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Extended Performance Appraise of Image Retrieval Using the Feature Vector as Row Mean of Transformed Column Image

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Abstract

The extension to the content based image retrieval (CBIR) technique based on row mean of transformed columns of image is presented here. As compared to earlier contemplation three image transforms, now the performance appraise of proposed CBIR technique is done using seven different image transforms like Discrete Cosine Transform (DCT), Discrete Sine Transform (DST), Hartley Transform, Haar Transform, Kekre Transform, Walsh Transform and Slant Transform. The generic image database with 1000 images spread across 11 categories is used to test the performance of proposed CBIR techniques. For each transform 55 queries (5 per category) were fired on the image database. Every technique is tested on both the color and grey version of image database. To compare the performance of image retrieval technique across transforms average precision and recall are computed of all queries. The results have shown the performance improvement (higher precision and recall values) with proposed methods compared to all pixel data of image at reduced computations resulting in faster retrieval in both gray as well as color versions of image database. Even the variation of considering DC component of transformed columns as part of feature vector and excluding it are also tested and it is found that presence of DC component in feature vector improvises the results in image retrieval. The ranking of transforms for performance in proposed gray CBIR techniques with DC component consideration can be given as DST, Haar, Hartley, DCT, Walsh, Slant and Kekre. In color variants of proposed techniques with DC component, the performance ranking of image transforms starting from best can be listed as DCT, Haar, Walsh, Slant, DST, Hartley and Kekre transform.

Keywords- CBIR, DCT, DST, Haar, Walsh, Kekre, Slant, Hartley, Row Mean.

1. INTRODUCTION

The hefty sized image databases which are being generated from a variety of sources (digital camera, video, scanner, the internet etc.) have posed technical challenges to computer systems to store/transmit and index/manage image data effectively to make such large collections easily accessible. Storage and transmission challenges are taken care by Image compression. The challenges of image indexing are studied in the context of image database [2,6,7,10,11], which has become one of the most important and promising research area for researchers from a wide range of disciplines like computer vision, image processing and database areas. The need for faster and better image retrieval techniques is increasing day by day. Some of important applications for CBIR technology could be identified as art galleries [12,14], museums, archaeology [3],

architecture design [8,13], geographic information systems [5], trademark databases [21,23], weather forecast [5,22], medical imaging [5,18], criminal investigations [24,25], image search on the Internet [9,19,20].

1.1 Content Based Image Retrieval

In literature the term content based image retrieval (CBIR) has been used for the first time by Kato et.al. [4], to describe his experiments into automatic retrieval of images from a database by color and shape feature. The typical CBIR system performs two major tasks [16,17]. The first one is feature extraction (FE), where a set of features, called feature vector, is generated to accurately represent the content of each image in the database. The second task is similarity measurement (SM), where a distance between the query image and each image in the database using their feature vectors is used to retrieve the top "closest" images [16,17,26].

For feature extraction in CBIR there are mainly two approaches [5] feature extraction in spatial domain and feature extraction in transform domain. The feature extraction in spatial domain includes the CBIR techniques based on histograms [5], BTC [1,2,16], VQ [21,25,26]. The transform domain methods are widely used in image compression, as they give high energy compaction in transformed image [17,24]. So it is obvious to use images in transformed domain for feature extraction in CBIR [23,28]. But taking transform of image is time consuming. Reducing the size of feature vector by applying transform on columns of the image and finally taking row mean of transformed columns and till getting the improvement in performance of image retrieval is the theme of the work presented here. Many current CBIR systems use Euclidean distance [1-3,8-14] on the extracted feature set as a similarity measure. The Direct Euclidian Distance between image P and query image Q can be given as equation 1, where Vpi and Vqi are the feature vectors of image P and Query image Q respectively with size 'n'.

