PIXEL COMPRESSION USING MULTI GRAPH FOURIER TRANSFORM

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Abstract: Many signals on Cartesian product graphs appear in the real world, such as digital images, sensor observation time series, and movie ratings on Netflix. These signals are "multidimensional" and have directional characteristics along each factor graph. However, the existing graph Fourier transform does not distinguish these directions, and assigns 1-D spectra to signals on product graphs. Further, these spectra are often multi-valued at some frequencies. Our main result is a multidimensional graph Fourier transform that solves such problems associated with the conventional Graph Fourier Transform.

Key words: Graph signal processing, image compression.

1. INTRODUCTION

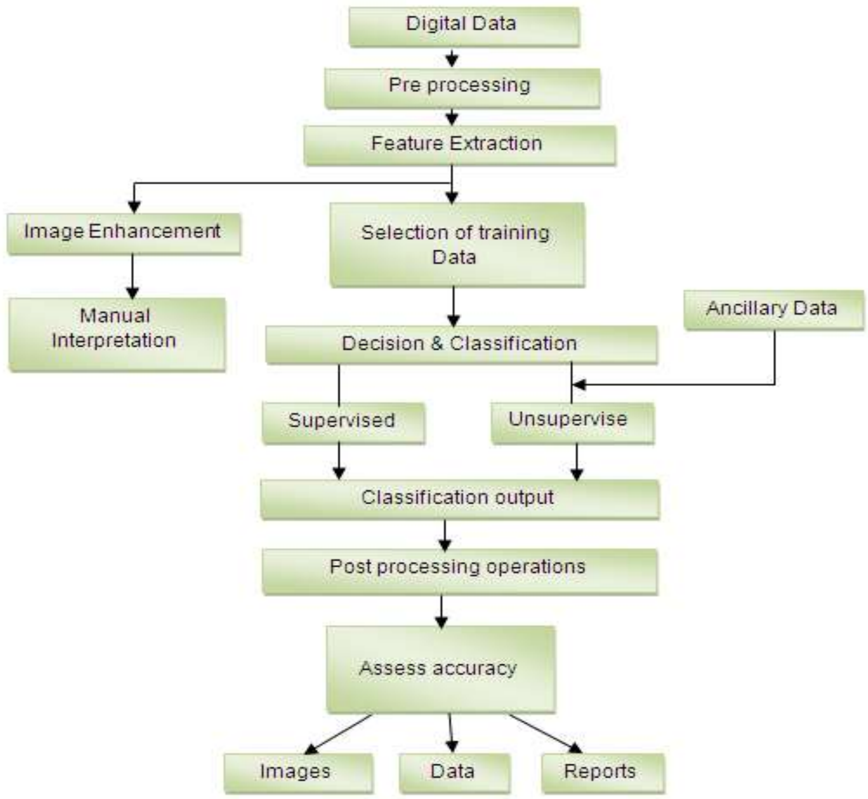
Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them.

It is among rapidly growing technologies today, with its applications in various aspects of a business. Image Processing forms core research area within engineering and computer science disciplines too.

Digital Processing techniques help in manipulation of the digital images by using computers. As raw data from imaging sensors from satellite platform contains deficiencies. To get over such flaws and to get originality of information, it has to undergo various phases of processing. The three general phases that all types of data have to undergo while using digital technique are Pre-processing, enhancement and display, information extraction.

Types

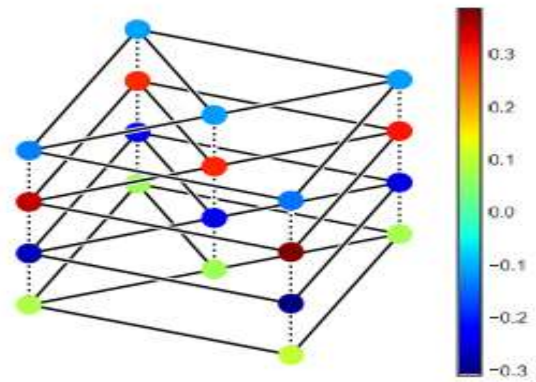
The two types of methods used for Image Processing are Analog and Digital Image Processing. Analog or visual techniques of image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. The image processing is not just confined to area that has to be studied but on knowledge of analyst. Association is another important tool in image processing through visual techniques. So analysts apply a combination of personal knowledge and collateral data to image processing.



