CMPE258 Part II

Nov. 10, 22

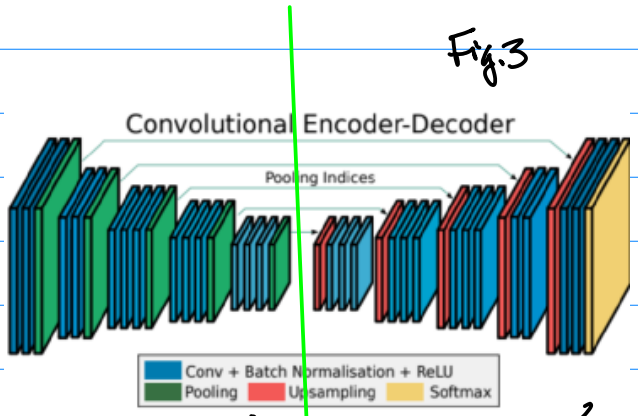
Now, Discussion On Semantic Segmentation.

Bounding Box Based Object Recognition (YOLO) → Pixel Based Object Recognition

Example:

Before v.s. After.

Fig.3



Deep Convolutional Neural Network:

Encoder:

Decoder:

Encoder:

Feature Extraction — Convolutions

Classification — Feedforward NN

To get Pixel by pixel Recognition of Objects e.g. Segmentation

2022F-109-semantic-seg-part1-HL-2022-11-10.pdf

Nov. 10 (Th). Deep Convolution Neural Networks for Semantic Segmentation.

Objectives: Object Recognition On pixel-by-pixel Basis.

Note: The Design tasks for us to achieve this goal is to project feature maps back to higher resolution, eventually to its original size (Same Resolution of the input image).

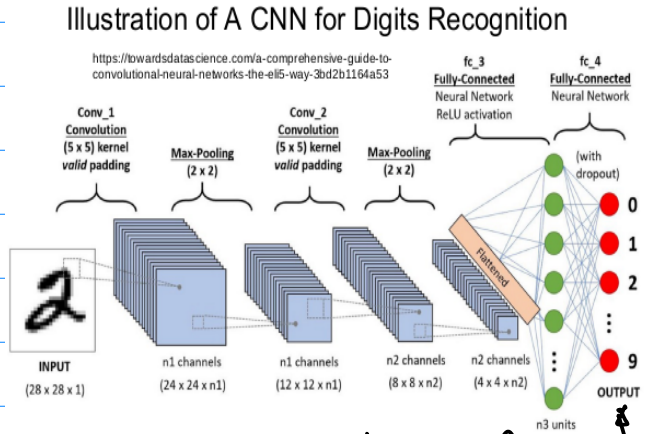


Fig1.

The process of moving from Lower Resolution feature maps to higher Resolution feature map, eventually to the Resolution of the original image is what we called "upsampling".

Outputs are Numerical Values. In Case of YOLO CNN, the outputs are the Bounding Boxes.

Improvement with pixel by pixel Object Recognition →

Fig.2

Design of

Example: UpSampling Techniques

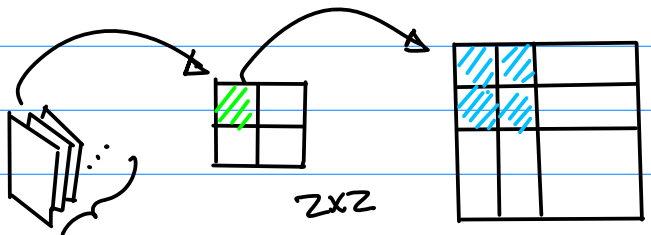


Fig.4

Consider A Design of The Simplest UpSampling. Duplication of the pixel.

Technique 1.

Fig.5

NN

Nearest Neighbour Upsampling.

The Need for Improvement of NN-UpSampling: 1) Sudden Change from one 2x2 Region to its Neighbouring Regions → which produces Visual Artifacts. → propagation till the Output Image; 2) Lack of the consideration of Spatial correlations.

