

Colorisation of Archival Aerial Imagery Using Deep Learning

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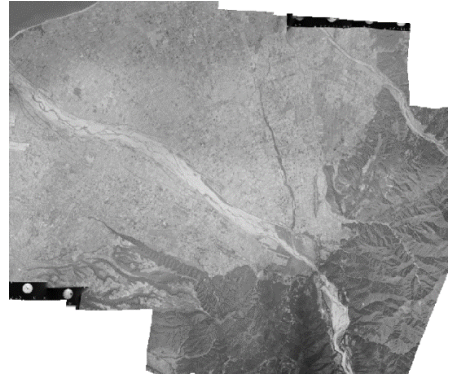
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Research Background & Purposes:

Archival grayscale imagery holds valuable information that pre-dates urban expansion and the worst impacts of climate change.

However, land cover classification to trace long-term historical changes in river basins is difficult from monochrome aerial imagery.



Archival grayscale imagery of the Kurobe River²⁾ with the SfM processing.

This presentation examines a colorizing method for archival grayscale river basin images in Japan using the Neural Style Transfer (NST)¹⁾ technique.

Transfer Learning of NST:

1. Create Image Tiles:

Extract 63,460 image tiles (100x100pixels) in the 6 classes from river basin color images



Urban River Forest Tree Grass Paddy Field

2. Transfer Learning of the CNN used in NST using the image tiles

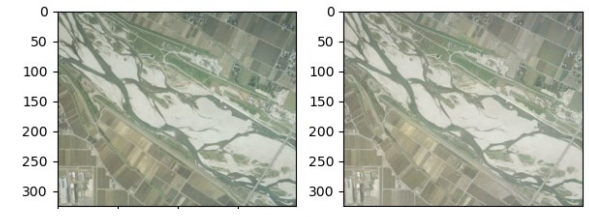
Fine-tune the CNN parameters in NST to derive the optimal model for colorization.

3. Analyze the best hyperparameters in NST with decolorized images

Results & Discussion:

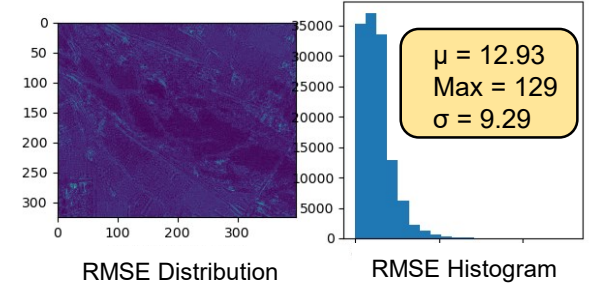
Colorization with best hyperparameters

larger style/content weighting ratio: 2.0×10^4 , lower content layer: 6, shallower freeze layer: 7



Input Image

Colorized Image



RMSE Distribution

RMSE Histogram

Application to archival grayscale imagery



Original archival grayscale image



Colorized image by the colorization method

Concluding Remarks:

- The fine-tuning of CNN in NST resulted in the F1-score of 0.957.
- The resultant land cover classification has much improved from F1 of 0.541 in original grayscale images to F1 of 0.804 in their colorized images.

Reference: 1) L. A. Gatys, et al. A neural algorithm of artistic style, ArXiv e-prints, 2015. 2) Geospatial Information Authority of Japan: <https://www.gsi.go.jp/ENGLISH/index.html>.