Artificial Intelligence: *Modeling Human Intelligence with Networks*

Jeová Farias Sales Rocha Neto
jeova_farias@brown.edu

Convolutions and Max Pooling

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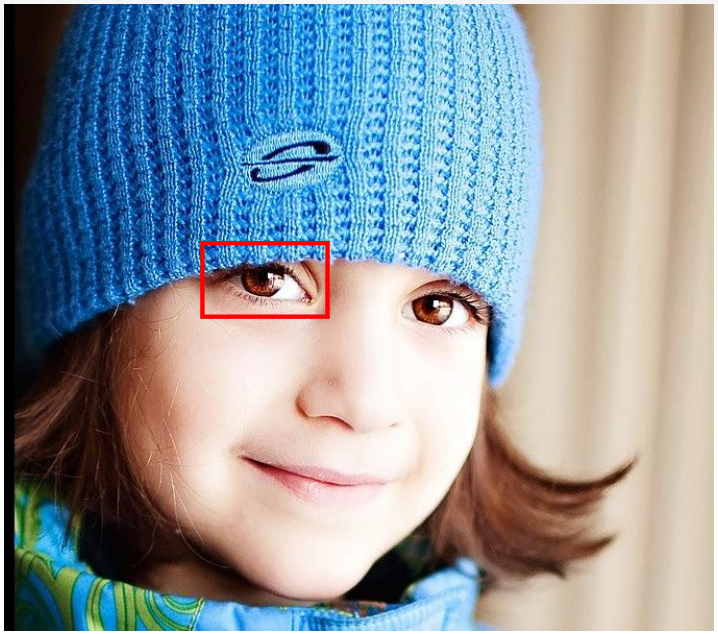

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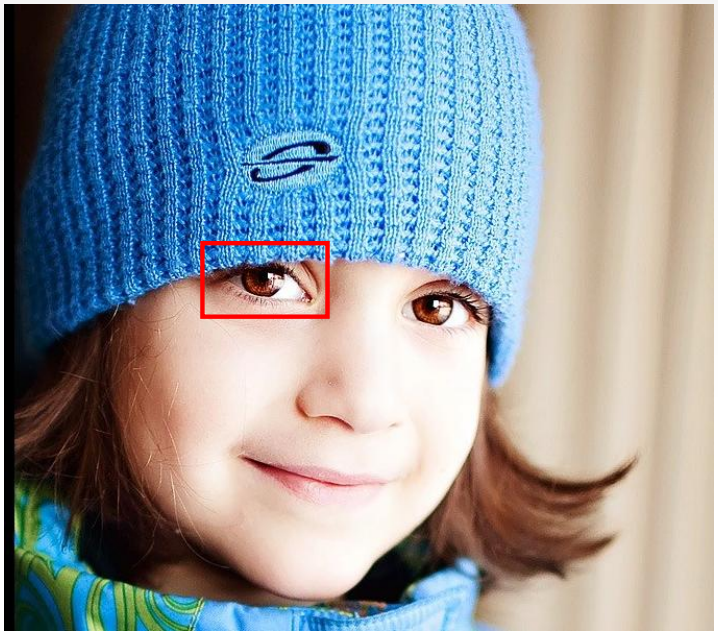

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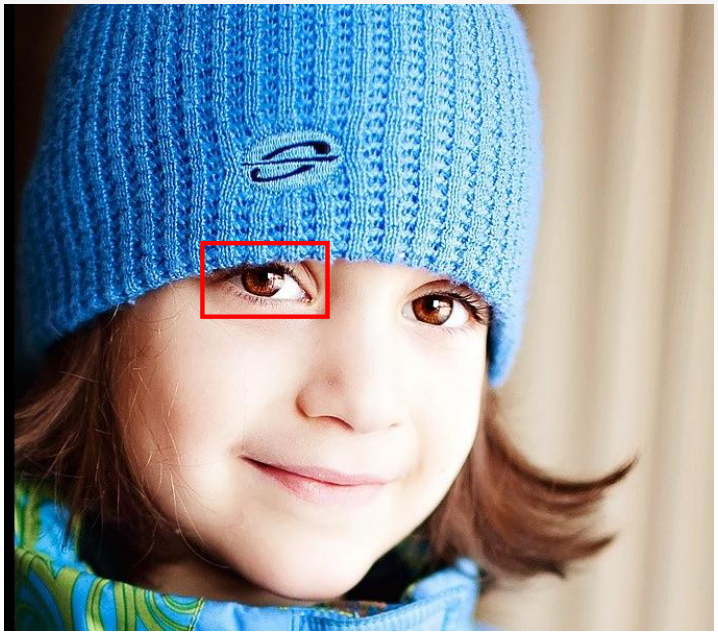

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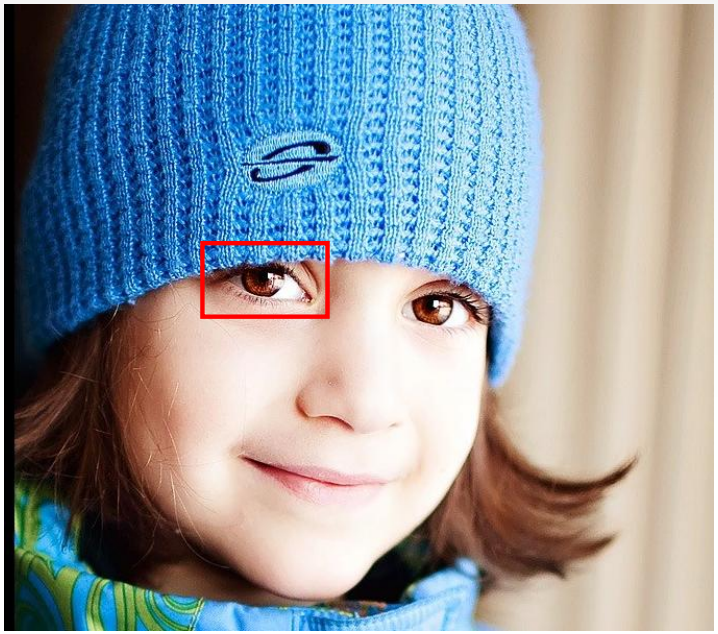

