PROJECT STILIZA (PROJECTX)

COLORIZATION PROJECT OVERVIEW

**INTORDUCTION**

The objective of this project is to use existing colorization studies and experiments to create a “best of the kin” AI driven colorization solution that improves upon current colorization solutions such as deoldify.

**CONCEPT**

**The Problem**: The typical approach to colorization has been to provide some samples of images and allow the AI algorithm to learn from these limited samples and predict colours for a video. The limitation in this instance is that the “training” of AI is limited to a few samples and, as a result, cannot possibly renders each video sequence correctly.

For instance, a full-length movie can contain hundred of sequences from interior to exterior setting, day or night, under sunny conditions or again during rainy or snowy days. In addition, the time of year can also change colour skims from fall to winter to summer, and so on.

**Proposed Solution**: The approach that I propose is to use multiple samples defining specific environment (“Interior house day”, “exterior beach on sunny day”, “green field with blue sky and light cloud”, etc.) and conditions (“rainy day”, “sunny day”, “cloudy night”, etc.) and associate these samples with specific section of a movie. In this instance, movie would be divided into sequences, each with its own ID. Each sequence, would in turn be associated with a sample image.

EXAMPLES

Let’s imagine a few sequences of a movie as follows:

Sequence 1 – Fall, Day. A couple walk along the beach as they talk. Seagulls fly around. Various camera angles show man and woman from various point of view ranging from ocean to coastline to beach with the two in forefront or together in long and medium shots

Sequence 2 – Same couple is now in their car driving. We see various shots of man and woman with neutral background of coastline.

Sequence 3 – Same couple arrive at their residence, drive to entrance, walk in the house.

Sequence 4 – Same couple are now inside the house in living room and seated at sofa. Man stands up and walk to another room

Sequence 5 – Man walks in kitchen and pull glasses and bottle from refrigerator and serves drinks

These 5 sequences offer samples of various scenery that could very much illustrate the concept, with each sequence being associated with several “reference images” to provide colorization training to the colorization module.

APPROACH TO COLORIZATION

Sequence 1 (identified as SQ\_001) ---- The colorization module is supplied with several images of people at a beach that match the sequence. Due to the various angles and perspective as well as background we would need to feed the module with 4-5 “reference images” as follows:

BD\_001=people at beach with clear sky (and light cloud if called for by sequence)

BD\_002=Ocean with clear sky,

BD\_003=Coastline with partial beach and ocean

etc.

These images can then be classified and given an identity for future use.

NOTE: Ideally while one set of “reference images” should be used for each sequence, since sequences consist of multiple angles and background, it may need to be broken down into sub-sequence, each with an assigned “reference image” to insure accuracy of colorization.

Sequence 2 (Identified as SQ\_002) --- Here again the colorization module is supplied with images that meet the requirement of this scene. However, in this instance some artistic (or in some instances historical) based decision are made by admin as follows: car is red, seats are brown, and interior is black.

In this instance it means that the sample images need to have matching colours for cars, sits and interior and, for a later version, provide point of colour insertion directly on the video to enable editor/admin to select a specific colour for an area of the video images.

Also, in this instance reference images used for sequence SQ\_001 such as the beach with clear sky could be used again since some angles in that sequence would show for background the beach and ocean

Sequence 3 (SQ\_003) – Same principle where one or more reference images of a house would be provided

Sequence 4 (SQ\_004) – Same approach with reference image(s) of a house interior will be provided.

Sequence 5 (SQ\_005) – Same as before but this time with reference image(s) of kitchen.

Based on above several questions and requirements become obvious.

1. Can a module realistically create colours for an entire video with hundreds of sequences using limited number of images?
2. If A) is possible what is the number reference images that we can add for an entire project that consist of hundreds of images?
3. If A) is not possible how many reference images can we add to a sequence to make colorization as accurate as possible based on colours provided

Additional observations

1. Assuming C is the best approach we will need to put in place a solution that would allow the admin to divide a video into sequences and provide ID to each sequence and be able to associate each sequence with one or more “reference images”

MODULES

At this time several colorization approaches (modules) have been identified. All seem to have AI learning from reference images or video with some difference in their logic and approach.

These modules are as follows:

VCGAN (<https://github.com/search?q=VCGAN>)

DEEP EXAMPLAR (<https://github.com/zhangmozhe/Deep-Exemplar-based-Video-Colorization> )

FASTAI (<https://github.com/fastai/fastai> )

TEMPORALLY CONSISTENT VIDEO COLORIZATION (<https://github.com/lyh-18/TCVC-Temporally-Consistent-Video-Colorization> )

* Pdf doc of these studies are available

Based on preliminary reviews VCGAN appears to be the most comprehensive solution. However, this is strictly based on review of algorithm and text tests. Implementation of code, manipulation of data, and rendition tests are needed to evaluate the rapport between theoretical concept, ease of use and results.

IMPLEMENTATION

To review and implement these modules, I have created a short video with various content to enable us to implement these codes on actual videos.

Along with these, I have also created “image samples” for the training of the AI.

The objective of this work is as follows:

Week 1 – Review the modules listed above, and setup on the server and optimize to ensure that server has enough capacity to manage them all at once.

Week 2 – Implement video colorization using various combination of image sample (IS) to identify best result by sequence (SQ) for each reference image. The idea is to see how the colorization work for sequence SQ\_1, 2, 3, etc. using sample IS1, 2, 3, etc.

Week 3 – Implement very simple UI using the one or (ideally) two top modules based on results

Week 4 – Continue testing using UI and push system to limit to evaluate how much video footage/time can be processed in one pass.

Week 4-6 – Enhance UI to implement sequence/image sample matching