Pattern Recognition Matching of Rheumatoid Arthritis Using bit Allocation

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1.Introduction

Rheumatoid arthritis (RA) is an autoimmune disease that results in a chronic, systemic inflammatory disorder that may affect many tissues and organs, but principally attacks flexible synovial joints. It can be a disabling and painful condition, which can lead to substantial loss of functioning and mobility if not adequately treated. The process involves an inflammatory response of the capsule around the joints synovium secondary to swelling turgescence of synovial cells, excess synovial fluid, and the development of fibrous tissue pannus in the synovium. The pathology of the disease process often leads to the destruction of articular cartilage and ankylosis fusion of the joints. RA can also produce diffuse inflammation in the lungs, the membrane around the heart (pericardium), the membranes of the lung pleura, and white of the eye sclera, and also nodular lesions, most common in subcutaneous tissue. Although the cause of RA is unknown, autoimmunity plays a big part, and RA is a systemic autoimmune disease. It is a clinical diagnosis made on the basis of symptoms, physical exam, radiographs X-rays and labs.

Treatments are pharmacological and non-pharmacological. Non-pharmacological treatment includes physical therapy, orthoses, occupational therapy and nutritional therapy but these don't stop the progression of joint destruction. Analgesia painkillers and anti-inflammatory drugs, including steroids, suppress symptoms, but don't stop the progression of joint destruction either. Disease-modifying antirheumatic drugs DMARDs slow or halt the progress of the disease. The newer biologics are DMARDs. The evidence for complementary and alternative medicine CAM)treatments for RA related pain is weak, with the lack of high quality evidence leading to the conclusions that their use is currently not supported by the evidence nor proved to be of benefit. The name is based on the term "rheumatic fever", an illness which includes joint pain and is as joint inflammation that resembles rheumatic fever.

Figure (1) A hand affected by rheumatoid arthritis

2.The major statistical methods of pattern matching are

1 Bit-Allocation Analysis

a) Attention-Based Quantizer Formation

b) Inter-Quantizer Prioritization by Bit Allocation Analysis

3 Principal component analysis

4 Bounded partial normalized correlation

5 Feedback neural networks

6 Fuzzy systems

7 Genetic algorithms

8Artificial intelligence

2.1 Bit Allocation Analysis

Is concerned with the study of efficient combinations of Quantizer-based allocations and bit consumption by a model capable of numerical application. The modus operandi of bit-allocation analysis is to be through the use of set theory and the fundamental theorems of mathematical optimization. The most important concept in this analysis is “efficient allocation process” which represents a combination of Quantizer-based allocations and bit consumption such that no bit allocation can be increased without decreasing other quantizer's allocation or increasing consumption.

The main result of this paper allows to characterize the concept of efficient allocation process by profit maximization with respect to any combination of allocation-consumption among competing quantizer's. In bit allocation analysis, the system makes a choice from the set of efficient allocations at any given time by using the appropriate strategy for computing the profit vector. It may allow to attend to different parameters of interest at different bit rates within the same spatial locations. It is a typical linear programming problem, of which the computational method is well known and widely used in practice. The comparative performance of the 3D-SPIHT with motion compensated temporal filtering and the proposed coder (without motion filtering) using bit-allocation analysis, is here tested on a set of X-ray images.

Figure(2) X-ray of the hand in rheumatoid arthritis

3.Attention-Based Quantizer Formation

In the first stage of the coding, a three level spatio-temporal wavelet transform is applied to the motion sequences In the 3D sub-band structure, a spatio-temporal orientation tree naturally defines the spatio-temporal relationship on the 3D pyramid that results from the wavelet transformation, gives the only one reasonable parent-offspring linkage.

Once a three level spatio-temporal wavelet transform is applied to the sequences of images, although most of the energy is concentrated in the temporal low frequency, spatial residual redundancy in the high temporal frequency band does exist due to the motion. That is, there exists not only spatial similarity inside each frame across scales, but also temporal similarity between two frames. However, Quantizer formation allows the exploitation of self-similarity across an spatio-temporal orientation tree using zerotree coding. The grouping and segregation of wavelet coefficients to form quantizer's is achieved now by attention-based Quantizer formation. In this formation process, wavelet coefficients of a 3D wavelet transform are partitioned into different quantizer's by attention thresholding. It compacts points of maximum attention to a small number of high-attention quantizer's.

Points of maximum attention can be calculated by searching for peaks in a local attention function. Local attention functions should be defined depending on the particular application of interest. We are here interested primarily in the transmission of sequences of moving targets . Since demonstrates that velocity only accounted for forty-eight percent variation in the probability of target detection, the local attention function is here computed to measure the velocity at any given point.

Points of maximum attention are then signalled by peaks in the attention function and thus, to detect points of maximum attention, the values can be threshold using a global threshold , where the value of is selected using a performance rule on a sample of sequences. The performance rule is a top-down rule where the threshold is adjusted based upon improving target detection performance. The model is then applied using the same threshold without need of adjustment. The grouping and segregation of wavelet coefficients into a small number of quantised.

Is achieved through Quantizer formation using detected points of maximum attention as follows:

4.Quantizer Formation Algorithm

Detect points of maximum attention, For each 3D-region of the sequence of frames:

1)Form a new quantizer corresponding to the wavelet coefficients for the points in of maximum attention.

2)The remaining coefficients are set to zero.

3)Form a last quantizer corresponding to the wavelet coefficients which were set to zero at quantizers for every 3D-region .

4) The remaining coefficients are set to zero.

5)Stop.

4.1 Inter-Quantizer Prioritization by Bit Allocation Analysis

Once the attention-based quantizer formation is completed, a prioritization protocol should be used to choose the allocation of bits among competing quantizer up to availability limit , at any given time of the transmission, where: (i) Intra-quantizer prioritization simply follows embedded zerotree coding [6]; and (ii) bit allocation among competing quantizer follows bit allocation analysis by finding the efficient combination of allocations up to the bit consumption limitation.

Intra-quantizer prioritization by zerotree coding provides substantial coding gains over the first-order entropy for significance maps. Zerotree coding predicts insignificance across scales and spatio-temporal orientations using a model that is easy for most sequences to satisfy. The zerotree approach can isolate interesting non-zero details by immediately eliminating large insignificant 3D regions from consideration. At very low bit rates, where the probability of an insignificant coefficient must be high and thus, the significant threshold must also be large, expecting the occurrence of zerotrees and encoding significance maps using zerotree coding is reasonable for every competing quantizer : If it is observed that a parent is insignificant with respect to the threshold, a zerotree is expected regardless of the correlation between squares of parents (coefficients) and squares of children. Hence we have that differences in quantization costs for competing quantizer are not relevant, at extremely low bit rates, in determining the technological where the bit consumption is when using at its basic activity level.

In the maximization of with respect to over the set of allocation processes at any given time , we have that is a profit vector and represents the profit from at time ; where denotes the gross profit per bit for quantizer at ; and denotes the price per bit for available consumption at . Following Theorem 1, we make use of the imputed profit vector at any time in order to make a choice from the set of efficient points at this particular truncation time of the progressive transmission.

5.Conclusion

It follows that, within a rational approach for progressive transmission, the gross profit per bit for any quantizer at any time can have the form of its expected increase in utility per coding but as given by , with denoting the maximum availability of bit resources for quantizer at time and being the number of bits in a fixed number of sorting and refinement bit streams from the intra-quantizer prioritization which follows the embedded zerotree coding scheme.

6.Bibliography

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