$$ED = \sqrt{\sum_{i=1}^{n} (Vpi - Vqi)^2} \qquad (1)$$

Total seven well-known image transforms [10,11,18,28] like Discrete Cosine Transform (DCT), Walsh Transform, Haar Transform, Kekre Transform, Discrete Sine Transform (DST), Slant Transform and Hartley Transform are used for performance comparison of the proposed CBIR techniques.
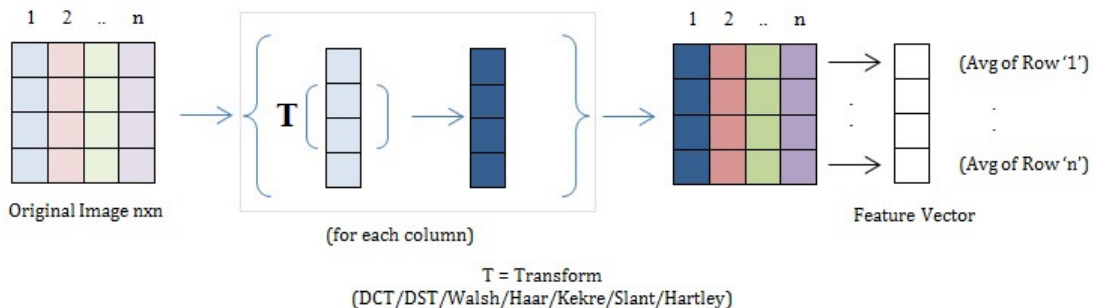
FIGURE 1: Feature Extraction in Proposed CBIR Technique with Row Mean of Transformed Image Columns

2. CBIR USING ROW MEAN OF TRANSFORMED COLUMN IMAGE [28]

Here image transform is applied on each column of image. Then row mean of the transformed columns is used as feature vector. Figure 1 shows the Feature Extraction in Proposed CBIR Technique with Row Mean of Transformed Image Columns. The obtained feature vector is used in two different ways (with and without DC component) to see the variations in retrieval accuracy. As indicated by experimental results, image retrieval using DC component value proves to be better than retrieval excluding it.

The following steps need to be followed for image retrieval using the proposed image retrieval techniques:

1. Apply transform T on the column of image of size NxN (I_{NxN}) to get column transformed image of the same size (cI_{NxN})

$$cI_{NxN} \text{ (column transformed)} = [T_{NxN}] [I_{NxN}] \qquad (2)$$

2. Calculate row mean of column transformed image to get feature vector of size N (instead of N^2)

3. The feature vector is considered with and without DC component to see variations in results. Then Euclidean Distance is applied to obtain precision and recall.

Applying transform on image columns instead of applying transform on the whole image, saves 50% of computations required resulting in faster retrieval [28]. Again row mean of column transformed image is taken as feature vector which further reduces the required number of comparisons among feature vectors resulting in faster retrieval. The results obtained from proposed techniques of row mean of column transformed image with DC component and row mean of column transformed image without DC component are compared with applying transform on full image and spatial row mean of image in both gray and color versions of image database.

3. IMPLEMENTATION
3.1 *The Platform and Image Database*

The implementation of the proposed CBIR techniques is done in MATLAB 7.0 using a computer with Intel Core 2 Duo Processor T8100 (2.1GHz) and 2 GB RAM.
The proposed CBIR techniques are tested on the image database of 1000 variable size images spread across 11 categories of human being, animals, natural scenery and manmade things. This image database in augmented version of Wang image database [15]. Figure 2 shows sample image of generic database.

FIGURE 2: Sample Images from Generic Image Database
[Image database contains total 1000 images with 11 categories]

3.2 *Precision/Recall*

To assess the retrieval effectiveness, we have used the precision and recall as statistical comparison parameters [1,2] for the proposed CBIR techniques. The standard definitions for these two measures are given by following equations.

$$\Pr ecision = \frac{Number\_of\_relevant\_images\_retrieved}{Total\_number\_of\_images\_retrieved} \qquad (3)$$

$$\text{Re}\,call = \frac{Number\_of\_relevant\_images\_retrieved}{Total\_number\_of\_relevent\_images\_in\_database} \qquad (4)$$

4. RESULTS AND DISCUSSIONS

For testing the performance of each proposed CBIR technique, per technique 55 queries (5 from each category) are fired on the database of 1000 variable size generic images spread across 11 categories. The query and database image matching is done using Euclidian distance. The average precision and average recall values for each proposed technique with respective image transform are computed and plotted against number of retrieved images for performance comparison.

The crossover point of precision and recall plays very important role in performance analysis of image retrieval method. At this crossover point value of precision equals to that of recall, which means all the relevant images from database have been retrieved and are exactly equal to the number of retrieved result images. In ideal situation the height of precision and recall crossover point should be at value one, which means all the retrieved images are relevant and all relevant from database are retrieved. Always the performance of image retrieval technique is compared to this ideal situation. The height of crossover point of precision and recall gives idea about how much the proposed technique is deviating from ideal one, more the height better the technique is.

The performance of proposed techniques with DC component (referred as 'Transform-RM-DC') and without DC component (referred as 'Transform-RM') for each transform is compared with CBIR using complete transformed image as feature vector (referred as 'Full'), spatial row mean vector of image as feature vector (referred as 'RM').