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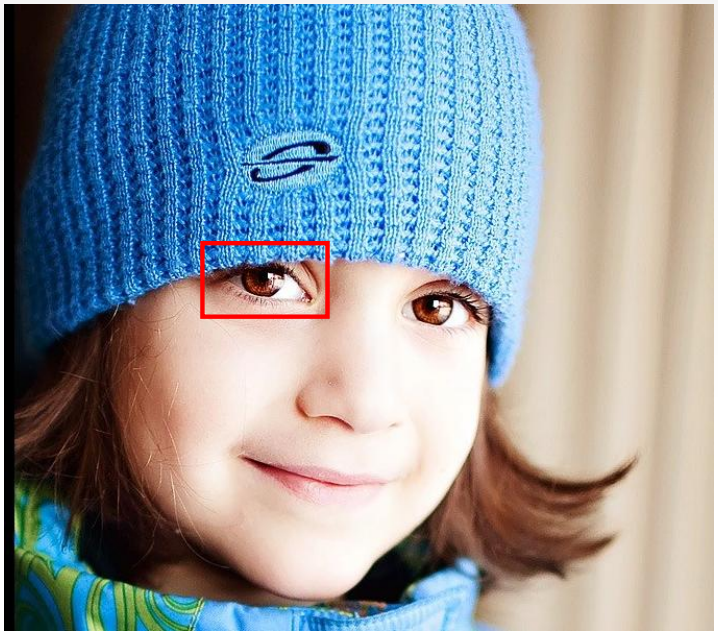

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R 255 G 255 B 102	R 255 G 0 B 204	R 51 G 204 B 255
R 51 G 51 B 0	R 51 G 51 B 153	R 255 G 153 B 153

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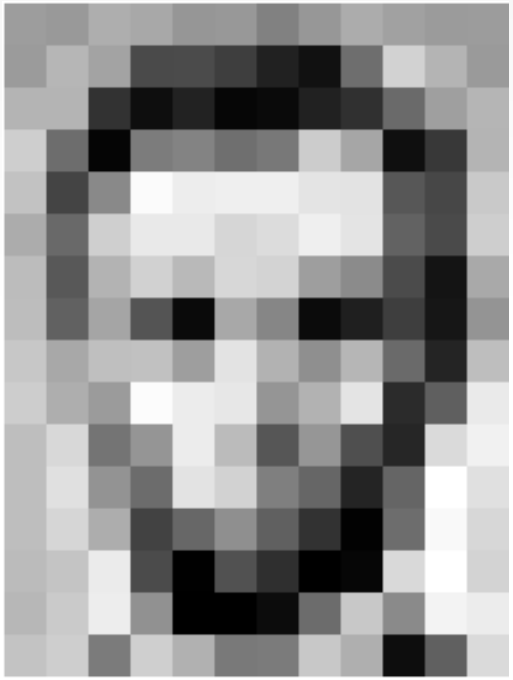

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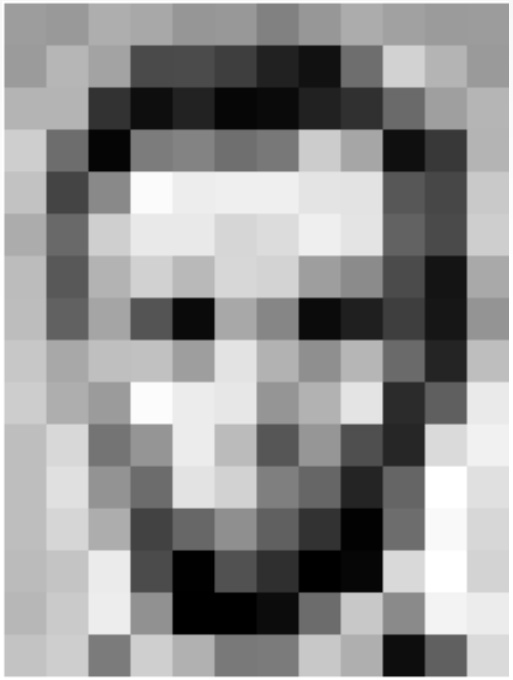

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172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
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190	224	147	108	227	210	127	102	36	101	255	224
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187	196	235	75	1	81	47	0	6	217	255	211
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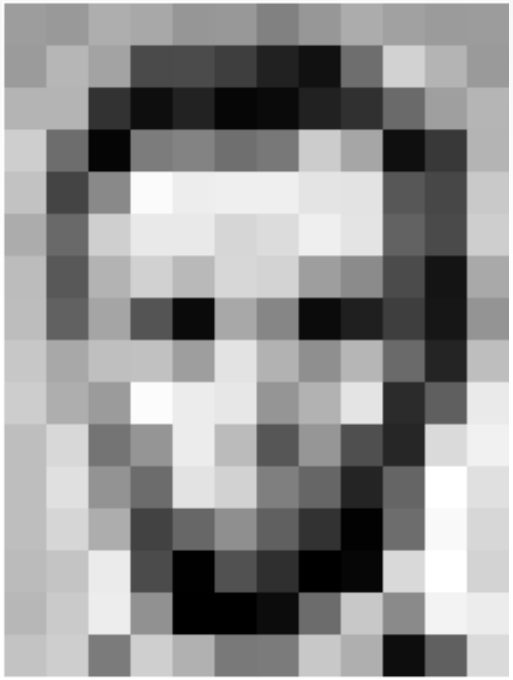

