CNNs para Reconhecimento de Personagens



Grupo 04

Escola Politécnica da USP
Princípios de Neurocomputação – PSI5886
Prof. Dr. Emílio Del Moral Hernandez
Dezembro de 2018

Integrantes



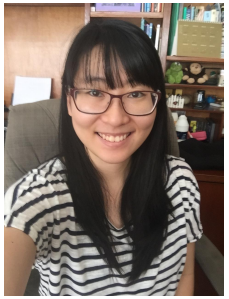
Bruno Padilha



Gabriel Takaoka Nishimura



Lucas Francisco A O Pellicer



Vivian Kimie Isuyama

Participação do Grupo

1. Vivian: Leitura da base e análise com a VGG
2. Gabriel: Análise com a ResNet
3. Bruno: Análise com a DenseNet
4. Lucas: Análise de Interpretabilidade

Objetivos

1. [TREINO] Realizar transfer learning em arquiteturas diferentes de CNNs
    a. VGG16
    b. ResNet50
    c. DenseNet121
2. [ANÁLISE] Analisar esses resultados utilizando:
    a. Layer Wise Relevance Propagation
    b. Deconvolution

A base de imagens







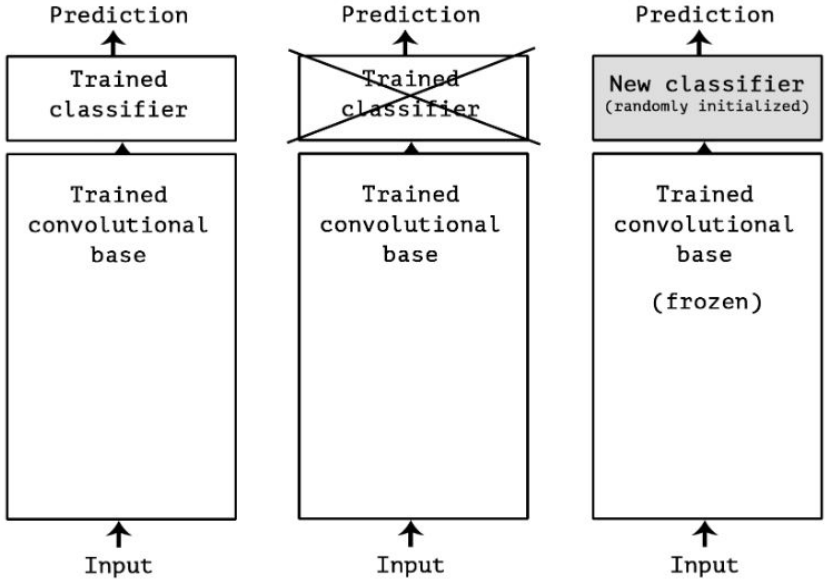




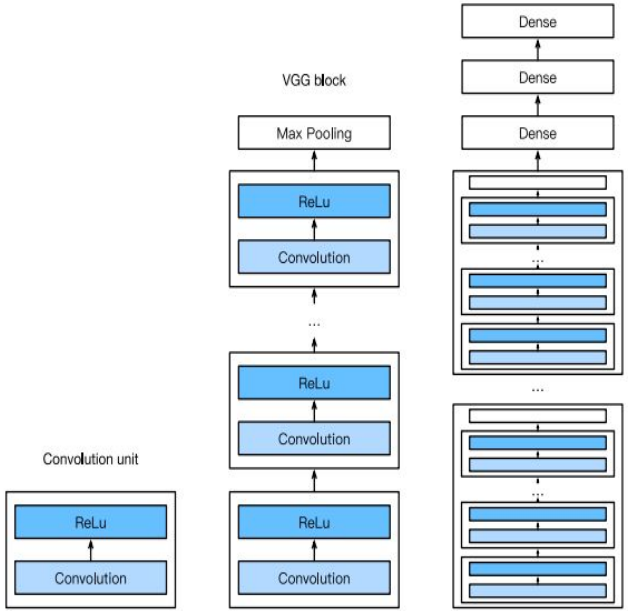
https://www.kaggle.com/alexattia/the-simpsons-characters-dataset