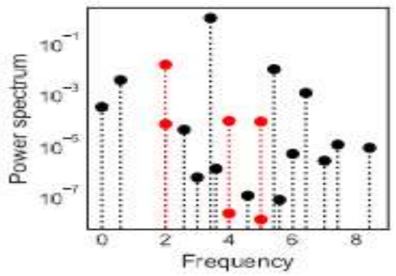
Steps in Image Processing

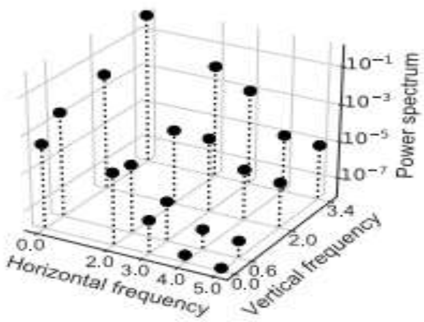
METHODOLOGY

MGFT that retains the dimensional information of multi-dimensional graph signals. The proposed transform has provided multi-dimensional spectral filtering, multi-dimensional optimization filtering, factor-graph wise stationarity, and directional stationarity. By considering multivariate graph signals as 2-D univariate graph signals, this study has proposed the multivariate GFT and stationarity Note that the proposed multi-dimensional GSP methodologies are not applicable to signals on a product graph with unknown factor graphs, or to signals on a nearly product graph (even small perturbation destroys Cartesian product structure . Preliminary decomposition or approximation of graphs with product graphs may solve the problem. Further work is needed to build upon the findings of this study. One future work is to clarify whether the proposed stationarities exist in practical graph signals or not. For 1- D univariate graph signals, numerical experiments indicated that the well-known USPS dataset was almost stationary . Further numerical experiments may show that a practical multidimensional graph signal is almost factor-wise or directional stationary, and that a practical multivariate graph signal is almost stationary. Another future work is to prove the importance of stationarities for graph signals. For 1-D univariate graph signals, the stationarity enables us to estimate the power spectral densities of the signals and to construct Wiener filters on graphs .We expect that the assumption of the proposed stationarities will provide new GSP methodologies.



(a)