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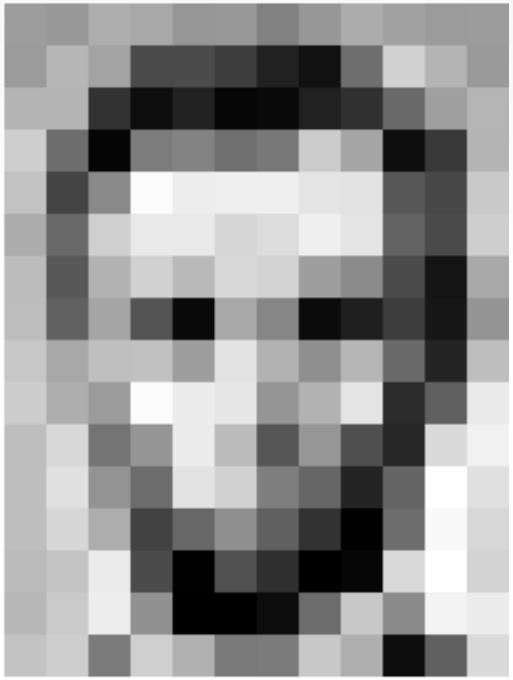

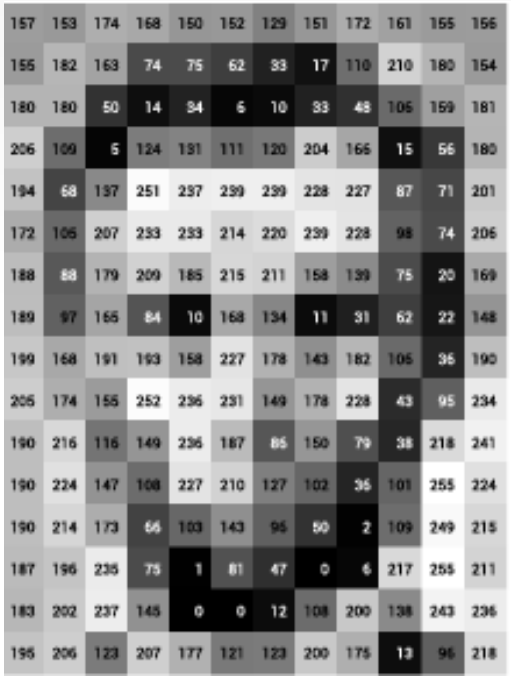

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- A matrix!

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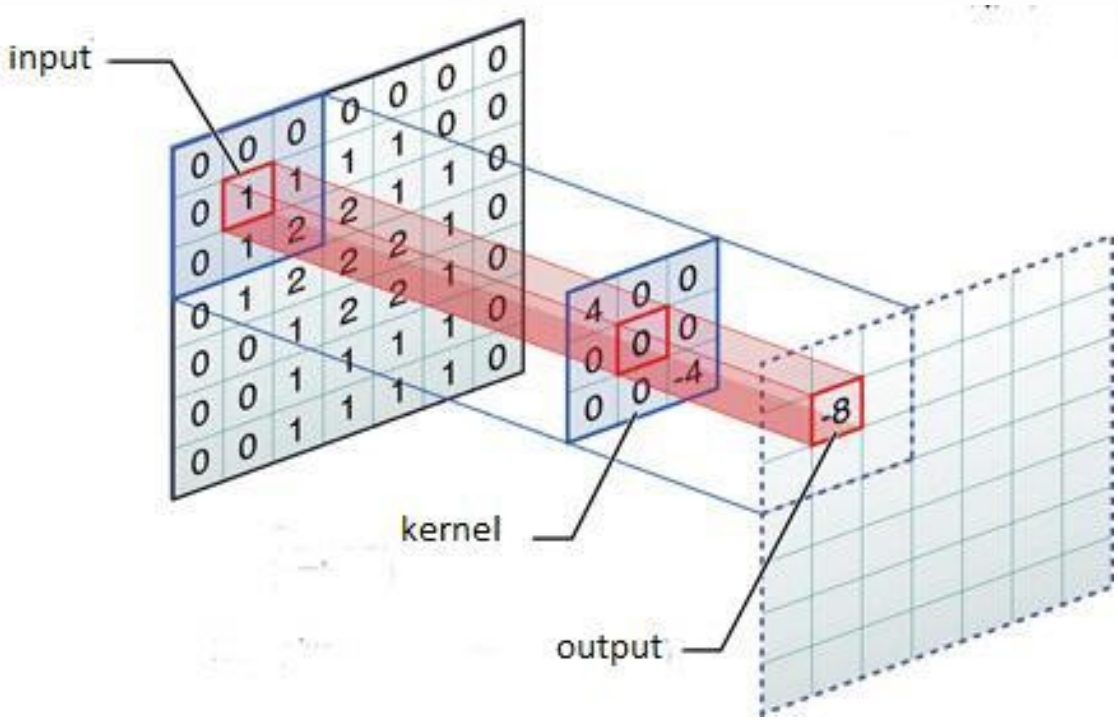