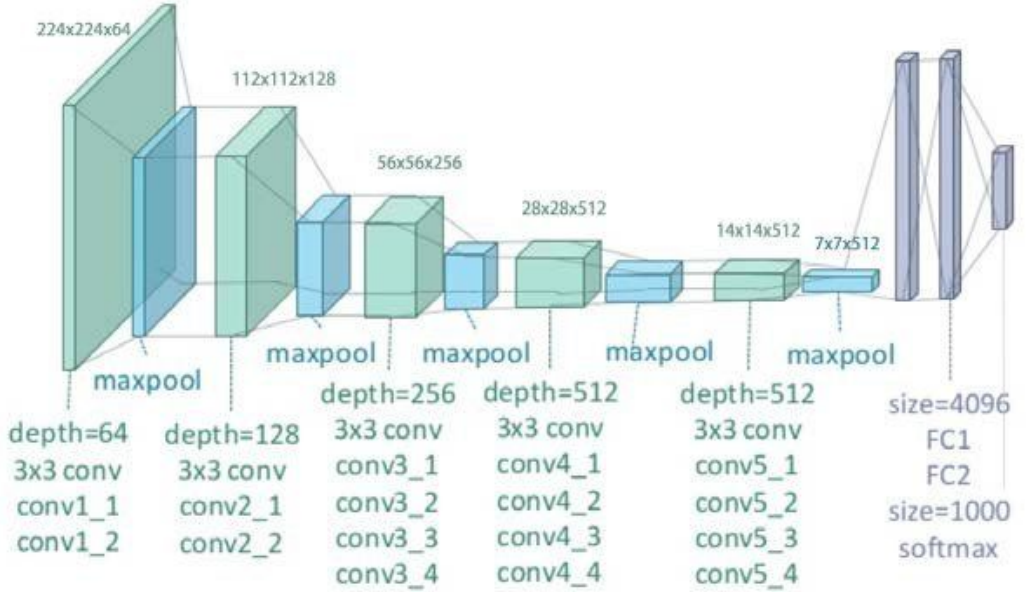
Transfer Learning

- Transfer learning é uma tática de treinamento que permite maior rapidez para ajuste dos pesos[1].
- Para imagens, em geral as redes pré-treinadas funcionam como extratores de variáveis da imagem[1], enquanto a camada densa que será adicionada é o classificador por si só.



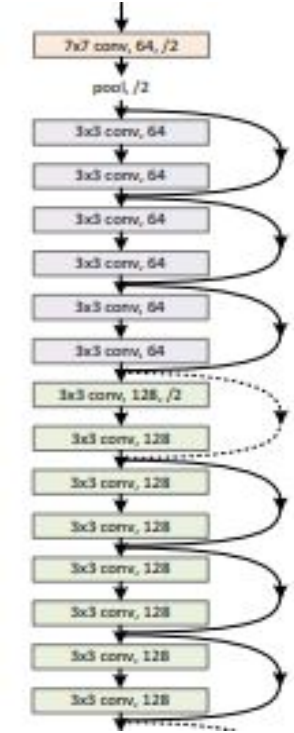
Arquiteturas abordadas - VGG16[2]

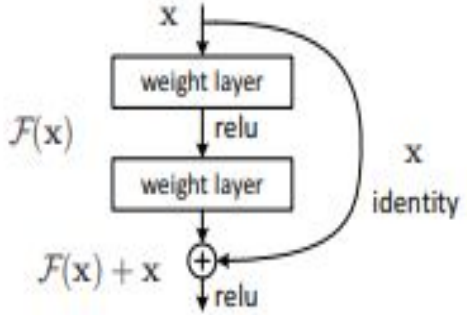




2: HE, K. et al. Deep residual learning for image recognition. In: Proceedings of the IEEE conference on computer vision and pattern recognition. [S.l.: s.n.], 2016. p. 770-778

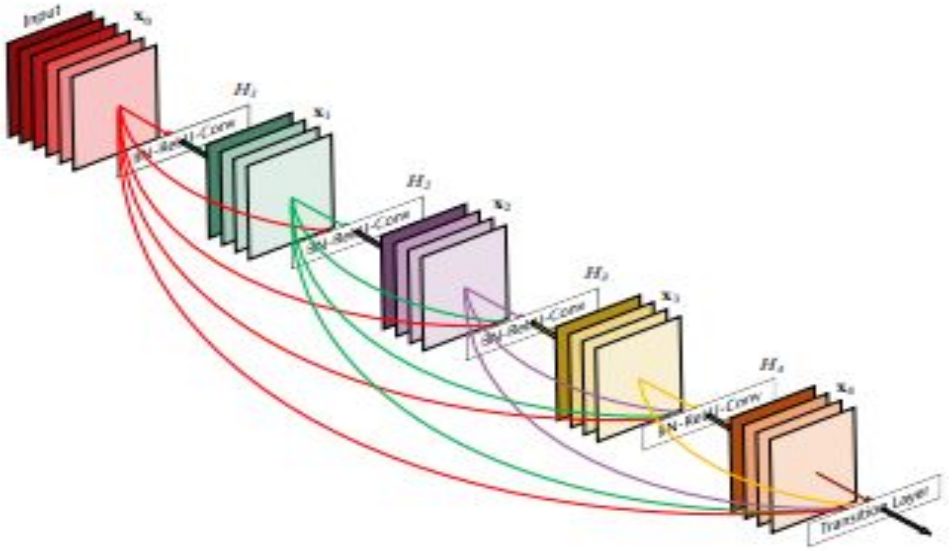
Arquiteturas abordadas - ResNet50[1]





2: HE, K. et al. Deep residual learning for image recognition. In: Proceedings of the IEEE conference on computer vision and pattern recognition. [S.l.: s.n.], 2016. p. 770-778

Arquiteturas abordadas - DenseNet



DenseNet[1]

https://arthurdouillard.com/post/densenet/

Comparação - Desempenho

Acurácia e Erro na base de teste de 890 imagens:

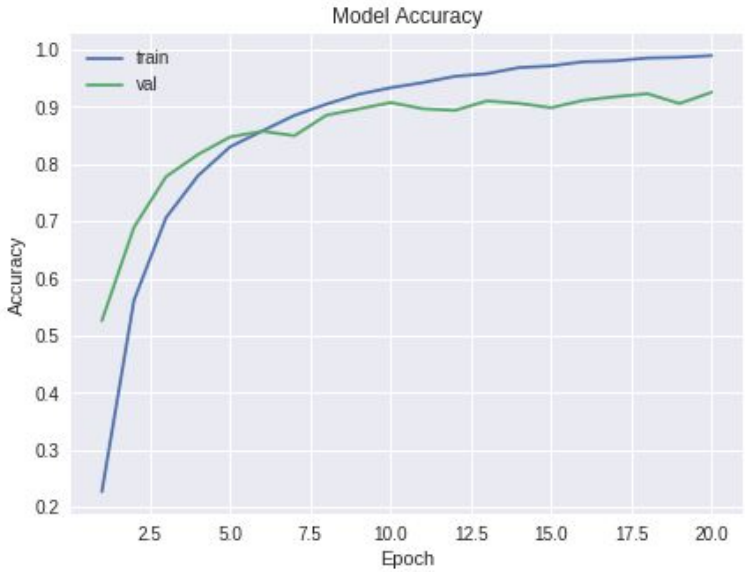
Rede	Acurácia	Erro	T_{treino}	Epochs
VGG16	98,3%	0,083	15 min	20
ResNet50	93,5%	0.274	22 min	20
DenseNet121	78,5%	0.837	21 min	20

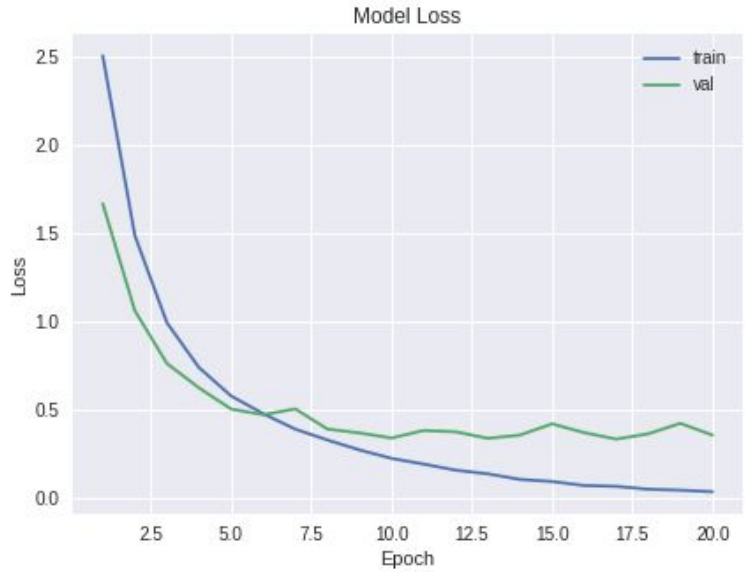


Disponível em: https://github.com/gabrieltnishimura/simpsons-tinnvestigate
Ensaios executados no Google Collab