The proposed techniques are tested for both grey and color versions of image database. In all image transforms the color versions of the discussed CBIR techniques give higher performance as compared to gray versions.

4.1 Results on Gray Version of Image Database

In Figure 3 the precision-recall crossover points of DCT applied to the full gray image (Full), gray row mean (RM), the proposed technique of row mean of DCT transformed gray columns applied with DC component (DCT-RM-DC) and without DC component (DCT-RM) are shown. Here the proposed method with DC component gives the highest crossover point indicating best performance. Even the computational complexity in proposed retrieval technique is less than that of applying full transform. This proves proposed image retrieval method is faster and better with DCT. The performance of proposed CBIR method degrades if the DC component is not considered.
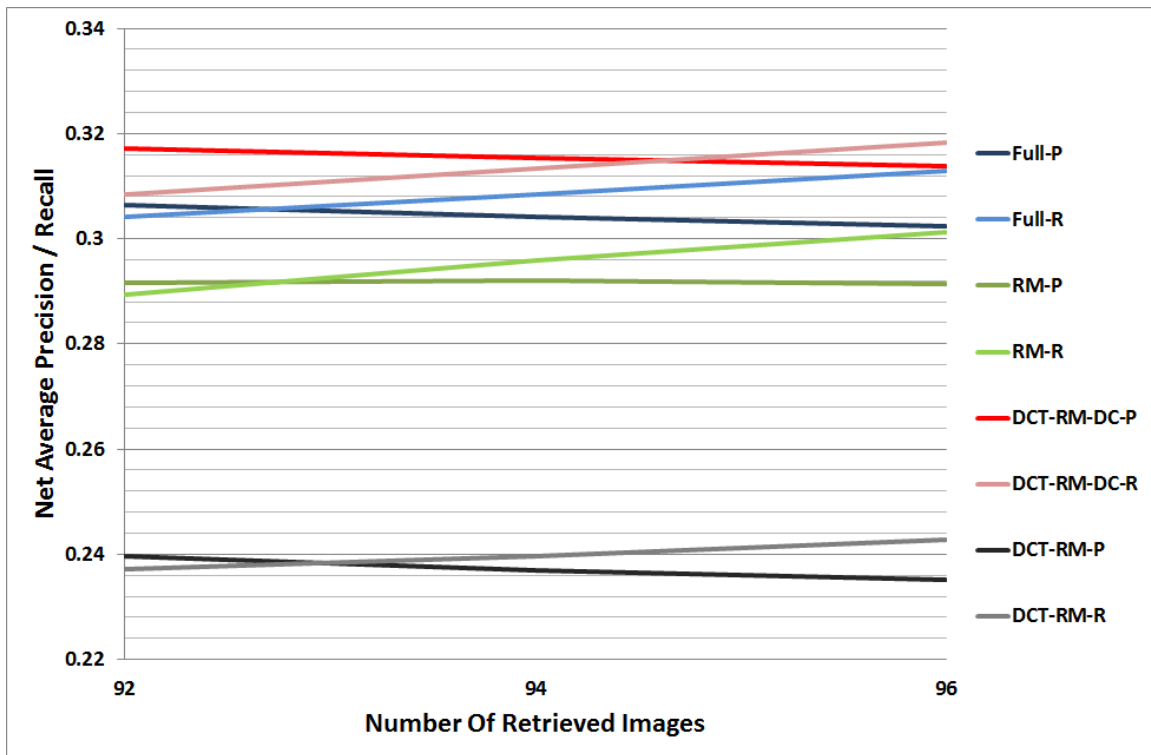
FIGURE 3: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using DCT
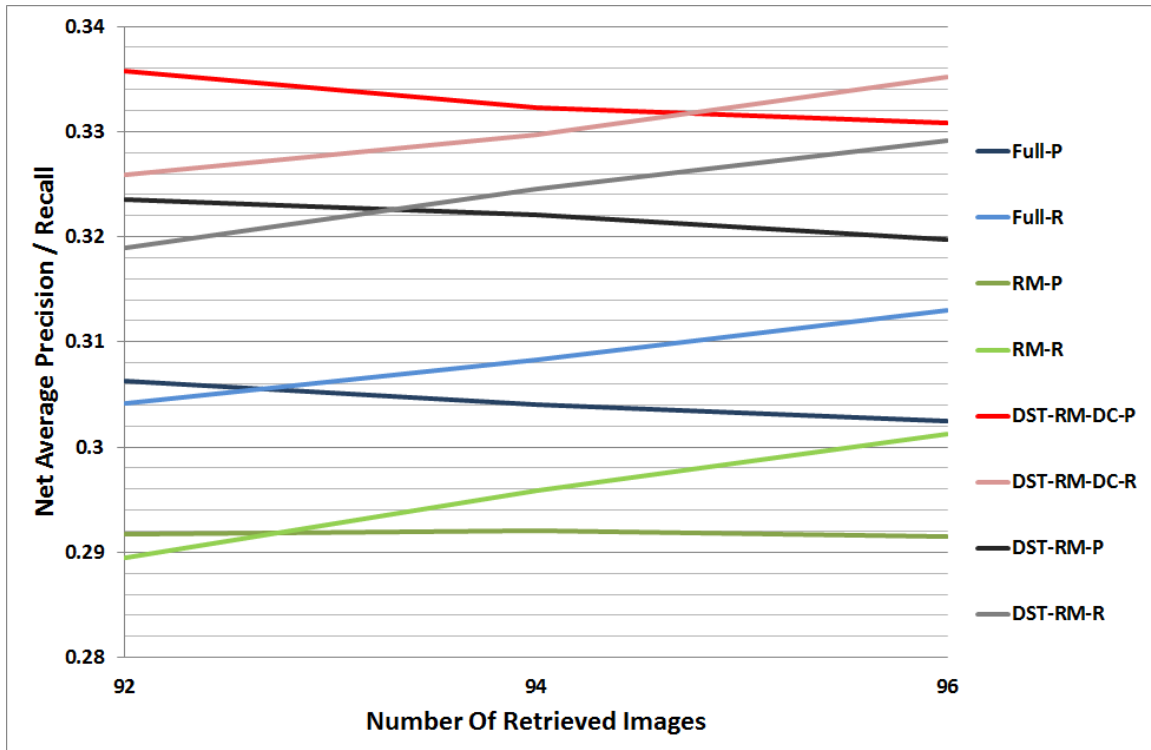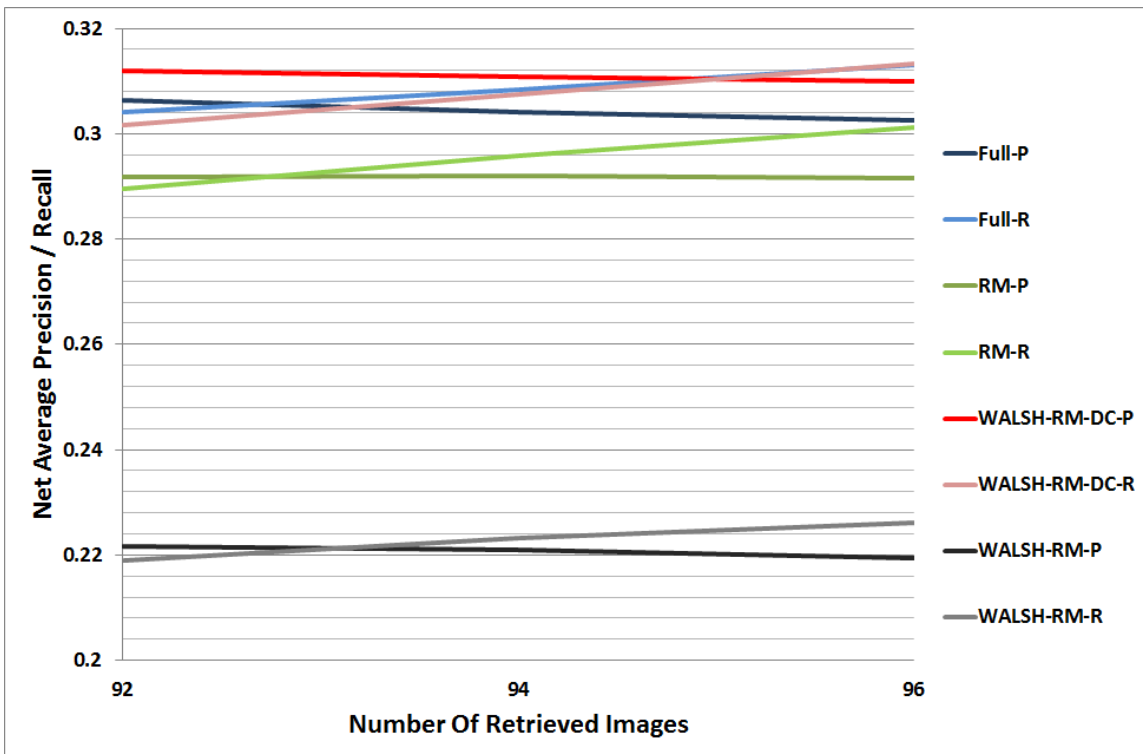

