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Un Algoritmo Para La Compresión De Imágenes Múltiples Utilizando la Transformada Discreta del Coseno y Block Matching

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*Abstract*—We have developed and algorithm that is capable of compressing multiple successive images using the discrete cosine transformation (DCT) to lower the size of the file, also, it’s used block matching between adjacent frames to reduce even more the quantity of information we are keeping on the file. The algorithm work using a cosine transformation matrix of size 8x8, and applies a simple encoding using tuples.

*Index Terms*—Image Processing, Image Motion Analysis, Image Coding, Image Storage

# INTRODUCTION

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A compresión de imágenes es un campo muy importante hoy en día, debido a las cantidades enormes de información que se generan diariamente, se deben crear métodos inteligentes para guardar esta información, en nuestro caso, imágenes digitales.

Existen una gran cantidad de formas para guardar la información de las imágenes, usando compresiones *lossless*, o compresiones con perdida. Para nuestro algoritmo estamos usando la transformada discreta del coseno, que nos permite reducir la información contenida en una ventana en unos pocos valores, pero se pierde parte de la información original.

Nuestro algoritmo está basado en dos ideas principalmente, la compresión con pérdida de la transformada discreta del coseno, y el uso de predicción de movimiento (block matching), para imágenes sucesivas. Esto con el fin de reducir la información que conservaremos de cada una de las imágenes o fotogramas.

# Prior and Related Work

Existe una gran cantidad de trabajo en esta área de compresión de imágenes y detección de movimiento por block matching, podemos ver los formatos H.264, o los estándares que se usan en la web, como JPEG (que usa la transformada del coseno), el MPEG-4, etc. Tenemos el trabajo realizado en block matching por Victor Padilla Ramirez, con el Algoritmo de Block-Matching Usando Búsqueda en Árboles.

# Description of the Algorithm

El algoritmo implementado esta dividido en varias fases, a continuación mostraremos cada una de las etapas de este y su funcionamiento.

Decidimos usar el formato PGM en formato ASCII crudo para las imágenes de prueba, debido a que solo contienen los valores de luminancia (escala de grises), para simplificar las pruebas,

Para comprimir imágenes, el algoritmo se divide en varios modulos, cada uno con una función muy especifica:

## Aplicada de la transformada del coseno

Consideremos la imagen como una matriz I de tamaño MxN, donde M y N son múltiplos de 8, entonces, dividiremos esta matriz en matrices más pequeñas, X, que serán de un tamaño 8x8, y a estas le aplicaremos la transformada del coseno, según la siguiente formula:

Y su inversa:

Donde A es la transformada del coseno, y esta dada por la siguiente ecuación:

Debemos aclarar que el valor de N en (3) está dado por el tamaño de una dimensión de la matriz, en este caso, 8.

## Normalización de los valores a través de la cuantización escalar

Cada uno de los valores obtenidos c on la ecuación (1), se deberán normalizar, usando la siguiente formula:

Donde QP es una matriz de tamaño idéntico a X, y está predefinida. Según la elección del QP, podemos aumentar la compresión sacrificando la calidad de la imagen, o viceversa.

Para nuestras pruebas, hemos decidido usar tres matrices QP, definidas a continuación:

El objetivo de esta operación, es llevar gran parte de los valores obtenidos a cero, con el fin de optimizar la compresión de los datos, y reducir el tamaño de la imagen original.

## Recorrido en Zig-Zag de la matriz X

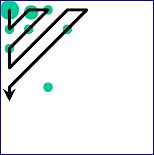


Fig. 1: Ejemplo de un recorrido zig-zag sobre la matriz, observe que el objetivo de hacer un recorrido así, es agrupar el conjunto de ceros (0) que se obtienen en la matriz después de aplicar la cuantización escalar

Obtendremos un vector de tamaño 64, donde los ceros estarán agrupados.

## Cambiar la representación del vector a tuplas

En el paso anterior, se obtuvo un vector de 64 elementos, donde se pueden encontrar muchos ceros seguidos, en estos casos, y es lo esperado por el algoritmo de compresión, usamos una nueva representación de los datos, llamada Tuplas run-level, de la siguiente forma:

(Número de ceros antes del dato, dato)

De esta forma, se agruparán los ceros que se encuentren, y se reducirá el espacio que ocupa la imagen físicamente.

## Aplicar una codificación entrópica (VLC)

Después de aplicar los pasos anteriores, se puede aplicar una codificación de este tipo para reducir aún más el espacio, pero eso esta fuera del alcance de este algoritmo.

# Publication Principles

The contents of IEEE TRANSACTIONS and JOURNALS are peer-reviewed and archival. The TRANSACTIONS publishes scholarly articles of archival value as well as tutorial expositions and critical reviews of classical subjects and topics of current interest.

Authors should consider the following points:

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3. Authors must convince both peer reviewers and the editors of the scientific and technical merit of a paper; the standards of proof are higher when extraordinary or unexpected results are reported.
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5. Papers that describe ongoing work or announce the latest technical achievement, which are suitable for presentation at a professional conference, may not be appropriate for publication in a TRANSACTIONS or JOURNAL.

# Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Appendix

Appendixes, if needed, appear before the acknowledgment.

Acknowledgment

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