Comparação - Desempenho

VGG16

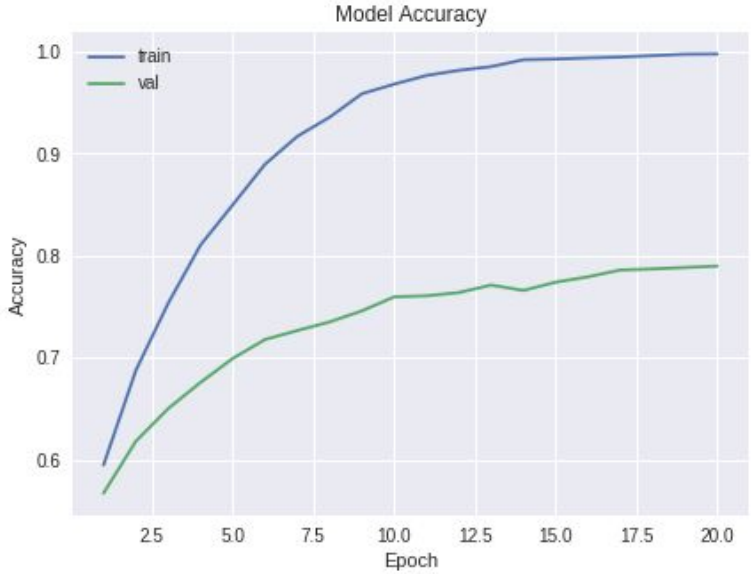


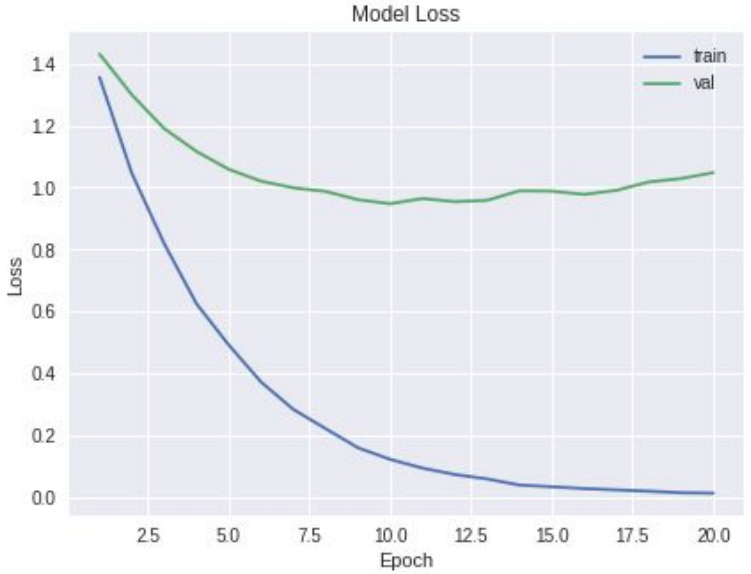


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Comparação - Desempenho

ResNet50

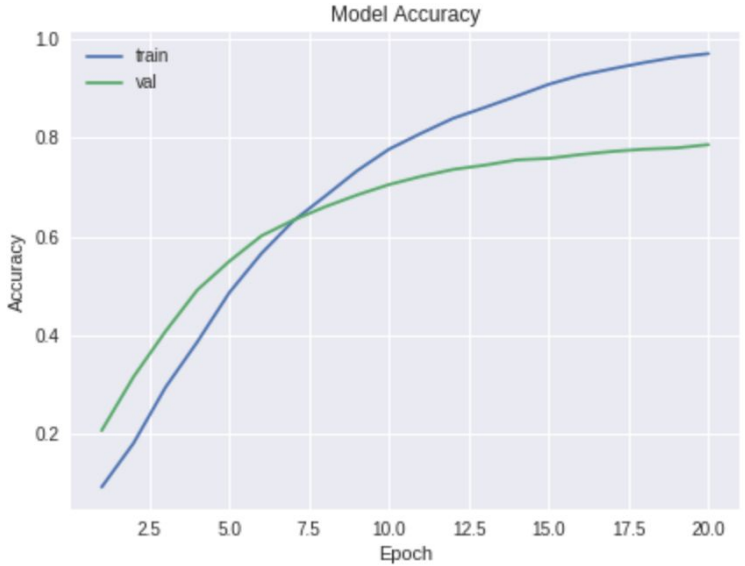


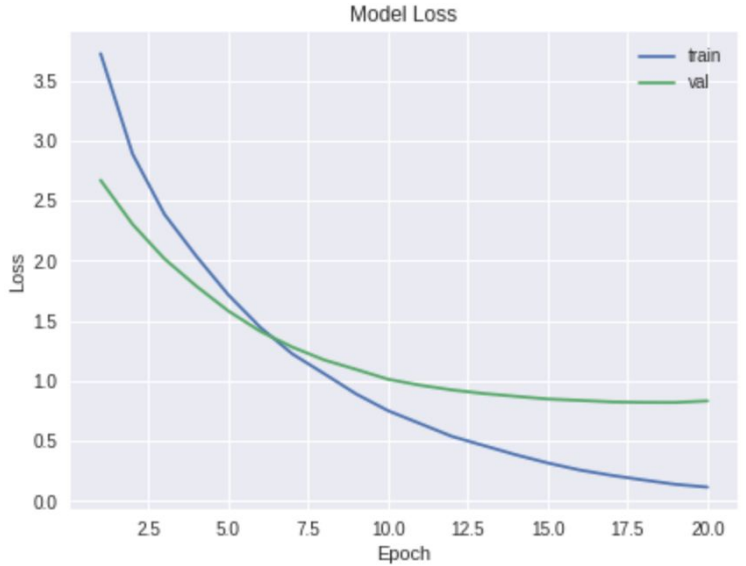


