Formulation

The **Dice coefficient** is written as follows,

$$Dice = \frac{TP + TP}{TP + TP + FP + TN}$$

Or simply,

$$\frac{2 \cdot IoU}{IoU + 1}$$

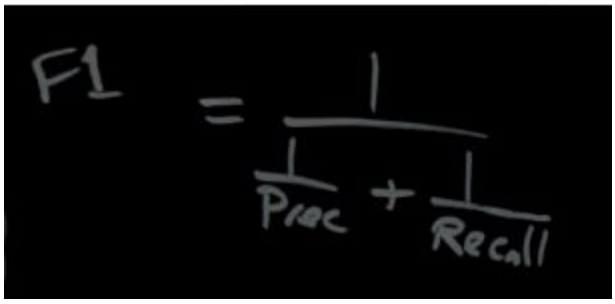
Dice loss = 1 - Dice coefficient

Range of the dice loss

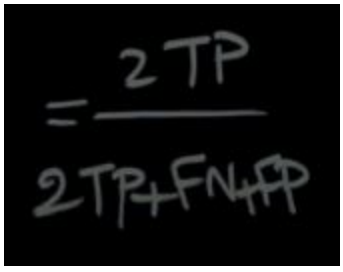
It ranges between 0 to 1

Interpretation of dice coefficient

If you look closely, you will notice that the dice coefficient is actually the F1 score!
F1 score is the harmonic mean of the precision and recall.



When you plug the precision and recall formulas in the above equation, you will get the following,

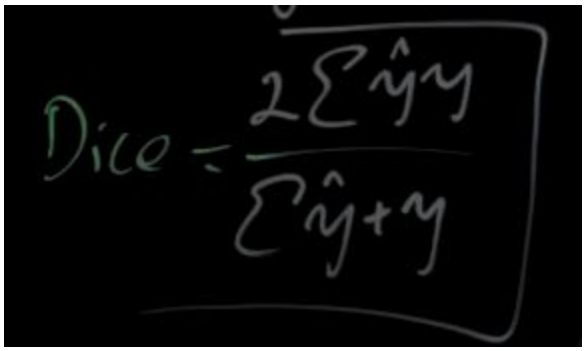


which is exactly same as the $\frac{2 \cdot IoU}{IoU + 1}$

F1 score works better, because the harmonic mean will give you the lowest values of each of the terms (here precision and recall). So, whatever score you get will be conservative.

The above formulation is called "**Hard dice coefficient**", because we are using the TP, FP,etc. which will be in the form of 0 or 1. However, in practice, you will get the probability value for each predicted pixel which will range from 0 to 1. For eg, 0.98.

Hence, we use "**Soft dice coefficient**" which is as follow,



The numerator term calculates the intersection of the class multiplied by 2, and the denominator calculates the addition of the intersection and the union.

Reference taken from:
https://www.youtube.com/watch?v=AZr64OxshLo&ab_channel=SmartAlphaAI