IMAGE COLOURIZATION VIA CONVOLUTIONAL NEURAL NETWORKS AND DEEP LEARNING

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ABSTRACT

This project addresses the challenge of automated colourization for 256×256 grayscale images using a dataset of 12,600 image pairs, balanced across human subjects, animals, and natural scenery. We frame colourization as a supervised learning problem in the CIELAB colour space, where a model predicts chrominance channels (a^*, b^*) from the luminance channel (L^*). A shallow convolutional neural network (CNN) provides the baseline performance, while our primary solution employs a deeper convolutional encoder-decoder architecture. This design captures high-level semantic features and spatial context, addressing limitations of shallow networks in perceptual realism. All source code, datasets, and results are publicly available here. —-Total Pages: 2

1 INTRODUCTION

While colour photography processes first emerged in the 1890s, colour photography did not become widely accessible until the 1970s (Science & Museum, 2020). Consequently, most historical photographs remain in black and white, lacking the visual richness that modern viewers are accustomed to. Moreover, individuals who undergo cataract removal as part of vision restoration procedures often struggle to interpret grayscale images, rendering many historical photographs inaccessible to them Vogelsang et al. (2024). This project aims to leverage deep learning to automatically colourize black and white images, with the goal of restoring visual information and improving accessibility for all audiences. Traditional, non-deep learning colourization methods tend to produce desaturated results and require extensive human input, limiting their scalability (Cheng et al., 2016). In contrast, deep neural networks such as convolutional neural networks (CNNs) can effectively learn spatial and semantic features, enabling realistic colourization without user intervention (Zhang et al., 2016). This makes deep learning a promising and scalable solution for image colourization.

2 CONTRIBUTIONS

Harkirpa	Peter	Thulasi	Youssef
24%	23%	26%	27%

Table 1: Contribution percentages by team member

I was responsible for several tasks as the team worked through the image colorization project. Starting with the progress report, I researched factors that facilitated the need for image colorization and the history of colorized photography. I also did research for the ethical considerations portion of the report. Next, for the progress report I wrote the individual contributions section and updated the

gantt chart. At this time, our model was facing an issue with avoiding vibrant colours and resorting to brown hues. Each of the members were responsible for implementing one possible solution, and I worked on changing our primary model to use quantized bins, however this method was not implemented in the final model. For the final report, I wrote the quantitative results section and updated the slideshow accordingly. Throughout the duration of the project, the team had weekly meetings which were lead on a rotating basis, such that each team member was responsible for preparing the meeting agenda and leading 25% of all meetings.

In addition, there were some tasks which I was assigned but unable to complete. These include writing the abstract for the project proposal and working on the initial version of the primary model. The abstract was completed by another team member as they had finished their assigned parts early. The initial primary model was assigned to Youssef and I, however we found it difficult to collaborate using Google Colab in addition to a large difference in time zones, so we agreed to have Youssef code the initial model.

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