Disponível em: https://github.com/gabrieltnishimura/simpsons-tinnvestigate

Comparação - Desempenho

DenseNet121

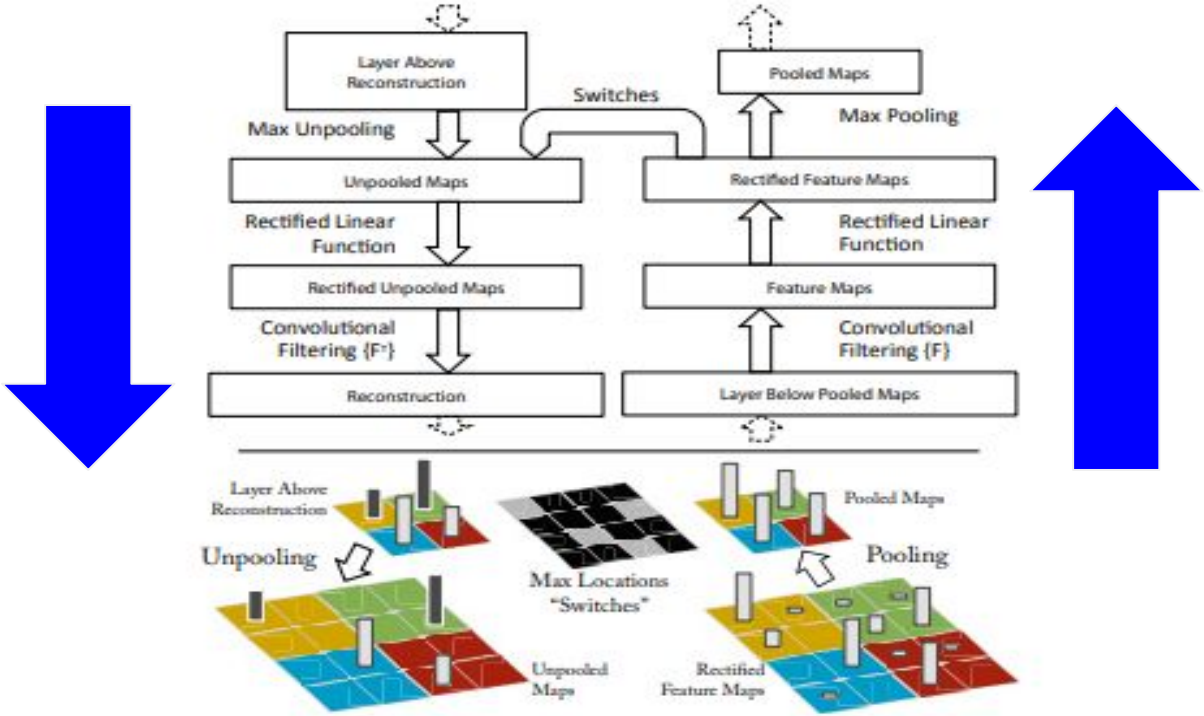




Disponível em: https://github.com/gabrieltnishimura/simpsons-tinnvestigate

Deconvolution[9]

