CS 663- Course Project Report

Team Members

1. **Kalpesh Patil** - 130040019 – EE Department third year
2. **Mehul Shah** - 130020090 – EE department third year
3. **Mredul Sarda** - 130020020 – EE department third year

Toonifcation

Paper1 By *Kevin Dade*- Image Toonification

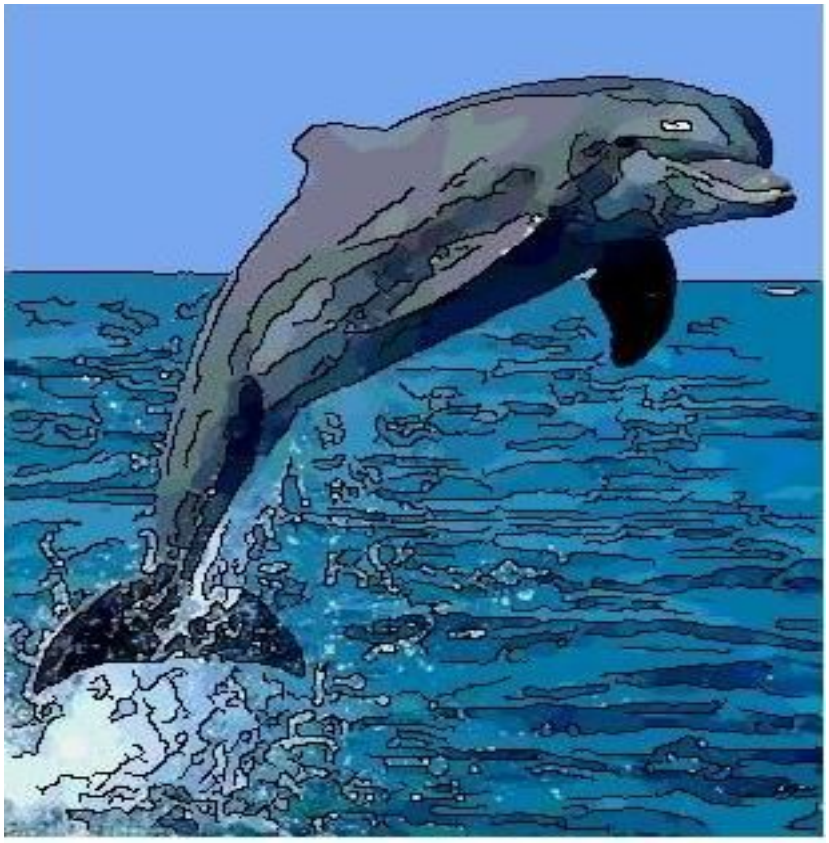
Method: The process to produce the cartoon effect is divided into two branches- one for **detecting and boldening the edges**, and one **for smoothing and quantizing the colors in the image**. At the end, the resulting images are combined to achieve the effect.

- Edges are detected using **canny edge detector** (implemented by us).
- Smoothing done with the help of **bilateral filtering** (implemented by us) and then later **colours are quantized** to give a cartoon effect.

Results: Algorithm Implemented on 3 images

1. Clooney


2. Dolphin



3. Elephant

Paper2 – Video Tooning

Video toonification was demonstrated using three different methods.

1. **Meanshift segmentation per frame:**
   Here we carried out meanshift segmentation (implemented by us) on each frame in the video. Nearest neighbour search was carried out in 5-D space (R,G,B,x,y) for weight assignment. Later edge detected image was overlapped onto this segmented image. Combining these frames together created a toonified video. The **video showed cluttering of colours** at certain places since we didn't consider time domain.

2. **Temporal Meanshift segmentation:**
   Here we considered 6-D space (R,G,B,x,y,time). We included few next and previous frames to find the nearest neighbours. This incorporated to the inclusion of time domain in meanshift segmentation. This **removed the colour cluttering.**

3. **Bilateral Filtering per frame:**
   Piecewise constant image was computed using bilateral filter on each frame and later edge detected image was added to it to produce toonification effect.

Links to the input videos and output videos are given below:
The video used for video tooning is given in the below link named sample1.mp4,https://drive.google.com/open?id=0B1u1764_3TdkOVN6eVByRjBPZGs. The following are the links of the output after tooning for the three different methods.

1. Mean Shift Segmentation
   https://drive.google.com/open?id=0B1u1764_3TdkTVhwaGtPdF9QTzg
2. Temporal Mean Shift Segmentation
   https://drive.google.com/open?id=0B1u1764_3TdkejRacnpRbFROSm8
3. Bilateral Filtering
   a. (only 10 frames)
   https://drive.google.com/open?id=0B1u1764_3TdkcHQ4UmNRN3AxQjA
   b. (complete video)
   https://drive.google.com/open?id=0B1u1764_3TdkcmFSWjg0U3hwV2s

Future work in Video Toonification:

1. **Canny edge detection incorporating time domain**
   Currently we have included time domain only for computing piecewise constant image, which removed colour clutter. Edge flickering can be removed similarly by considering few neighbouring frames for computing edges.

2. **Anisotropic kernel**
   Instead of having isotropic kernel (uniform along all the directions), anisotropic kernel can be used, which would give better results because the shape, size and orientation of the kernel will adapt to the local features of the image/video.