Road extraction by deep residual u-net
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Structrure Analysis of Deep Image Prior

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Motivation

- Solving inverse problems by directly applying CNN on the target image is a novel idea and avoids training on large datasets
- Original paper[1] chooses Unet with skip connections but does not explain the reasons
- As the training proceeds network starts to overfit but we cannot predict when to stop

Related Work

- ResNet[2] proves to be a performant CV architecture and identity mapping is desired in denoising[3]
- Different residual blocks are investigated[4]
- Combination of ResNet and Unet succeeds in problems like road extraction[5]
- Variants on skip connections of Unet have been proposed[6]
  - Unet++, Dense Unet, Adversarial Unet, …

References

[1] Ulyanov et al. Deep image prior.
[2] He et al. Deep residual learning for image recognition.
[3] Zhang et al. Beyond a gaussian denoiser: Residual learning of deep cnn for image denoising.
[4] He et al. Identity mappings in deep residual networks.
[5] Zhang et al. Road extraction by deep residual u-net.
[6] Siddique et al. U-net and its variants for medical image segmentation: A review of theory and applications

New Technique

- Try ResNet architecture - remove front-to-end skip connections
- Change hour-glass shape - remove downsampling and upsampling
- Fuse ResNet building block with Unet - Res-Unet
- Add dropout layer to solve overfitting

Experimental Results & Conclusions

- Problem setting: Denoising (may extend to other problems in the last two days)
- Evaluation Metrics: PSNR with original image
- Architectures
  - Unet outperforms ResNet mainly because of skip connections
  - Hour-glass shaped structure enhances training but does not improve PSNR
- Better model: residual block and dropout layer
  - Residual block can improve PSNR and learn faster
  - Dropout can significantly improve one-pass PSNR and slow down overfitting