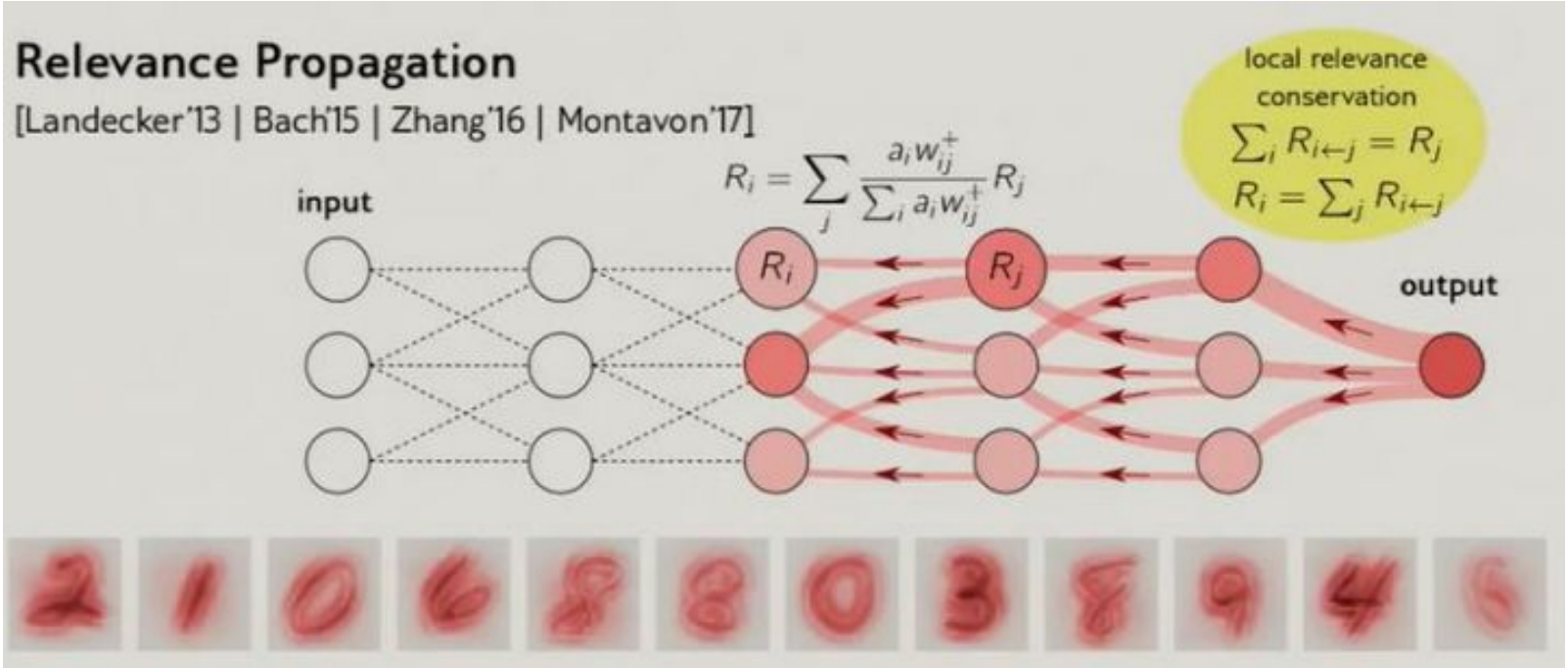
Deconvolution
Interpretação



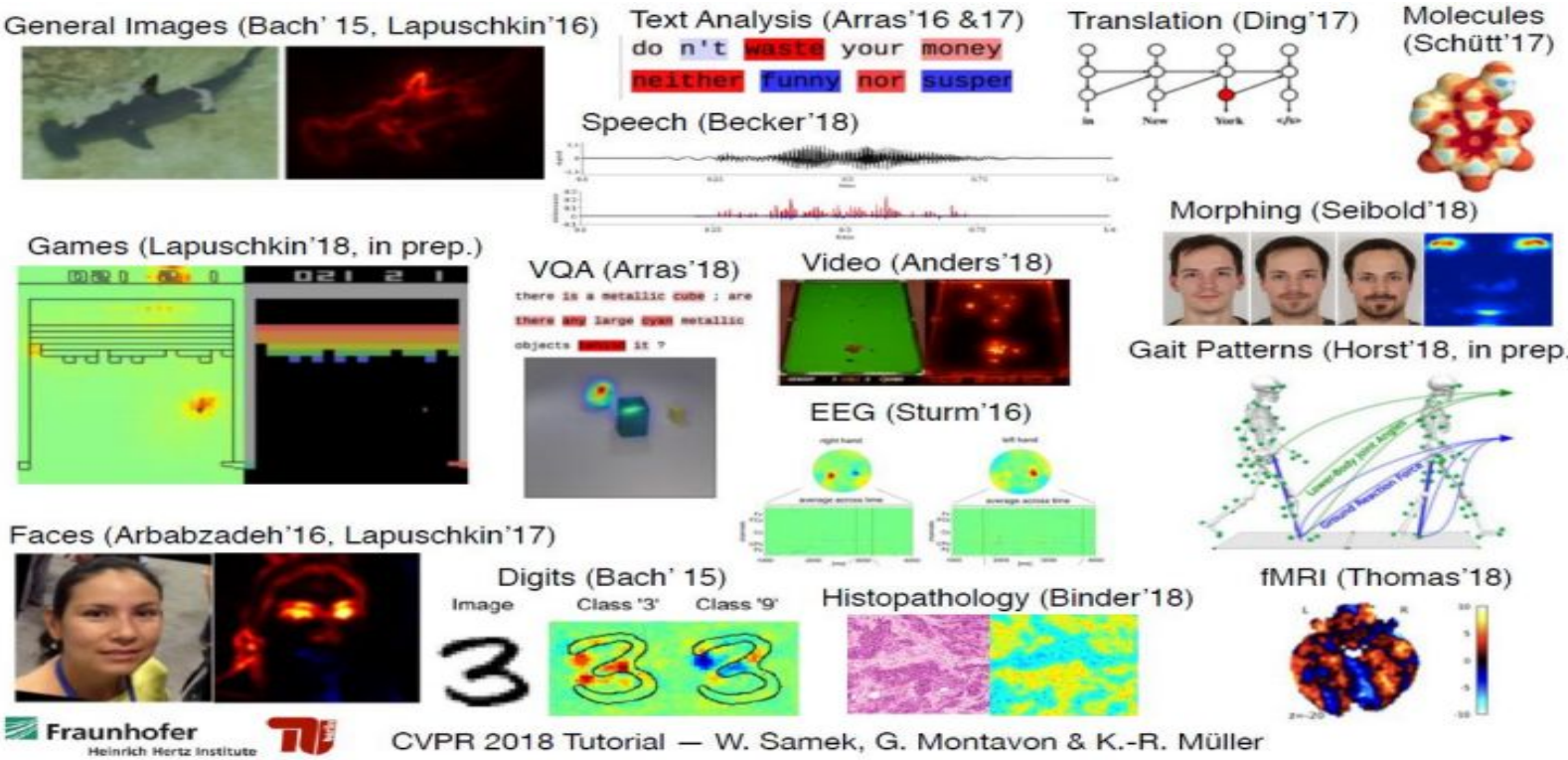
FeedForward
Predição

9:ZEILER, M. D.; FERGUS, R. Visualizing and understanding convolutional networks. In: SPRINGER. European conference on computer vision. [S.l.], 2014. p. 818-833