Convolutions

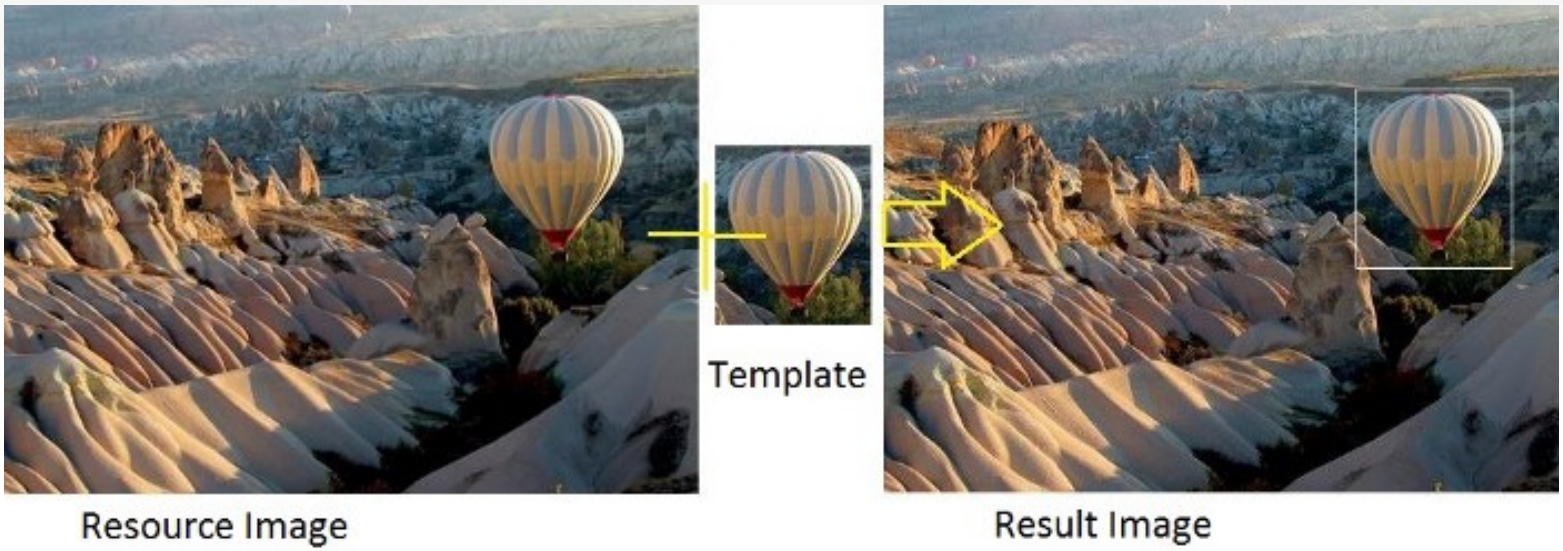
Algorithm 1 *Convolution*

Input: An image I and a filter $f \in \mathbb{R}^{n \times n}$, both matrices
Output: A matrix M.

1: Compute n_row and n_col as the number of rows and columns of I
2: Compute $d = (n-1)/2$
3: **for** i from d to $n\_row - d$ **do**
4: **for** j from d to $n\_col - d$ **do**
5: $M[i,j] = I[i-d : i+d+1, j-d : j+d+1] \cdot f$
6: **end for**
7: **end for**

Template Matching

- Convolutions can also be used to do cool things with images, like template matching!



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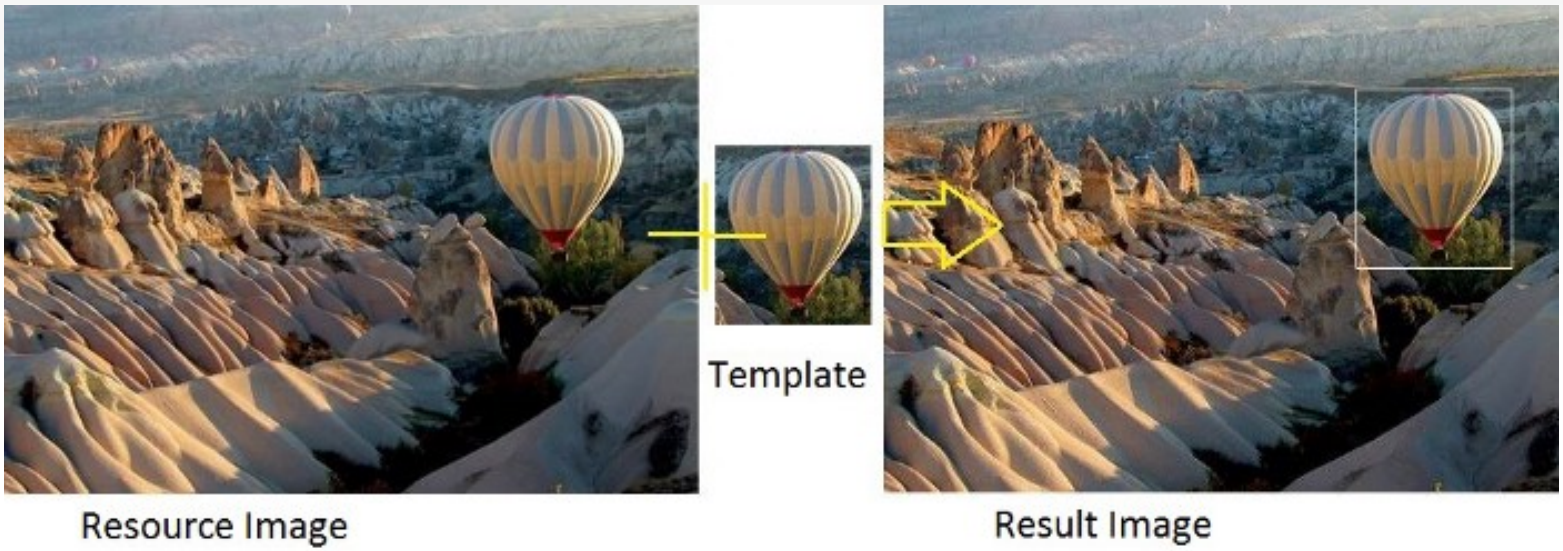

