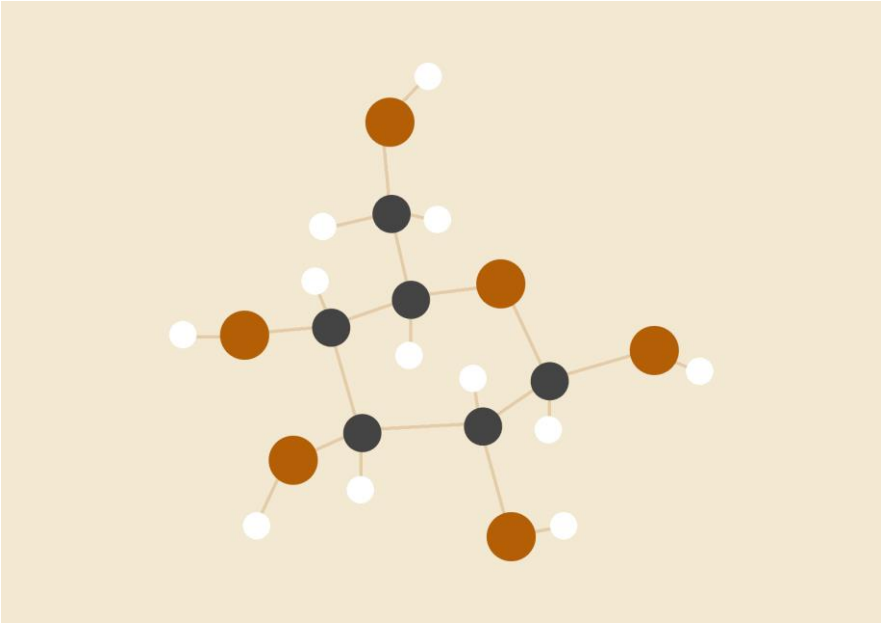
Data compression project

Compressing a video using discrete cosine transformation Algorithm



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INTRODUCTION

The Discrete Cosine Transform (DCT) algorithm is a mathematical technique used to convert a spatial domain signal, such as an image or video frame, into a frequency domain representation, it reduces redundancy in video data by analyzing and encoding the frequency components .

CODE OF APPLYING THE DCT-ALGORITHM ON A VIDEO (MATLAB)

this code reads a video file, extracts its frames, applies DCT-based compression to the frames, and writes the compressed frames to an output video file.

```
clear all;
close all;
clc;

% Read the input video file
v = VideoReader('v1.mp4');

% Create a directory to store frames(images)
working = 'Frames';
mkdir(working);
mkdir(fullfile(working,'images'));
%ii will be used in the while loop
ii = 1;
% Write each frame of the input video to an image file in the working directory
while hasFrame(v)
    img = readFrame(v);

    %imgshow(img) and store the frames as images .png
    filename = [sprintf('%04d', ii),'.png'];
    fullname = fullfile(working, 'images', filename);
    imwrite(img,fullname);
    ii = ii+1;
end
% Get the list of image files in the working directory
imageNames = dir(fullfile(working, 'images','*.png'));
imageNames = {imageNames.name};
% Create a video writer object for the compressed output video
writeObj = VideoWriter(fullfile(working, 'output.avi'));
vid = VideoReader('v1.mp4');
% Open the video writer object for writing
open(writeObj);
```

```
% Loop through each image file in the working directory
for t = 1:length(imageNames)
    Frame = imread(fullfile(working, 'images', imageNames{t}));
    % Resize the image to 512x512 pixels
    n = imresize(Frame,[512,512]);
    % Apply DCT to each color channel of the image and store the results in
    % matrix z
    Z(:,:,1) = dct2(n(:,:,1));
    Z(:,:,2) = dct2(n(:,:,2));
    Z(:,:,3) = dct2(n(:,:,3));
% loop through matrix z
    for i = 1:512
        for j = 1:512
            %chick if the rows and cols >60
            if( (i+j) > 60 )
                Z(1,j,1) = 0;
                Z(1,j,2) = 0;
                Z(1,j,3) = 0;
            end
        end
    end
    % Recovering the bixels using the inverse of dct (icdt)for the channels
    % of the frames

    K(:,:,1) = idct2(Z(:,:,1));
    K(:,:,2) = idct2(Z(:,:,2));
    K(:,:,3) = idct2(Z(:,:,3));

    %Resize the frames to 30% and put the new frames in the opened video
    Frame = imresize(uint8(K),0.3);
    writeVideo(writeObj, Frame);

end
%Close the video writer object
close(writeObj);
```

USED FUNCTIONS

1. **VideoReader()** : It reads an input video file
2. **readFrame()** : it reads each frame from the video
3. **imwrite()** : used to save the frames as PNG images
4. **imread() :** It reads an image frame from directory
5. **imresize() :** It resizes the image frame

6. **dct2() :** applies the DCT (Discrete Cosine Transform)
7. **writeVideo() :** it writes the compressed frame to the VideoWriter object

PSEUDO CODE

```
clear all

close all

clc

v <- OUTPUT openreadvideo('video.extension of video)

working <- 'frames'

OUTPUT makedirection(working)

OUTPUT makedirection (OUTPUT fullfile (working,'images'))

ii<-1

while hasframed[v]

  img<- OUTPUT readframe(v)

  filename <- display in next line ('%04d',ii),.          extension of photos)

   fullname <- OUTPUT fullfile(working,'images', filename)

  OUTPUT WriteImagesInFormat(img, fullname)

  ii<-ii+1

Endloop

Imgnames <- directory (OUTPUT fullfile(working,'images','*. extension of photos))

Imgnames <- [imgnames.names]

writeObj <- OUTPUT videowriter(fullfile (working , output.avi)

Vid <- openreadvideo (video.extension of video)

open(writeobj)
```

```
for t=1 to length(imagenames)
  Frame <- OUTPUT WriteImagesInFormat ( OUTPUT fullfile (working,'images',
imagenames (t)))
  n<- OUTPUT imgsize(frame,scale[width,hight])
  Z(:,:,1)= OUTPUT 2d discrete cosine transform(n,(:,:,1))
  Z(:,:,2)= OUTPUT 2d discrete cosine transform(n,(:,:,2))
  Z(:,:,3)= OUTPUT 2d discrete cosine transform(n,(:,:,3))
  for i=1 to 512
     for j=1 to 512
        if( (i+j)>60))
           Z(1,j, 1)=0
            Z(1,j, 3)=0
             Z(1,j, 4)=0
        Endif
    Enfor
Endfor
 K(:,:,1)=OUTPUT inverse of 2d discrete cosine transform z(:,:,1))
 K(:,:,2)=OUTPUT inverse of 2d discrete cosine transform z(:,:,2))
 K(:,:,3)=OUTPUT inverse of 2d discrete cosine transform z(:,:,3))
 frame <- imgsize(unit8(k), scale)
 Write video (writeObj ,frame)
Endfor
Close( writeobj)
```

COMPARISON BETWEEN VIDEO CHARACTERISTICS BEFORE AND AFTER COMPRESSION

POINT OF COMPARISON	BEFORE	AFTER
Bitrate : the amount of data that is required to represent one second of video	1179 kbps	802 kbps
Frame : a still image that represents a single moment in time in the video sequence	179	176
Ratio aspect : relationship between the width and height of the video frame	(1:1.78/1:1.78)	(1:1/1:1)
Resolution: refers to its pixel dimensions, usually expressed as the number of pixels in the height and width of the video frame	576 x 1024	154 x 154
Size	848 KB	605 KB