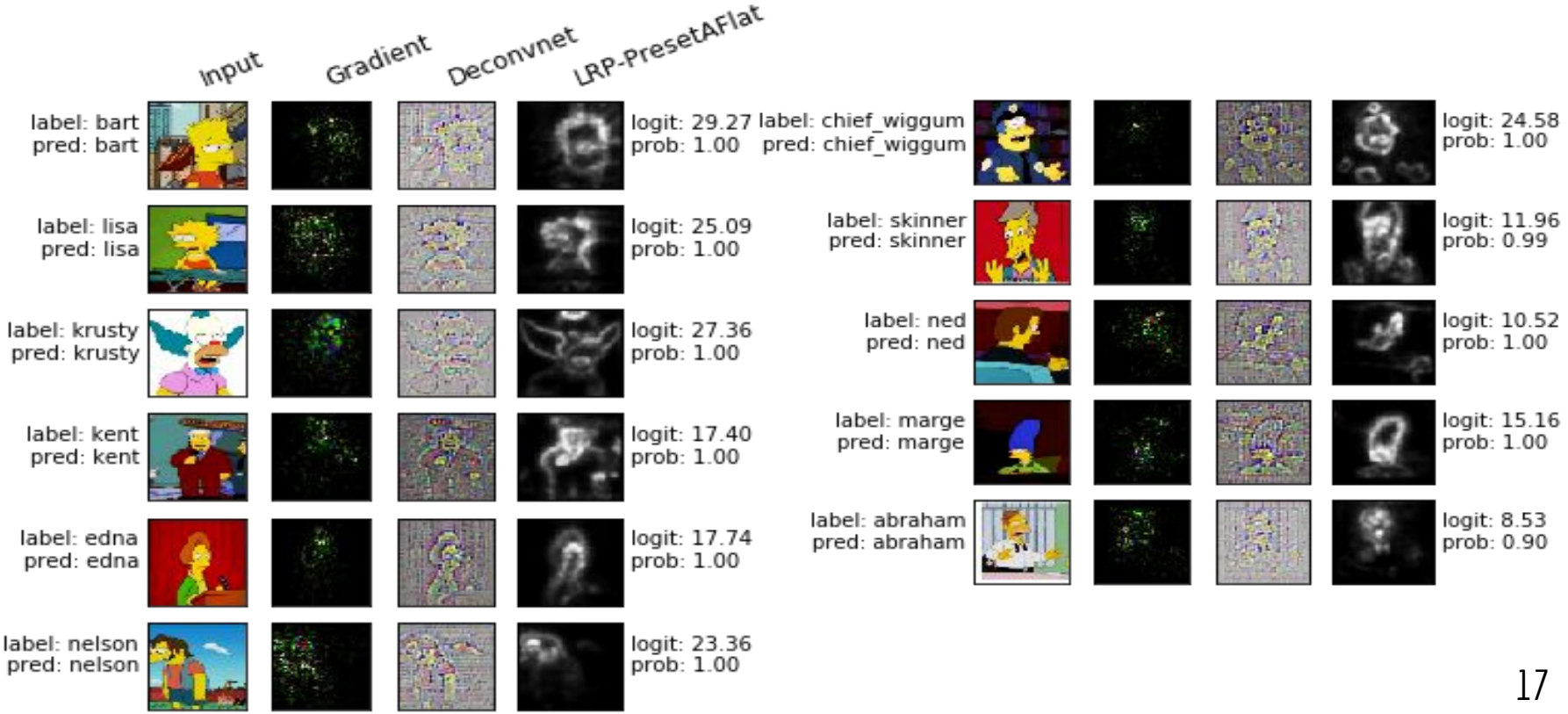
Layer-wise propagation[6]



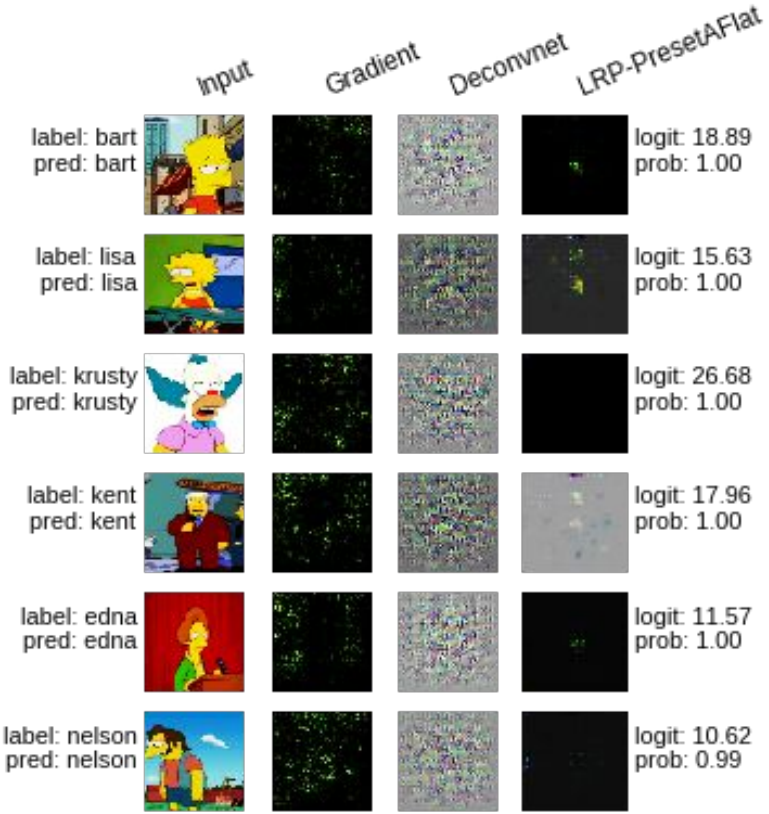
Layer-wise propagation[6]

