

Neural Style Transfer

seminarski rad iz predmeta Računarska inteligencija
Marija Lakić, 84/2017

Definicija problema

- **Content image**
- **Style image**
- **Combined image**
- **Korišćenjem neuronskih mreža**

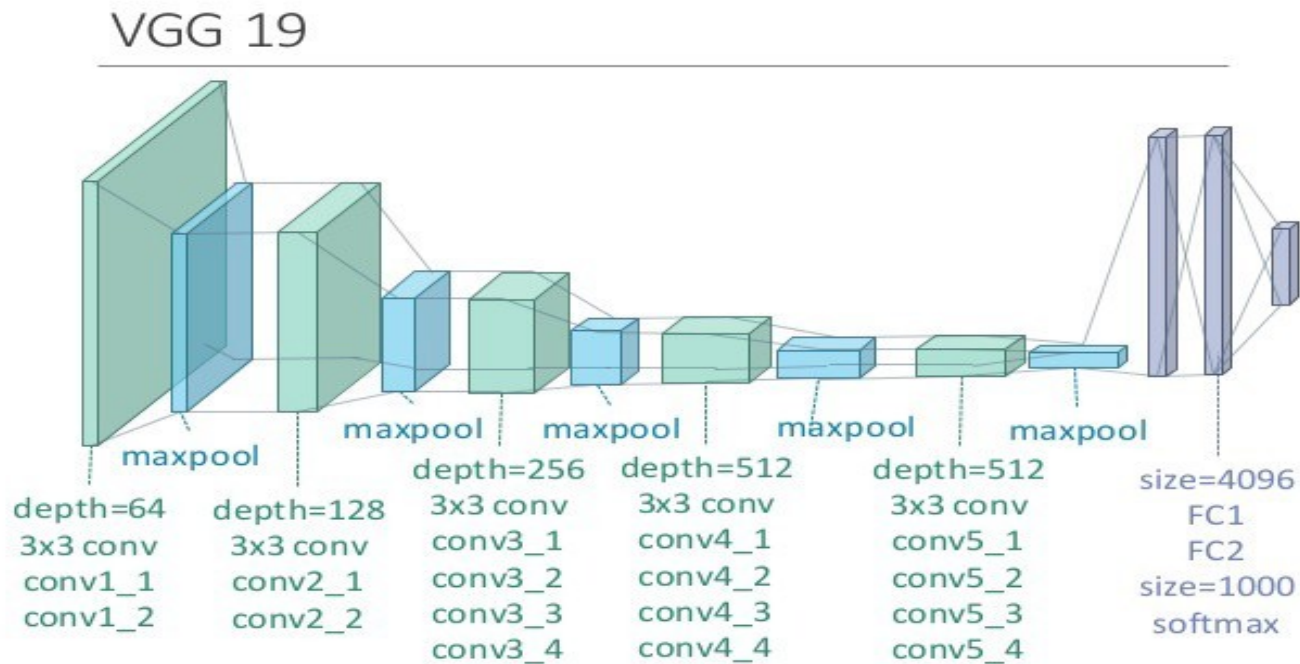
Rešenje prezentovano u originalnom radu

- **Izvlačenje karakteristika slika**
 - treniranje filtera nad ulazom pomoću VGG19 mreže
 - reprezentacija stila i sadržaja
- **Optimizacija gradijentnim spustom nad white-noise slikom**
 - definisane su posebne funkcije greške za stil i sadržaj

VGG19 mreža

- **Utrenirana konvolutivna neuronska mreža nad Imagenet skupom podataka**
- **avg pooling**

VGG19 mreža (2)



Slika preuzeta sa:

<https://www.slideshare.net/ckmarkohchang/applied-deep-learning-1103-convolutional-neural-networks>

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Reprezentacija sadržaja i stila

- **Sadržaj: block4_conv2**
- **Stil: block1_conv1, block2_conv1, block3_conv1, block4_conv1, block5_conv1**
- **Moguće je menjati skup slojeva koji se koristi za izvlačenje karakteristika**

Reprezentacija sadržaja

- **Funkcija greške:**

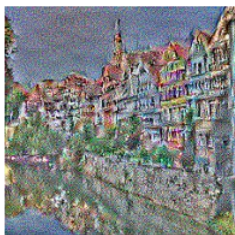
$$L_{content}(\vec{p}, \vec{x}, l) = \frac{1}{2} \sum (F_{ij}^l - P_{ij}^l)^2$$

Reprezentacija sadržaja (2)