Technique 2. Use Interpolation Technique

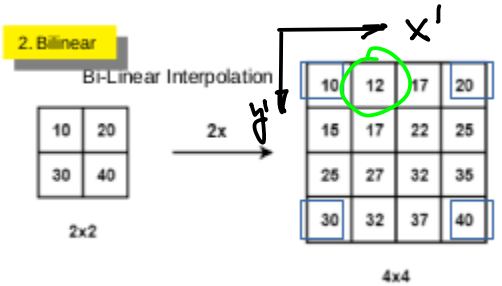


Fig.5-b

Step 1. place "Anchor points" onto the higher resolution patch.

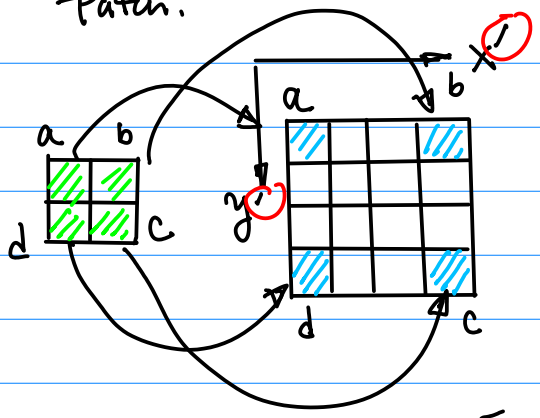


Fig.6

Step 2. Perform Interpolation

Background: Given (x_1, y_1), (x_2, y_2) and x_3, Find $y_3 = ?$

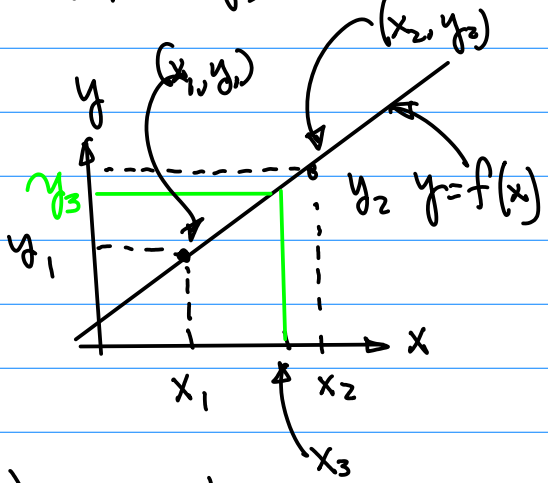


Fig.7

$y = f(x)$, $y = ax + b$ ... (1)

Which is a linear function, (since x is Not in 2nd, 3rd, or higher order).

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{y - y_1}{x - x_1} \quad \text{... (2)}$$

Solve for a and b in the Above equation

$$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$$

$$y = \underbrace{\frac{y_2-y_1}{x_2-x_1}}_{a} x \underbrace{- \frac{y_2-y_1}{x_2-x_1} x_1}_{b} + y_1 \quad \cdots (3)$$

$$a = \frac{y_2-y_1}{x_2-x_1} \quad \cdots (3\text{-}b)$$

$$b = -\frac{y_2-y_1}{x_2-x_1} x_1 + y_1 \quad \cdots (3\text{-}c)$$

Let $x = x'$, y equal to the intensity,

So $x_1 = 0, y_1 = 10$

$x_2 = 3, y_2 = 20$

Nov. 15 (Tue).

1° Project on Semantic Segmentation.

2022F-104f-project-yolact.pdf Due on Nov. 27.

11:59 pm;

Reference for the github code Implementation

2022F-107-#102n-1a-README-YOLACT-...

2° Team Project: Presentation is scheduled on Nov. 29th (Tuesday, In-Class Team Presentation).

