Compressão de ficheiros de texto

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*Abstract*—

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# Introdução

A compressão de dados trata-se da redução do tamanho de ficheiros para uma menor ocupação de espaço em memória, possibilitando, por exemplo, o envio mais rápido dos mesmos através de canais com uma largura de banda limitada. Existem dois tipos de compressão: *lossy* e *lossless*. A compressão destrutiva (*lossy*) comprime um ficheiro à custa de parte do mesmo, isto é, após a compressão não é possível reconstruí-lo na íntegra devido à perda de informação na compressão. *JPEG* e *MP3* são exemplos de algoritmos *lossy* que podem ser usados na compressão de imagem e áudio, respetivamente. A compressão não destrutiva (*Lossless*) comprime e descomprime um ficheiro sem se perder informação do mesmo, ou seja, a compressão é reversível ao ponto do descodificador de informação (*decoder)* reconstruir totalmente a informação codificada pelo codificador (*encoder)*. O facto de nenhuma parte da informação ser perdida faz com que a taxa de compressão de um algoritmo *lossless* seja inferior à de um *lossy*. *LZW* e *Huffman Coding* são exemplos de algoritmos de compressão *lossless* que podem ser usados para a compressão de imagens médicas, executáveis e, como vai ser abordada principalmente neste artigo, compressão de texto.

# Metodologia

Neste artigo, são utilizados diversos algoritmos de compressão *lossless* para comprimir ficheiros de texto. Apresentam-se, em primeiro lugar, algoritmos que servem de base, juntamente com algumas transformadas, para outros algoritmos de compressão mais complexos, que são depois apresentados.

## Algoritmos base

1. *Huffman Code* – Algoritmo utilizado para muitos dos algoritmos de compressão modernos. O seu objetivo é criar códigos para cada símbolo, sendo que os símbolos mais frequentes na fonte terão códigos mais pequenos. Estes códigos são gerados a partir da “árvore de Huffman” que garante que os códigos sejam unicamente descodificáveis (não existe ambiguidade ao ler uma sequência de símbolos) e também que o descodificador reconheça o fim de cada símbolo sem necessitar do símbolo seguinte (instantaneidade). Os códigos de Huffman são principalmente divididos em dois tipos de algoritmo: (a) fixo, onde uma tabela de frequências dos símbolos é gerada previamente, sendo criada uma única árvore para compressão e descompressão; (b) dinâmico, onde são criadas duas árvores (uma para compressão e outra para descompressão), e estas vão sendo atualizadas ao receber cada símbolo.
2. *Run Length Encoding* *(RLE)* – Algoritmo que substitui sequências de símbolos iguais por um carater especial, seguido do símbolo e do número de vezes seguidas que aparece.
3. *Lempel-Ziv 77 (LZ77)* - Algoritmoque tira proveito de padrões frequentes numa fonte. Consiste em utilizar dois *buffers*,uma *search window* e uma *look-ahead window*, em que é procurado no primeiro o maior padrão que ocorre no segundo.
4. *Lempel*-*Ziv 78 (LZ78)* – Algoritmo que utiliza um dicionário construído de forma adaptativa tanto no codificador como no descodificador, tirando proveito da repetição de padrões na fonte. Os símbolos são codificados com o seu índice no dicionário e o código do carater seguinte.

## Transformadas

*1) Burrows-Wheeler Transform (BWT)* – Algoritmo que transforma a sequência original de símbolos numa onde os símbolos iguais tendem a ficar juntos. Tendo uma sequência de n símbolos, são geradas n-1 sequências, através dum shift cíclico, também de n símbolos; de seguida, ordena-se a primeira coluna por ordem lexicográfica, e a última coluna é o resultado da transformada (guarda-se a linha da sequência original para a descodificação).

*2) Move-to-Front (MTF)* – Algoritmo cujo objetivo é transformar sequências longas no mesmo símbolo, o que aumenta a probabilidade deste símbolo, e, consequentemente, diminui a entropia. Normalmente é aplicado um *BWT* antes deste algoritmo, e um *RLE* ou um codificador entrópico depois. Consiste em, tendo uma lista com cada símbolo por ordem lexicográfica, um símbolo é codificado com o seu índice na lista, e depois é movido para o início da lista.

## Algoritmos mais complexos/modernos

1. *Lempel-Ziv-Welch (LZW)* – Variante do *LZ78* em que é apenas enviado o índice do símbolo no dicionário. Em cada iteração, ao ler-se um símbolo, procura-se a maior sequência desse símbolo na fonte que ainda não exista no dicionário e cria-se uma nova entrada neste.

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*a**b* 

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