U-Net for Fingerprint Denoising

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1 Team details

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- Team website URL (if any)
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2 Contribution details

- Title of the contribution : U-Net for Fingerprint Denoising
- Final score :
  MSE 0.0189 / PSNR 17.6968 / SSIM 0.8427
- General method description
  We use U-Net architecture and data augmentation to perform the denoising task.
- References
  U-Net: Convolutional Networks for Biomedical Image Segmentation - https://arxiv.org/abs/1505.04597
- Representative image / diagram of the method
- Describe data preprocessing techniques applied (if any)
  Normalization ./255 and resizing

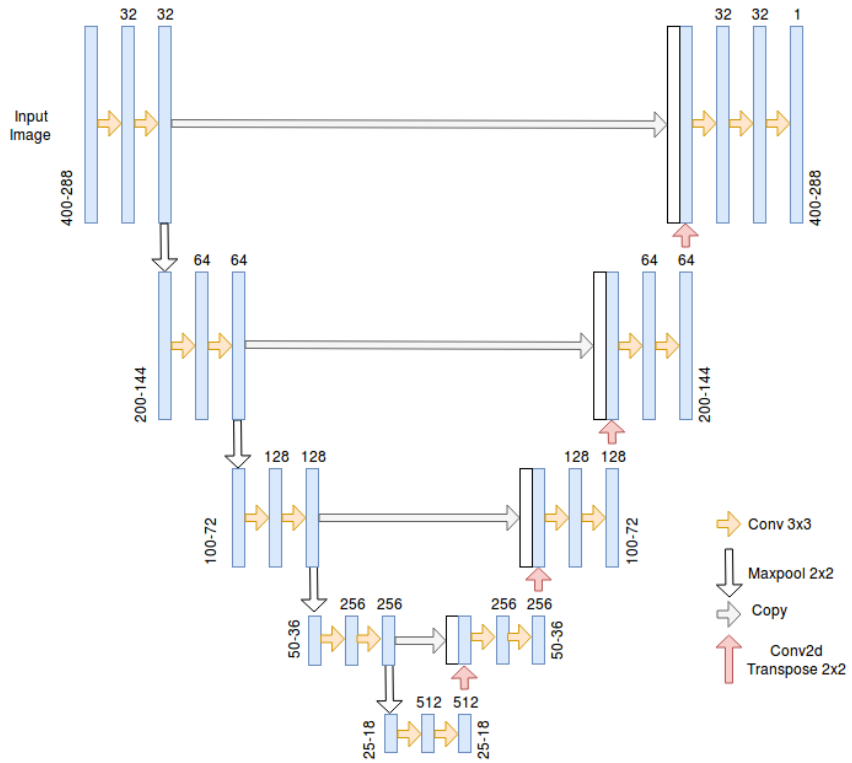

Figure 1: U-net architecture used

3 Method description

3.1 Features / Data representation

Describe features used or data representation model (if any)

Raw images with normalized pixel values are the only input to the model

3.1.1 Dimensionality reduction

Dimensionality reduction technique applied (if any)

None

3.1.2 Compositional model

Compositional model used, i.e. pictorial structure (if any)

None

3.1.3 Learning strategy

Learning strategy applied (if any)

Adam optimizer with a learning rate that is reduced each time the validation loss plateaued + early stopping

3.1.4 Other techniques

Other technique/strategy used not included in previous items (if any)

Dropout for regularization

Data augmentation : Synthetic images are generated on the fly while training

- Random flip (Horizontal or vertical or both)
- Random Shear
- Random translation (Horizontal or vertical or both)
- Random Zoom
- Random Contrast change
- Random Saturation change
- Random Rotation

3.1.5 Method complexity

Estimated method complexity

Prediction has the same complexity as 2D Conv

3.2 Data Fusion Strategies

List data fusion strategies (how different feature descriptions are combined) for learning the model / network: Single frame, early, slow, late. (if any)

3.3 Global Method Description

- Which pre-trained or external methods have been used (for any stage, if any)

  None

- Which additional data has been used in addition to the provided ChaLearn training and validation data (at any stage, if any)