Note: (1) Training & Annotation are encouraged & Required;

(2) modification, enhancement, Experimental study are encouraged and Carries more Weight

(3) PPT, with Adequate information for Reproducing, Verifying the Presented; References (Authors, URL Link of the papers, or Publication), github link;

(4) Title page with Authors Names, e-mail, Affliation, CMPE258 Presentation,

(5) One Slide in PPT with the Table

Team member 1. First, Last Name	Responsibility of the work	Contributions, in the areas of (1) Any coding and the % of the entire project; (2) Testing, Verification; (3) PPT; (4) Executive summary; (5) coordinator; (6) others
Team member 2. First, Last Name	Responsibility of the work	Contributions, in the areas of (1) Any coding and the % of the entire project; (2) Testing, Verification; (3) PPT; (4) Executive summary; (5) coordinator; (6) others
Team member 3. First, Last Name	Responsibility of the work	Contributions, in the areas of (1) Any coding and the % of the entire project; (2) Testing, Verification; (3) PPT; (4) Executive summary; (5) coordinator; (6) others
Team member 4. First, Last Name	Responsibility of the work	Contributions, in the areas of (1) Any coding and the % of the entire project; (2) Testing, Verification; (3) PPT; (4) Executive summary; (5) coordinator; (6) others

↑ Fill out this Table.

Example: Continuation of Up Sampling using Bi-Linear Interpolation.

Due to the fact that interpolation is carried out in both Row & Col. Direction.

A straight Line $y = ax + b$ to Connect Between 2 Known Points (x_1, y_1), (x_2, y_2)

Find the pixel value at the Next Right pixel location. Assuming x': 0, 1, 2, 3 (Left to Right) and y': 0, 1, 2, 3 (Top Down)

Sol Find $I(x', y')\big|_{\substack{x'=1 \\ y'=0}} = ?$

From Eqn (3), (3-b), and (3-c),

From the given condition, we have

$$y = \underbrace{\frac{y_2-y_1}{x_2-x_1}}_{a} x \underbrace{- \frac{y_2-y_1}{x_2-x_1} x_1 + y_1}_{b}$$

where

$a = \frac{y_2-y_1}{x_2-x_1}$ Can be found from the given condition, e.g.

$(x_1, y_1) = (0,10)$ See Fig.5-b.

$(x_2, y_2) = (3,20)$

Hence $a = \frac{y_2-y_1}{x_2-x_1} = \frac{20-10}{3-0} = 10/3$

and

$$b = -\frac{y_2-y_1}{x_2-x_1} x_1 + y_1$$

$$= -\frac{20-10}{3-0} \cdot 0 + 10 = 10$$

Therefore, from Eqn(3), we have

$$y = ax+b = \frac{10}{3} \cdot x + 10 \Big|_{x=1} = \frac{10}{3} + 10$$

$$\cong 3.3 + 10 = 13.$$

Note: Round Down 13.3 to 13.

Next, Take Care of the Interpolation of the vertical pair,

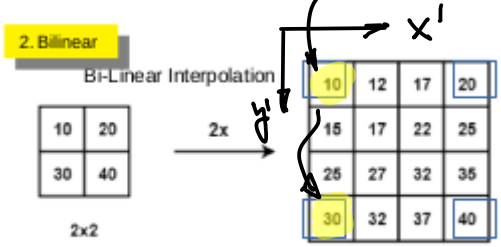


Fig.1.

Apply Eqn(3) Again, from the given condition, if we use the previous independant variable, we have:

$(x_1, y_1) = (0,10)$

$(x_2, y_2) = (0,30)$

But We know we are "moving" Top Down. So,

$$a = \frac{y_2-y_1}{x_2-x_1} \neq \frac{30-10}{0}$$

does not Apply;

Checking for the Index, $y' = 0, 1, 2, 3$, therefore, we use y'_1 for x_1, y'_2 for x_2, as a result we have

$$a = \frac{30-10}{3-0} = 20/3$$

(y'_2, y'_1)

$$b = -\frac{y_2-y_1}{x_2-x_1} x_1 + y_1$$

$$= -\frac{30-10}{3-0} \cdot y'_1 + 10 \Big|_{y'_1=0}$$

$$= 10$$

Hence, Eqn(3) Becomes

$$y = ax+b$$

$$= 20/3 \cdot x + 10 = 20/3 \cdot y' + 10$$

$y = ax + b$

$= \frac{20}{3} \cdot x + 10 = \frac{20}{3} \cdot y' + 10 \Big|_{y'=1}$

$= \frac{20}{3} \cdot 1 + 10 \simeq 7 + 10 = 17$