Iteration: 0



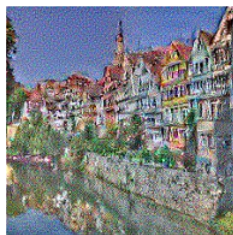
Iteration: 100



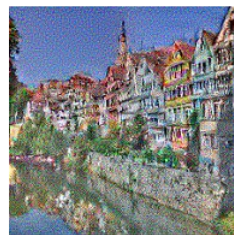
Iteration: 200



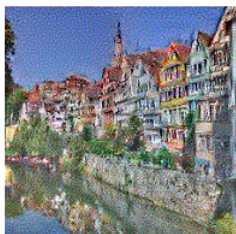
Iteration: 300



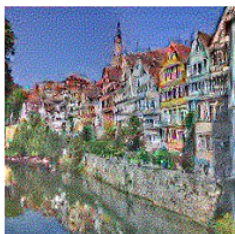
Iteration: 400



Iteration: 500



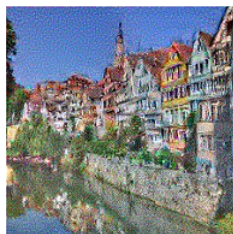
Iteration: 600



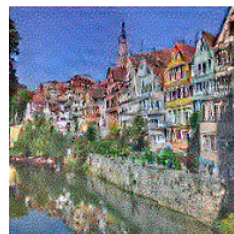
Iteration: 700



Iteration: 800



Iteration: 900



Reprezentacija stila

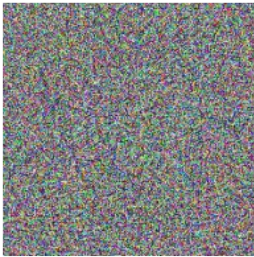
- **Funkcija greške:**

$$E_l = \frac{1}{4N_l^2 M_l^2} \sum_{i,j} (G_{ij}^l - A_{ij}^l)$$

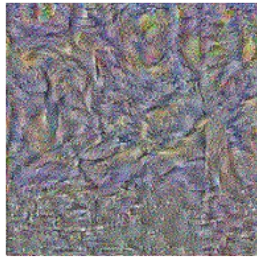
$$L_{style}(\vec{a}, \vec{x}) = \sum_{l=0}^L w_l E_l$$

Reprezentacija stila

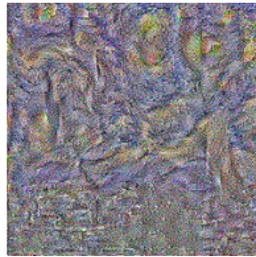
Iteration: 0



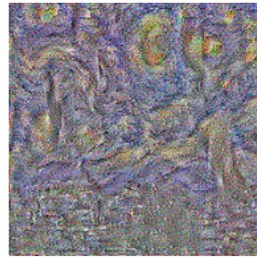
Iteration: 100



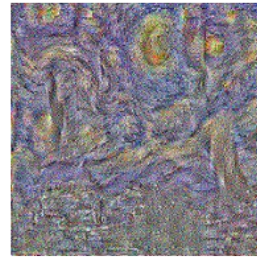
Iteration: 200



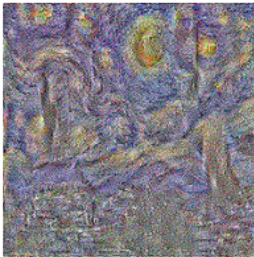
Iteration: 300



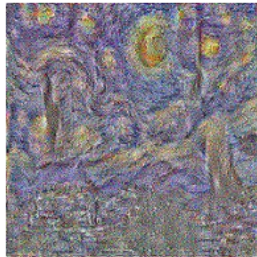
Iteration: 400



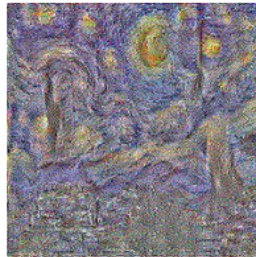
Iteration: 500



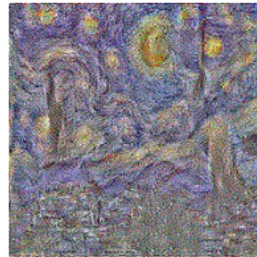
Iteration: 600



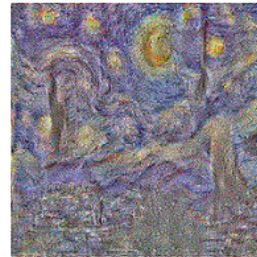
Iteration: 700



Iteration: 800



Iteration: 900



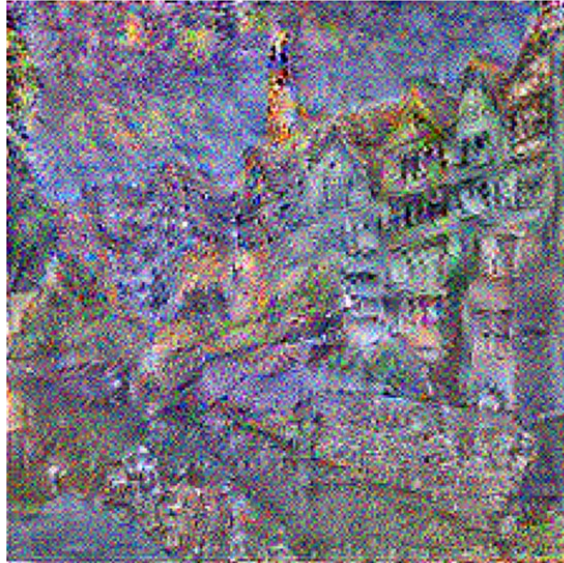
Funkcije greške

- **Funkcija greške koja se optimizuje za kombinovanu sliku:**

$$L_{total}(\vec{p}, \vec{a}, \vec{x}) = \alpha L_{content}(\vec{p}, \vec{x}) + \beta L_{style}(\vec{a}, \vec{x})$$

- **Adam optimizator**

Rezultat



Hvala na pažnji!