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- Let's try to do that in python!

Non-maxima Suppression

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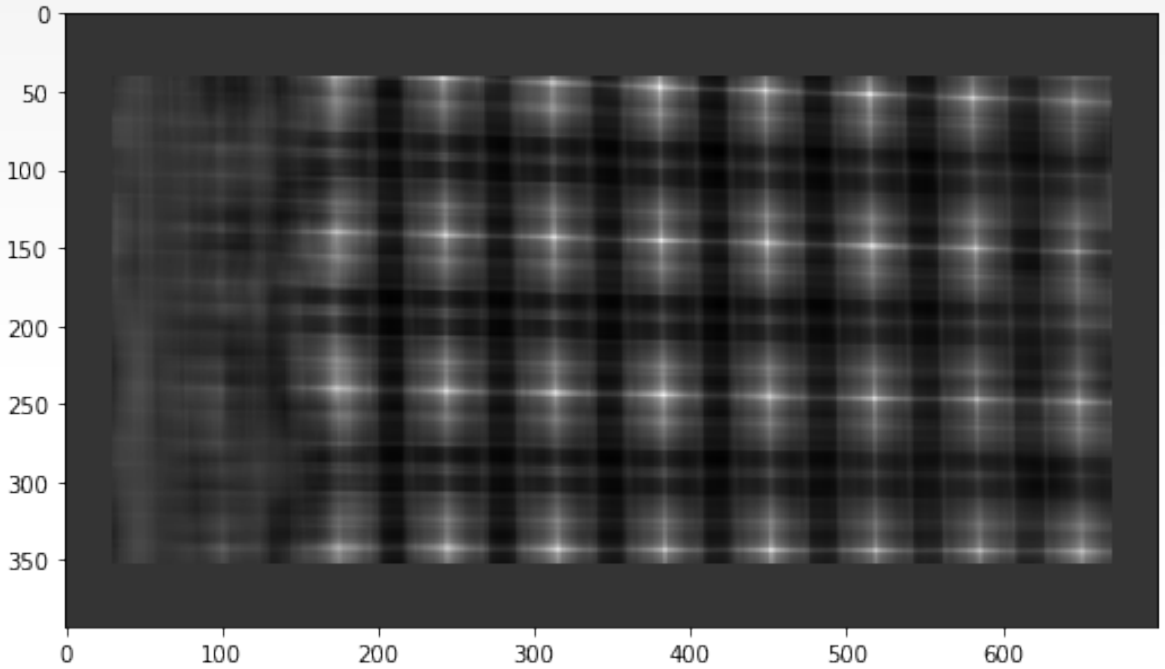

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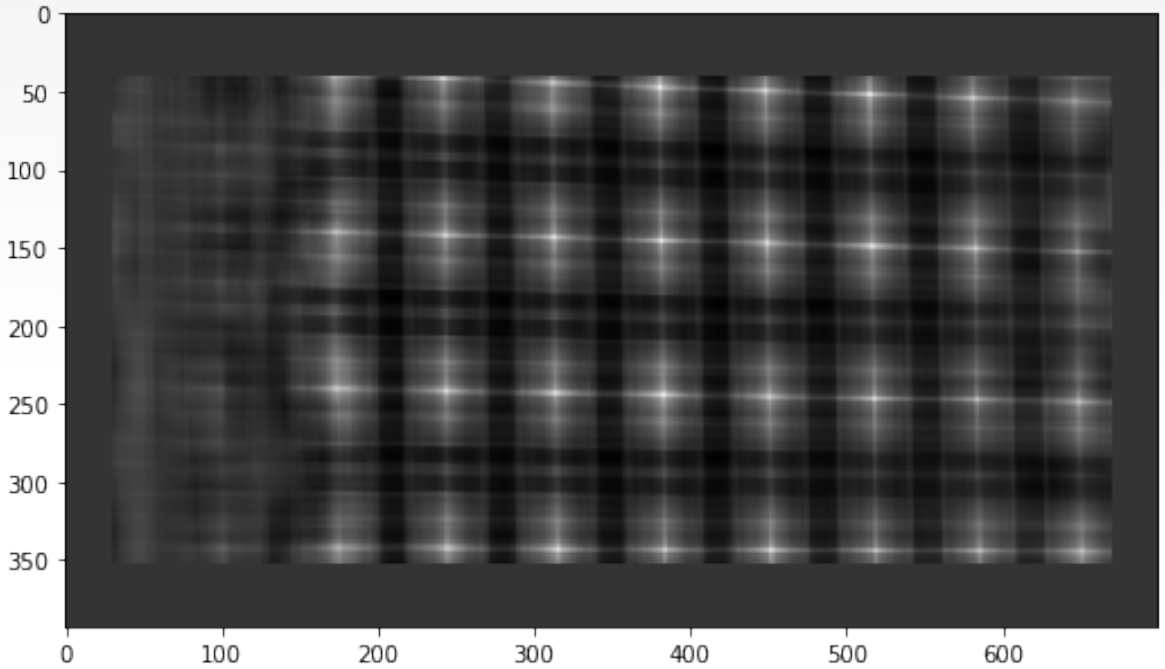

