Abstract

The present thesis concentrates on motion vector estimation in video compression. A review of the earlier works on video encoding, compression standards and existing techniques for motion vector estimation is presented. In order to satisfy the multi-objective function of compression ratio, codec time and picture quality, six new schemes for motion vector estimation are proposed. Each scheme produces optimized results for a particular characteristic in a video sequence. These schemes include motion estimation by frequency domain search, edge detection, filtering and decimation, interpolation, sub-block assignment and adaptive refinement techniques. A preprocessor is designed for adaptive selection of proper algorithms at three different levels of approximations to produce desired results with real-life video sequences which are having time varying combination of various characteristics dominating in different regions within a frame. At the first level of approximation, a group-of-pictures (GOP) is characterized by a single characteristic which selects a particular algorithm for that GOP. As a better approximation, at the second level, the frames in a GOP are partitioned into several time invariant regions depending upon their dominating characteristics and accordingly different algorithms get enabled for their encoding. Partitioning is carried out with blocks of various sizes and shapes changing with time, at the third level of adaptivity, where proper algorithms are selected for such time varying regions associated with their respective dominating characteristics. As we move towards higher level of adaptivity, better quality and compression is achieved at the expense of commensurate encoding time. Finally, a novel intra-frame coding technique with non-square block partitioning using discrete Haar wavelet transform is proposed which is found to produce better quality and compression in most of the cases, compared to JPEG algorithm.

Keywords: Video compression, Motion vector, Motion compensation, Discrete Haar wavelet transform, Frequency domain search, Edge detection, Filtering and decimation, Sub-block assignment and Interpolation, Adaptive selection of schemes, Variable block size partitioning, Intra-frame coding, Blocking artifacts reduction.