

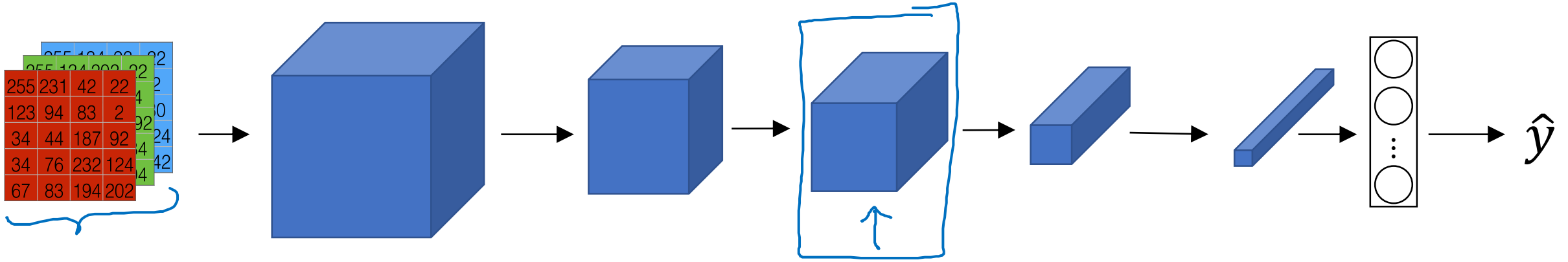


deeplearning.ai

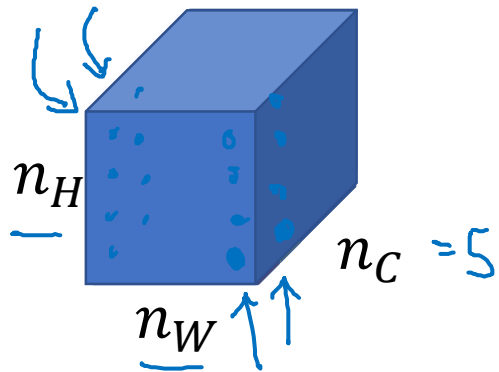
Neural Style Transfer

Style cost function

Meaning of the “style” of an image



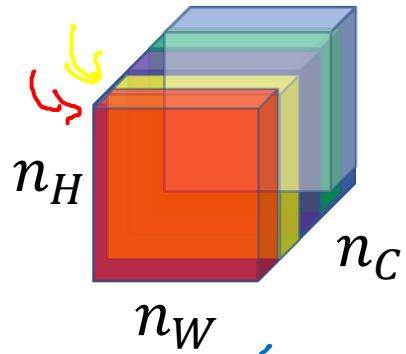
Say you are using layer l 's activation to measure “style.”
Define style as correlation between activations across channels.



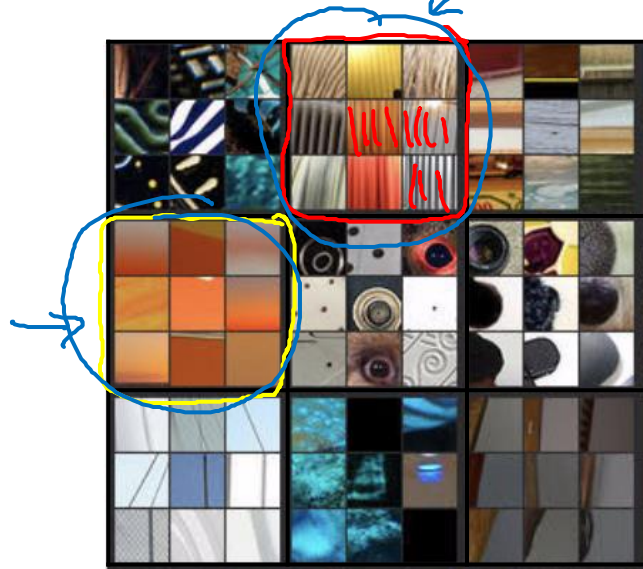
How correlated are the activations
across different channels?

Intuition about style of an image

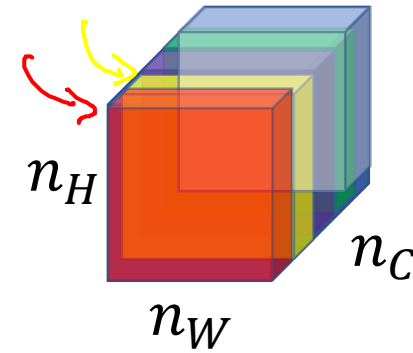
Style image



Correlated?
Uncorrelated



Generated Image



Style matrix

Let $a_{i,j,k}^{[l]}$ = activation at (i, j, k) . $G^{[l]}$ is $n_c^{[l]} \times n_c^{[l]}$

$$\begin{aligned} \rightarrow G_{kk'}^{[l](S)} &= \sum_{i=1}^{n_H^{[l]}} \sum_{j=1}^{n_W^{[l]}} a_{ijk}^{[l](S)} a_{ijk'}^{[l](S)} \\ \rightarrow G_{kk'}^{[l](G)} &= \sum_{i=1}^{n_H^{[l]}} \sum_{j=1}^{n_W^{[l]}} a_{ijk}^{[l](G)} a_{ijk}^{[l](G)} \end{aligned}$$

$$G_{kk'}^{[l]} \quad k, k' = 1, \dots, n_c^{[l]}$$

"Gram matrix"

$$\begin{aligned} J_{\text{style}}^{[l]}(S, G) &= \frac{1}{(\dots)} \|G^{[l](S)} - G^{[l](G)}\|_F^2 \\ &= \frac{1}{(2n_H^{[l]}n_W^{[l]}n_c^{[l]})^2} \sum_k \sum_{k'} (G_{kk'}^{[l](S)} - G_{kk'}^{[l](G)})^2 \end{aligned}$$

Style cost function

$$\|G^{[l](S)} - G^{[l](G)}\|_F^2$$

$$J_{style}^{[l]}(S, G) = \frac{1}{\left(2n_H^{[l]}n_W^{[l]}n_C^{[l]}\right)^2} \sum_k \sum_{k'} (G_{kk'}^{[l](S)} - G_{kk'}^{[l](G)})^2$$

$$J_{style}(S, G) = \sum_l \lambda_l J_{style}^{[l]}(S, G)$$

$$\underbrace{J(G)}_G = \alpha J_{content}(G) + \beta J_{style}(S, G)$$