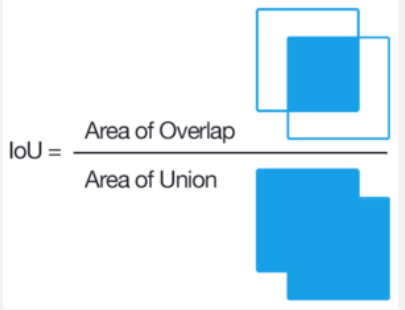
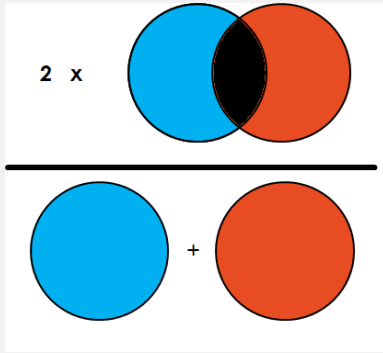
Calculating Intersection Over Union and Dice Scores for Annotations

Intersection Over Union (IoU) and Dice Score

- Intersection over Union (IoU) measures the overlap between two bounding boxes or annotation masks. The better the overlap between the bounding boxes/masks the better
  - Calculations are different for localization and annotation masks
- Dice Score: measures the similarity between two annotation masks. It is defined as the 2 x the area of overlap divided by the number of pixels in A and number of pixels in B. More similar the annotations the better





IoU Calculations: Localization

- Step 1: Extract bounding box coordinates for annotators
- Step 2: Find the intersection coordinates of the bounding boxes

$$x_{I_0} = \max(x_0^A, x_0^B)$$
$$y_{I_0} = \max(y_0^A, y_0^B)$$
$$x_{I_1} = \min(x_1^A, x_1^B)$$
$$y_{I_1} = \min(y_1^A, y_1^B)$$

- Step 3: Calculate area of the intersection:

$$A \cap B = (x_1^I - x_0^I) * (y_1^I - y_0^I)$$

- Step 4: Calculate area of the union

$$Area\ A = \left(x_1^A - x_0^A\right) * (y_1^A - y_0^A)$$
$$Area\ B = (x_1^B - x_0^B) * (y_1^B - y_0^B)$$
$$A \cup B = AreaA + AreaB - A \cap B$$

- Step 5: Calculate IoU

$$IoU = \frac{A \cap B}{A \cup B}$$

IoU Calculations: Segmentation

- Step 1: Create binary masks for each class
- Step 2: For each class mask A and B:
  - a. Find the intersection of the two class masks (logical and):

$$A \cap B = A * B$$

  - b. Find the union of the two class masks (logical or):

$$A \cup B = A + B - A \cap B$$

  - c. Calculate the IoU:

$$IoU = \frac{A \cap B}{A \cup B}$$

- Step 3: Average the class IoU scores

Dice Score Calculations: Segmentation

- Step 1: Create binary masks for each class
- Step 2: For each class mask A and B:
  - a. Find the intersection of the two class masks (logical and):

$$A \cap B = A * B$$

  - b. Find the union of the two class masks (logical or):

$$A \cup B = A + B$$

  - c. Calculate Dice Score

$$Dice = \frac{2 * A \cap B}{A \cup B}$$

- Step 3: Average the class Dice scores

IoU and Dice Score: Segmentation

- Alternatively, you can utilize the sklearn library to compute the IoU and Dice scores for each mask. The steps are:
  - Step 1: Load in annotation masks A and B
  - Step 2: Flatten the masks .flatten()
  - Step 3: Call jaccard_score(A, B, average="macro") for IoU and f1_score(A, B, average="macro") for Dice score