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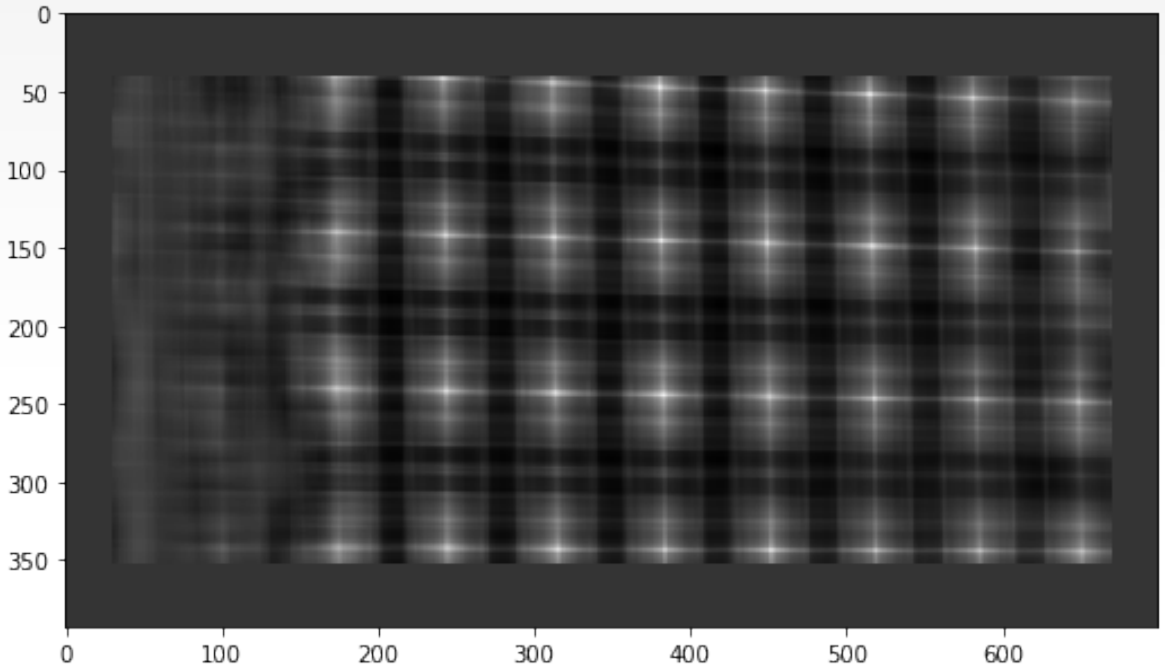

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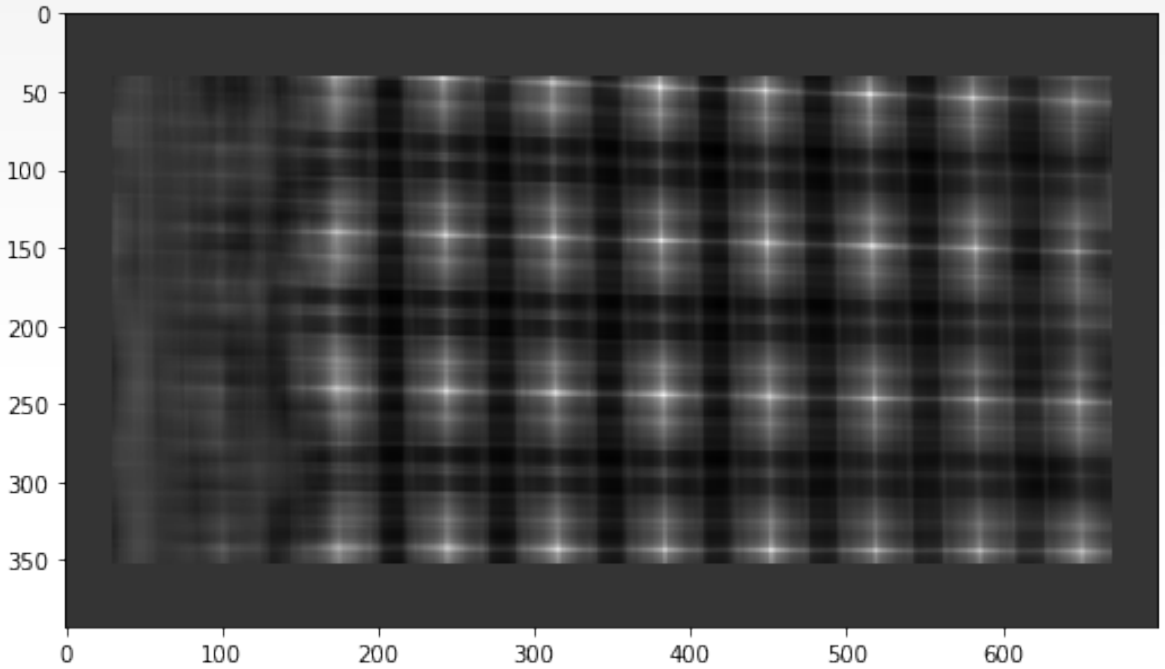

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- What does “Non-maxima Suppression” mean?