  None

- Qualitative advantages of the proposed solution

  Minimal preprocessing, no feature engineering and end-to-end

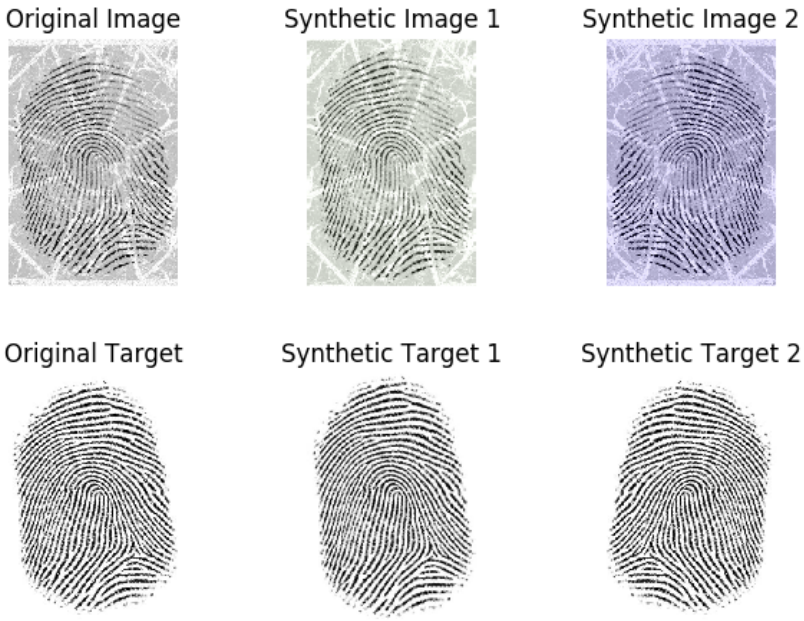

Figure 2: Example of synthetic examples

- Results of the comparison to other approaches (if any)
- Novelty degree of the solution and if is has been previously published

  U-net is usually applied to medical image segmentation (Liver tumor, cell nuclei...) Here we show that it also works well on denoising and background removal problems.

4 Other details

- Language and implementation details (including platform, memory, parallelization requirements)
  - Tensorflow
  - Keras
  - Python 3
  - GTX 1070 8gb
  - 16 gb Ram
  - i7-7700K CPU @ 4.20GHz

- Human effort required for implementation, training and validation?

  Few hours

- Training/testing expended time?

  Few days

- General comments and impressions of the challenge? what do you expect from a new challenge in face and looking at people analysis?

  It would be better if it had more participants and an active discussion in the forums.

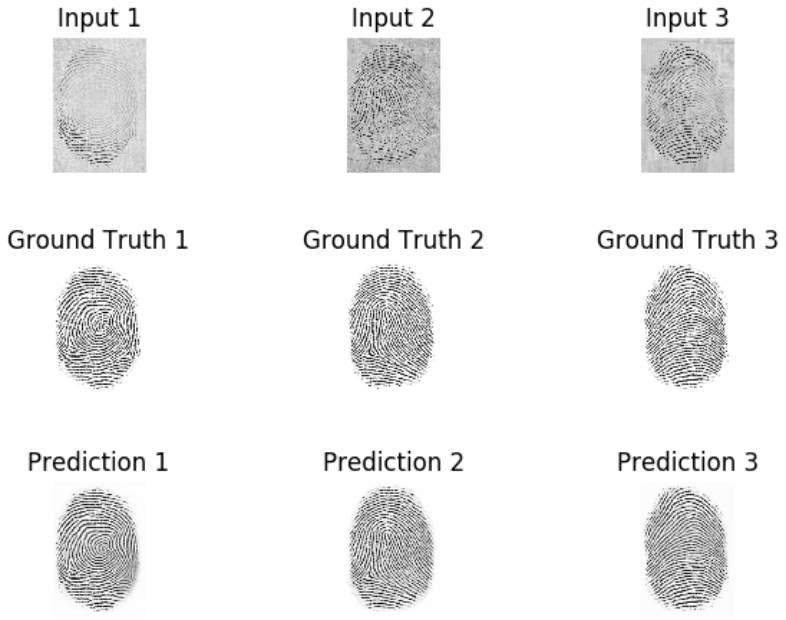

Figure 3: Examples of predictions using the trained model