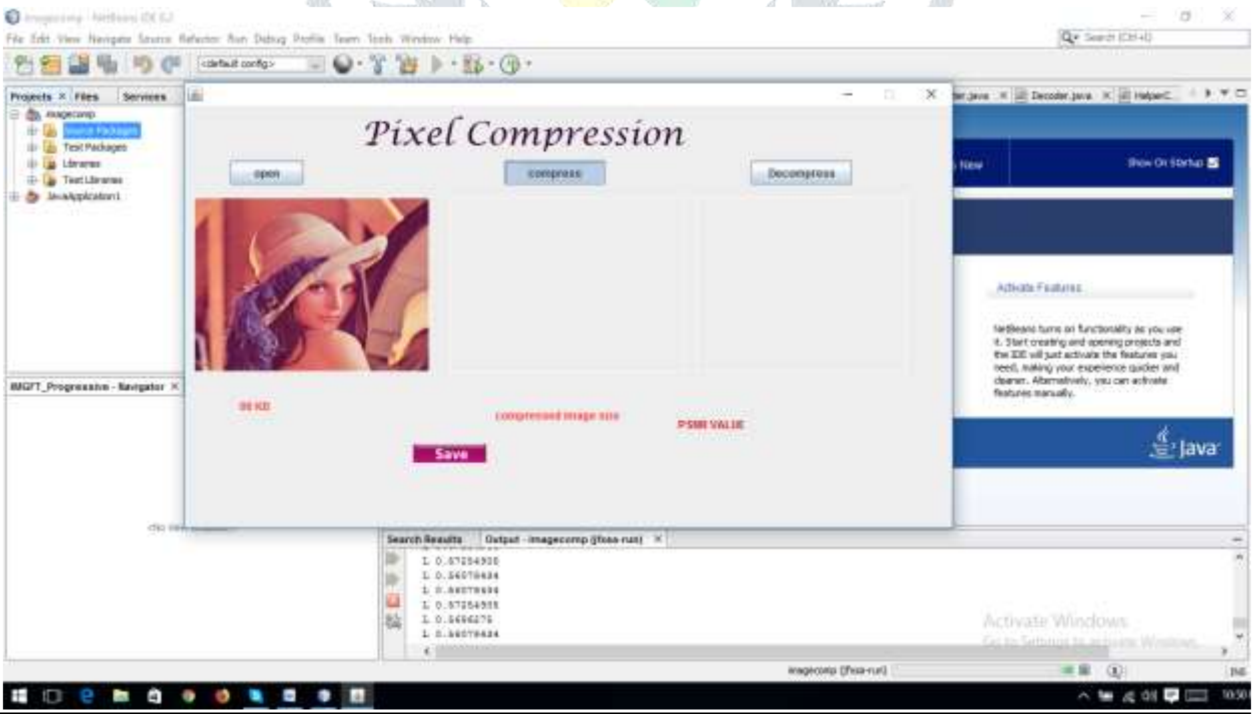


(b) (c)

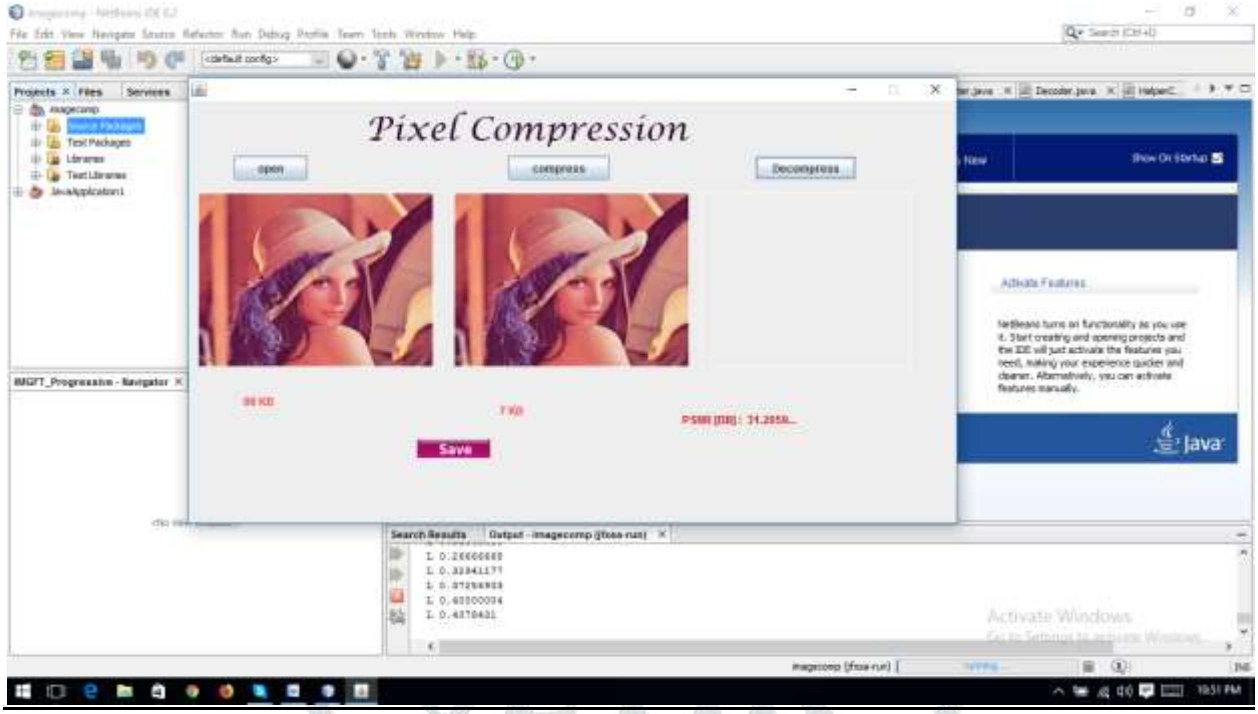
(a) Example of 2-D graph signal. The intensity of the signal is indicated by color on each vertex. (b) 1-D power spectrum of (a) obtained by a conventional graph Fourier transform (GFT), and (c) 2-D power spectrum of (a) obtained by the proposed multi-dimensional graph Fourier transform (MGFT). The 1-D spectrum is double-valued at red points, whereas the 2-D spectrum is single-valued everywhere.