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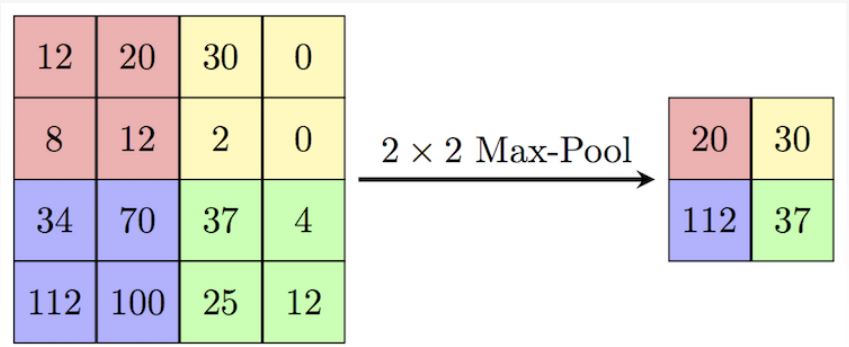

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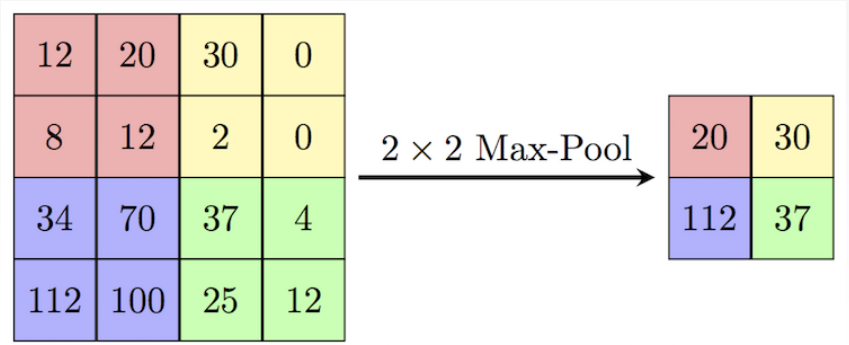

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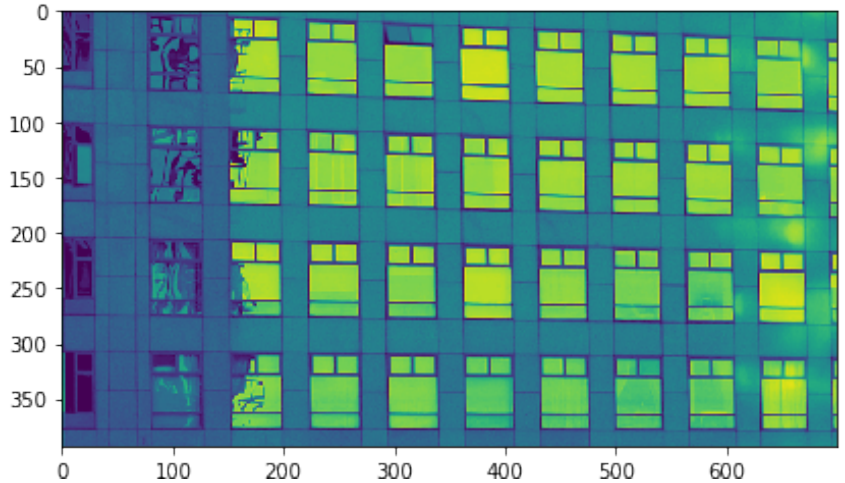

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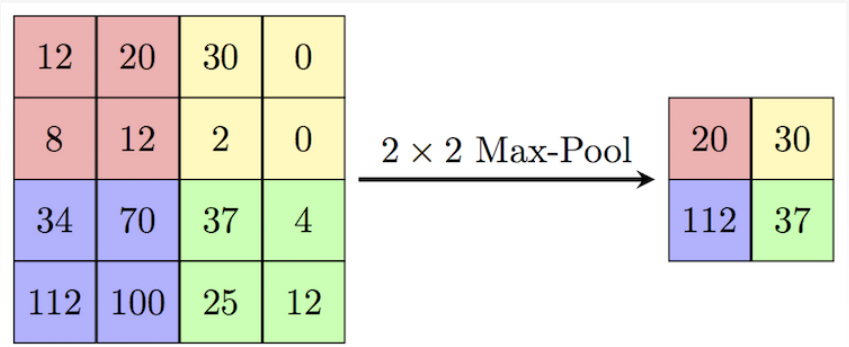

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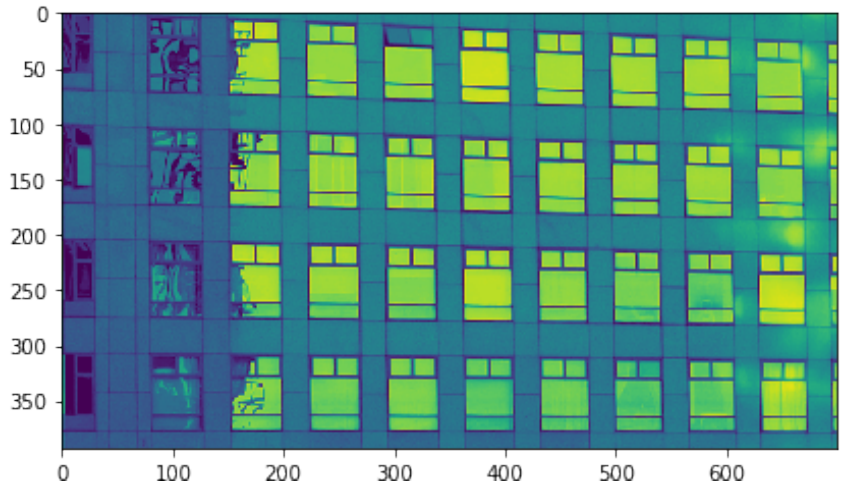

