{1}{11}(5 \cdot 1 + 3 \cdot 0{,}5 + 3 \cdot 0{,}2) = 0{,}645$$

$$mAP_2 = \frac{1}{11}(4 \cdot 1 + 0{,}8 + 0{,}6 + 2 \cdot 0{,}5 + 3 \cdot 0{,}2) = 0{,}636$$

$$mAP = \frac{1}{2}(mAP_1 + mAP_2) = \underline{\underline{0{,}641}}$$