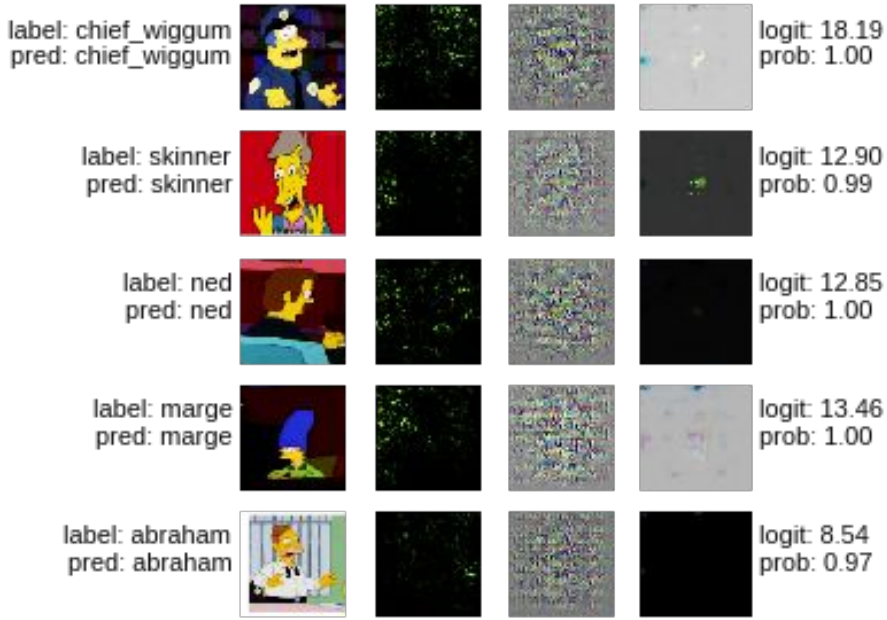


Comparação (VGG16)[8]

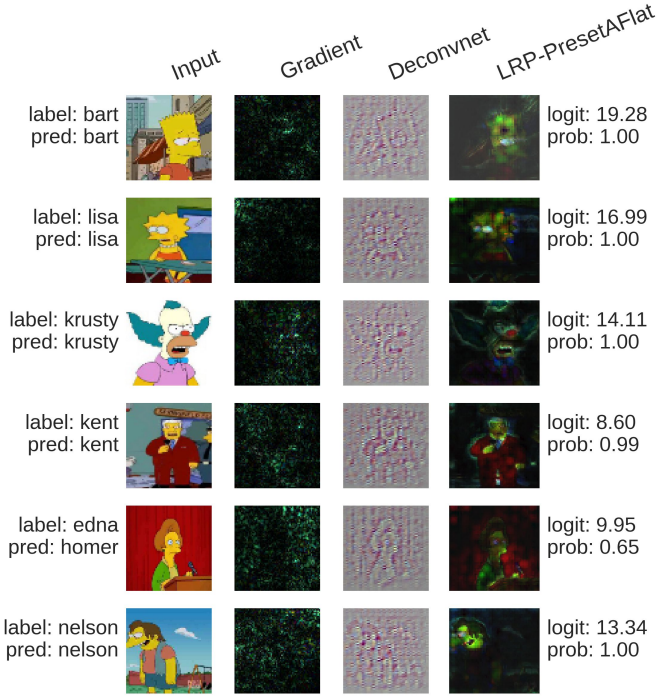


Comparação (ResNet50)[8]





Comparação (DenseNet121)[8]





Conclusões

- É possível observar que arquiteturas complexas não significam melhores desempenho.
- A DenseNet sofreu muito mais com sobreajuste que as demais redes por isso não acabou com um bom desempenho.
- Os slides anteriores de interpretabilidade de rede demonstrou que a VGG aprendeu o que era de fato o foco da classificação, o contorno dos personagens.
- As redes ResNet e DenseNet só conseguem aprender parte dos personagens (ex: a boca ou olhos), sendo que a DenseNet classifica pelo fundo da imagem em alguns caso, ou seja, o “ruído” das imagens foi aprendido (overfitting).

Referências

[1] Drive into Deep Learning - Zang A., Linpton Z. C. et all - MxNet (Amazon Publisher) -2018

[2] Deep Residual Learning for Images - He K, Zang X. et all - arXiv - 2015

[3] Very Deep Convolutional Networks for Large-Scale Image Recognition - Simonyan K. & Zisserman A. - 2015

[4] Densely Connected Convolutional Networks - Huang G. et all - arXiv - 2018

[5] Methods for interpreting and understanding deep neural networks - MONTAVON, G et all - 2018

[6] On Pixel-wise Explanations for Non-Linear Classifier Decisions by Layer-wise Relevance Propagation- Bach S. et all - 2015

[7] Deep Learning in Python - Chollet F. - 2010

[8] iNNvestigate Neural Networks - Alber M. et all - arXiv - 2018

[9] Visualizing and understanding convolutional networks - ZEILER, M. D.; FERGUS, R. - 2014

Imagens simpsons: https://www.kaggle.com/alexattia/the-simpsons-characters-dataset
Repositório git: https://github.com/gabrieltnishimura/simpsons-tinnvestigate