OUTPUT

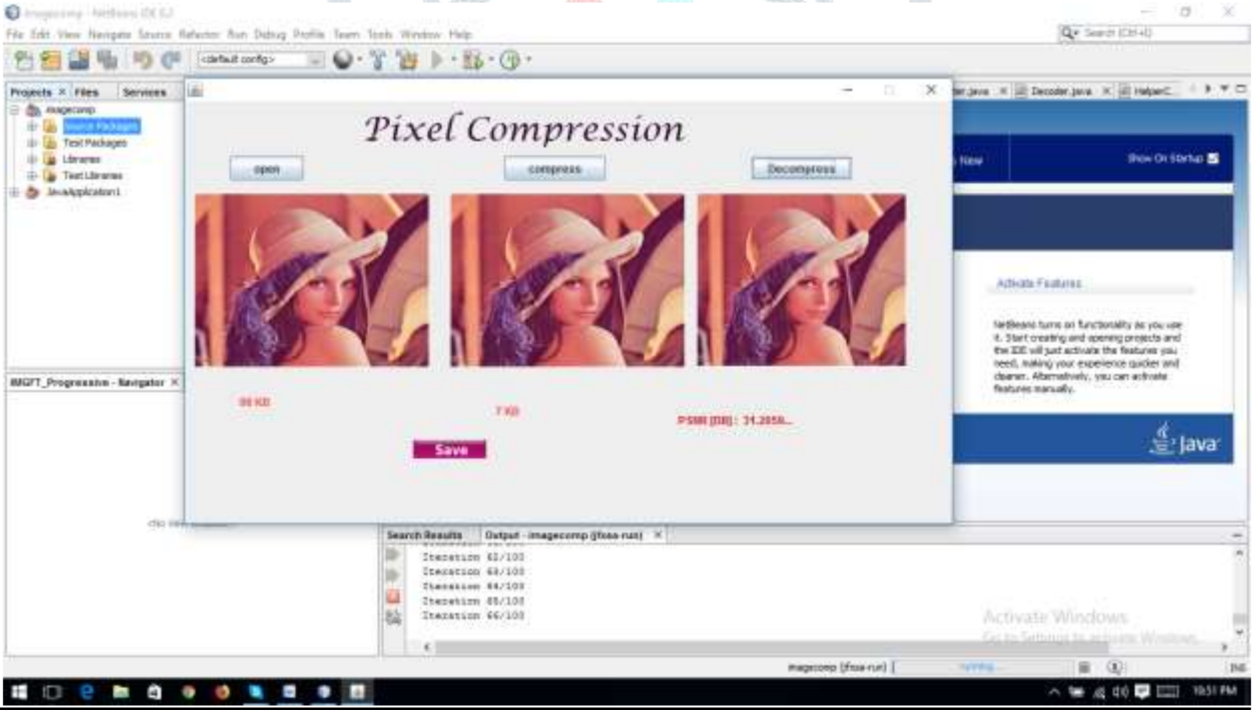
APPLYING COMPRESSION ON SELECTED IMAGE FILE



COMPRESSED FILE WITH PSNR VALUE



DECOMPRESSED FILE



CONCLUSION

✓ This study has proposed an MGFT that retains the dimensional information of multi-dimensional graph signals.

✓ Thus, the multi-dimensional graph Fourier transform enables directional frequency analysis, in addition to frequency analysis with the conventional GFT. Moreover, this rearrangement resolves the multi-valuedness of spectra in some cases.

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