

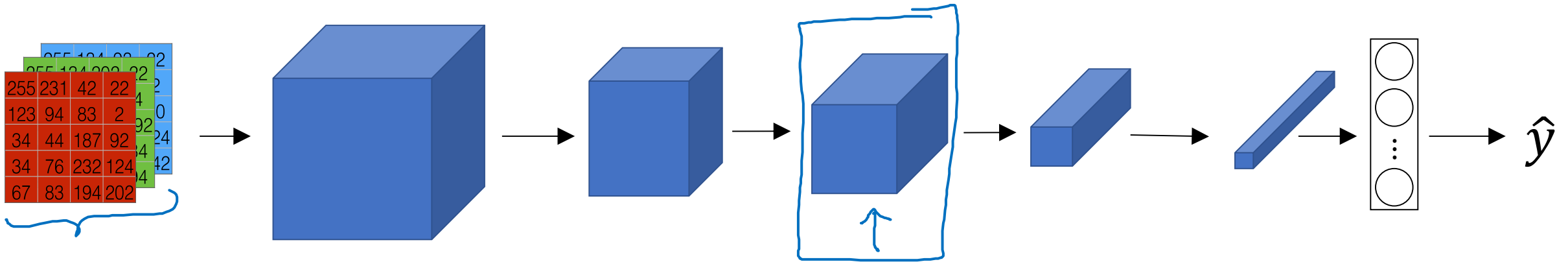


deeplearning.ai

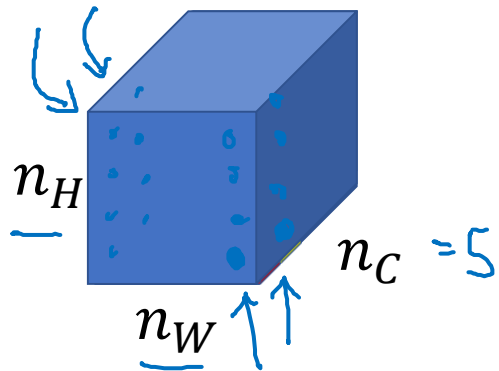
Neural Style Transfer

Style cost function

Meaning of the “style” of an image



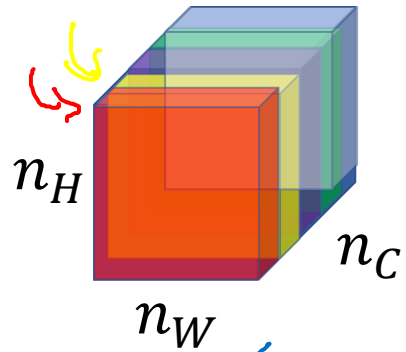
Say you are using layer l 's activation to measure “style.”
Define style as correlation between activations across channels.



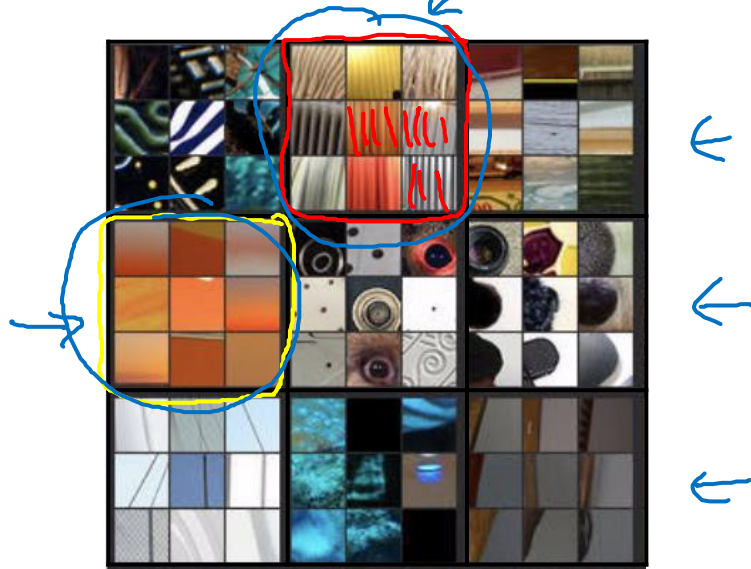
How correlated are the activations
across different channels?

Intuition about style of an image

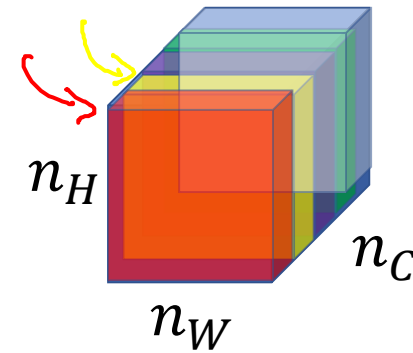
Style image



Correlated?
Uncorrelated



Generated Image



Style matrix

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

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

$$\begin{aligned} & n_c \\ & G_{kk'}^{[l]} \\ & \uparrow \uparrow \\ & k = 1, \dots, n_c \end{aligned}$$

"Gram matrix"

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

Style cost function

$$\|G^{TL(S)} - G^{TL(G)}\|_F^2$$

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

$$J_{style}(S, G) = \sum_l \lambda_l^{TL} J_{style}^{TL}(S, G)$$

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