

Image Super-Resolution using an Efficient Sub-Pixel CNN

Abstract:

Recently, several models based on deep neural networks have achieved great success in terms of both reconstruction accuracy and computational performance for single image super-resolution. In these methods, the low resolution (LR) input image is upsampled to the high resolution (HR) space using a single filter, commonly bicubic interpolation, before reconstruction. This means that the super-resolution (SR) operation is performed in HR space.

We demonstrate that this is sub-optimal and adds computational complexity. In this project, we present the first convolutional neural network (CNN) capable of real-time SR of 1080p videos on a single K2 GPU. To achieve this, we propose a novel CNN architecture where the feature maps are extracted in the LR space. In addition, we introduce an efficient sub-pixel convolution layer which learns an array of upscaling filters to upscale the final LR feature maps into the HR output. By doing so, we effectively replace the handcrafted bicubic filter in the SR pipeline with more complex upscaling filters specifically trained for each feature map, whilst also reducing the computational complexity of the overall SR operation.

We evaluate the proposed approach using images and videos from publicly available datasets and show that it performs significantly better (+0.15dB on Images and +0.39dB on Videos) and is an order of magnitude faster than previous CNN-based methods.

Existing System:

Super resolution, the enhancement of image resolution by intelligent means, is an extremely important and challenging topic. All digital capture systems are limited by their pixel resolution (and other capture media like film have their own resolution limits). The standards for capture, processing, and display of digital images are constantly growing as technologies improve. As display resolution increases, older content becomes increasingly obsolete. This is particularly relevant in video technology, where in the last decade standard definition (480p) video has been rapidly replaced by high definition (720p and 1080p).

Proposed System:

The recovery of a high resolution (HR) image or video is needed from its low resolution (LR) counterpart is topic of great interest in digital image processing. This task, referred to as super-resolution (SR), finds direct applications in many areas such as HDTV, medical imaging, satellite imaging, face recognition and surveillance.

Software Tools:

1. TensorFlow
2. Keras
3. Matplotlib
4. Python3
5. VS Code
6. Jupyter Notebook

Hardware Tools:

1. Laptop
2. Operating System: Windows 11
3. RAM: 16GB RAM
4. GPU

Applications:

1. Social Networking Applications where image resolution is a key factor
2. Media and Entertainment
3. Games