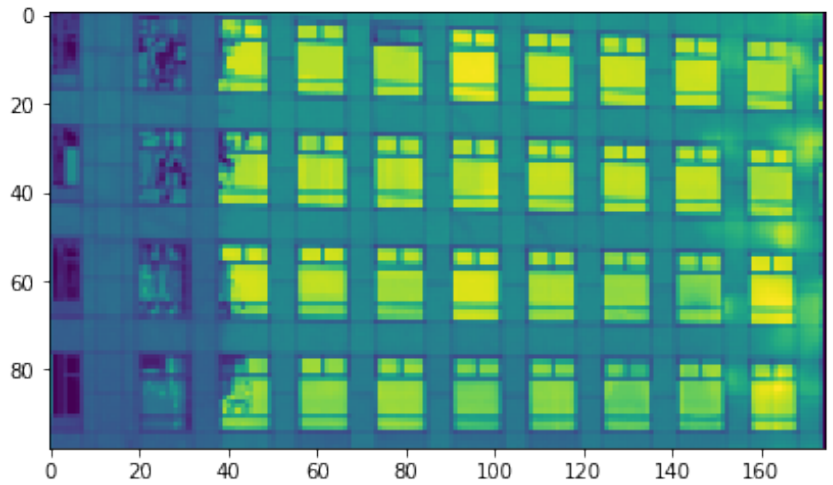

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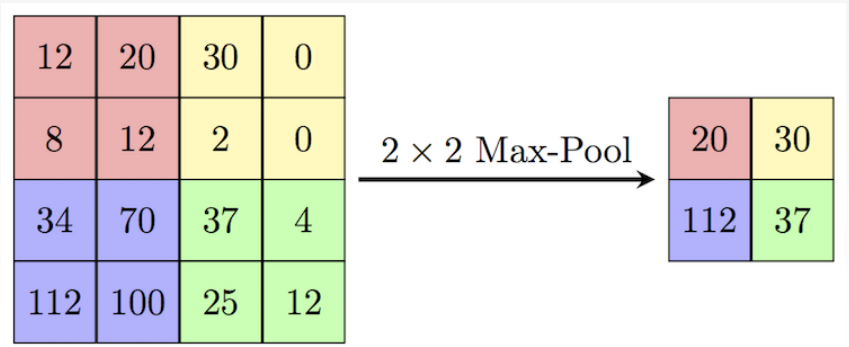

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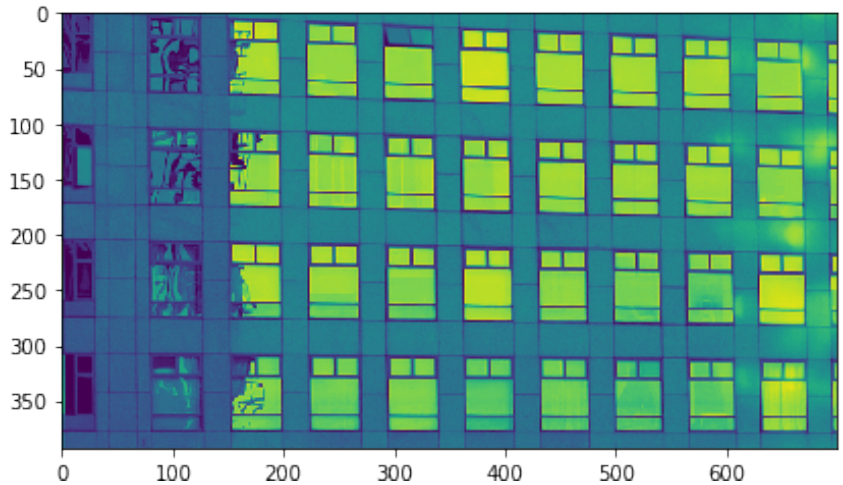

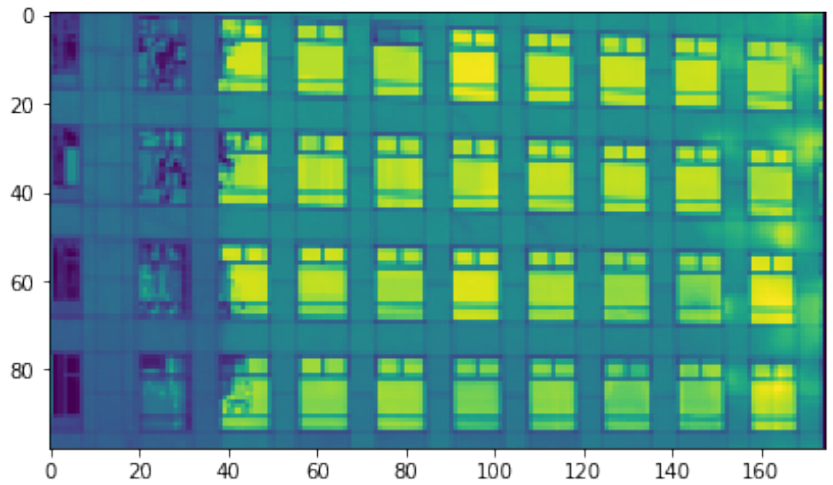

- What happened to the image?