CMiC: THE Image Compressor

Julian Serra, Justin Chan

Intro

- Why Discrete Wavelength Transform?
  - Separate image components by frequency into 4 sub-bands
  - Human eyesight is less sensitive to high frequency details
- Why Differential encoding?
  - Preserve ½ resolution version of basic image
  - Produce similar numbers for Huffman
- Why Quantization?
  - Produce more similar numbers in band arrays
    - Allows for better Huffman
- Why Huffman?
  - Compress

Code Design

Steps:

1. Decompose Image (DWT)
2. Differentiate LL
3. Quantize other bands
4. Flatten arrays and concatenate
5. Create Huffman Code
6. Convert concatenated array to binary string

```
LL, (LH, HL, HH) = pywt.dwt2(im, wavelet, mode='periodization')

flatLL = LL.flatten()

diffArray = differential(flatLL)
LHq = LH/q
HLq = HL/q
HHq = HH/q
flatLHq = LHq.flatten()
flatHLq = HLq.flatten()
flatHHq = HHq.flatten()

LLint = np.round(diffArray).astype(int)
LHint = np.round(flatLHq).astype(int)
HLint = np.round(flatHLq).astype(int)
HHint = np.round(flatHHq).astype(int)

Huffready = list(np.concatenate([LLint,LHint,HLint,HHint]))
```

```
#After that, it's up to you!
def differential(LL):

def getStats(array):

def listConvert(input):

def huff(lst,side,code):

def encode(items):

def packer(dict, list):

def padder(binarystring):

def headerMaker(file, height, width, wavelet, quantization, alpha):

def stringToData(string, out):

def main():
```

Code Design

- Libraries:
  - Numpy: More efficient multi-dimensional array access, greater scalability
    - Flatten, round
- Headers:
  - Allows us to pass information to the decompressor
  - Two headers:
    - Size, quantization, wavelet specifications
    - Huffman code (dictionary)

Stretch Goals

- Color - need to decompose each band into RGB components (implementation time ~ shorter)
- Arbitrary Resolution - if statement checking width or height - adding row of pixels depending on which is odd (implementation time ~ shorter)
- Run Length Encoding: Further compress (implementation time ~longer)
- Quantize LL: More similarities before Huffman/less quality (implementation time~shorter)

What were asking for

- 2 more software engineers
- Higher salaries
- Equity
- Housing
- Paid holidays
- Massages (MWF)
- Drinking at the workplace
- Formal Fridays

Results

- Original image: 2.5MB
- Compressed File: 233KB
- Decompressed image: 617KB

Demo