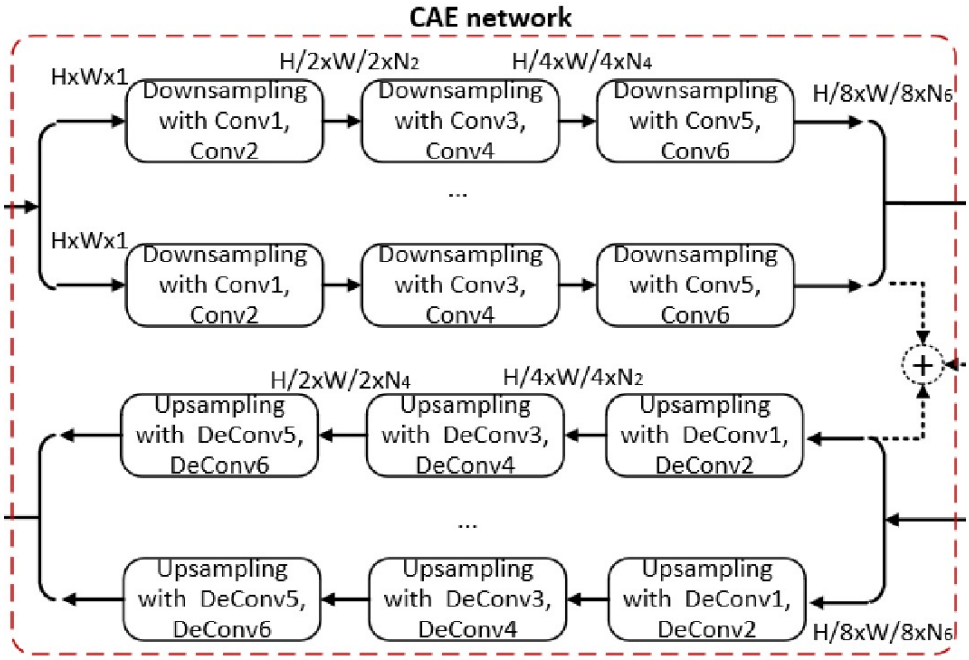
ARCHITECTURE DESIGN

Overview of Architecture :

The block diagram of the proposed image compression based on CAE is illustrated in fig.The encoder part includes the pre-processing steps, CAE computation, PCA rotation, quantisation, and entropy coder. The decoder part mirrors the architecture of the encoder.

To build an effective codec for image compression, we train this approach in two stages. First, a symmetric CAE network is designed using convolution and deconvolution filters. Then, we train this CAE greedily using an RD loss function with an added uniform noise, which is used to imitate the quantisation noises during the optimising process. Second, by analysing the produced feature maps from the pre-trained CAE, we utilise the PCA rotation to produce more zeros for improving the coding efficiency further. Subsequently, quantisation and entropy coder are used to compress the rotated feature maps and the side information for PCA (matrix U) to generate the compressed bitstream. Each of these components will be discussed in detail in the following.

CAE - Convolutional Auto Encoder :



As the pre-processing steps before the CAE design, the raw RGB image is mapped to YCbCr images and normalised to [0,1]. For general purposes, we design the CAE for each luma or chroma component; therefore, the CAE network handles inputs of size H ×W ×1. When the size of raw image is larger than H ×W , the image will be split into non-overlapping H × W patches, which can be compressed independently.

PCA Rotation :

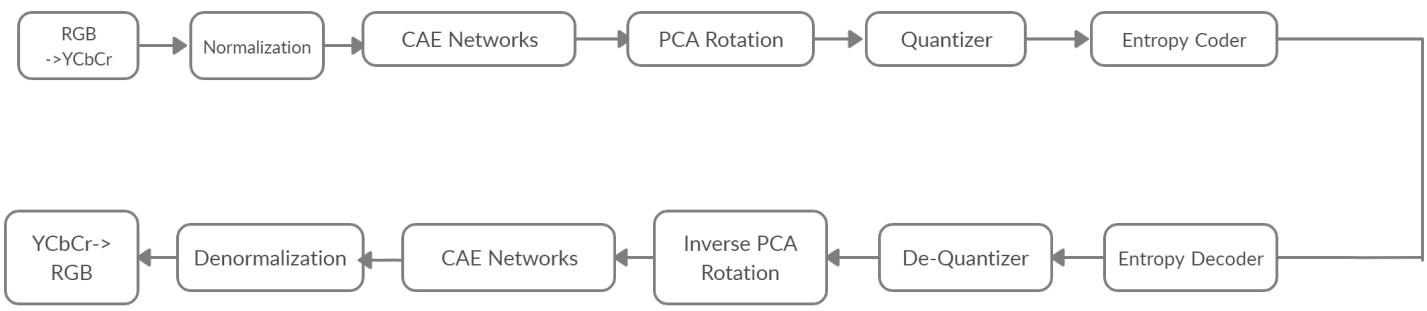
PCA seeks to represent observations (or signals, images, and general data) in a form that enhances the mutual independence of contributory components. One observation is assumed to be a point in a p-dimensional linear space. This linear space has some 'natural' orthogonal basis vectors. It is of advantage to express observation as a linear combination with regards to this 'natural' base (given by eigen-vectors as we will see later). PCA is mathematically defined as an orthogonal linear transformation that transforms the data to a new coordinate system such that the greatest variance by some projection of the data comes to lie on the first coordinate (called the first principal component), the second greatest variance on the second coordinate, and so on.

Quantisation :

Quantisation, involved in image processing, is a lossy compression technique achieved by compressing a range of values to a single quantum value. ... For example, reducing the number of colors required to represent a digital image makes it possible to reduce its file size.

Entropy Encoding :

In information theory an entropy encoding is a lossless data compression scheme that is independent of the specific characteristics of the medium. One of the main types of entropy coding creates and assigns a unique prefix-free code to each unique symbol that occurs in the input.



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