FIGURE 4: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using DST

In Figure 4 the performance of proposed gray CBIR method with DST is shown. The gray crossover point of DST based proposed technique with DC component is highest indicating best performance. Therefore better retrieval of images is possible with lower computations in the proposed CBIR technique with DST. Even here the performance degrades if the DC component is neglected in proposed image retrieval technique.
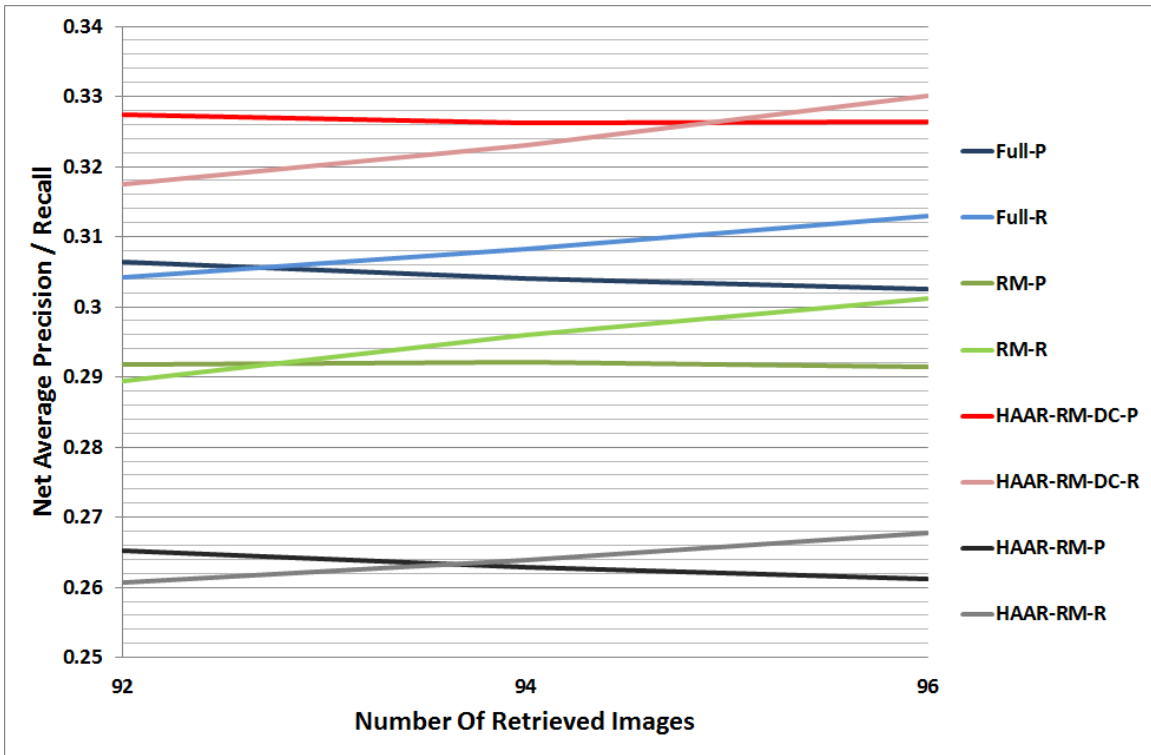

FIGURE 5: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using Walsh Transform

In Figure 5 the performance comparison of gray proposed CBIR methods for Walsh transform is given. Here also the best results are obtained using the proposed technique with DC component and the performance degrades if the DC component is not considered.

In Figure 6 the precision-recall crossover points of gray CBIR using Haar Transform applied to the full image (Full), row mean of image mage (RM), the proposed technique with DC component (HAAR-RM-DC) and without DC component (HAAR-RM) are shown. Also in case of Haar transform, the proposed technique with DC component gives best performance indicated by highest crossover point value and the performance degrades if the DC component is not considered. In Figure 7 the performance comparison of Slant transform based proposed gray CBIR techniques is shown, which again proves the proposed image retrieval technique with DC component to be the best.

In Figure 8 the gray crossover points of precision and recall for proposed CBIR methods with Hartley Transform are given. The result that proposed gray CBIR technique with DC component is best is again proved even in case of Hartley transform as indicated by highest precision-recall crossover point value. Here also performance degrades drastically of DC component is neglected in proposed image retrieval method. In Kekre transform used in proposed gray CBIR methods the techniques with DC component considered gives almost same performance to that of complete Kekre transform applied to image as shown in figure 9, but at great complexity reduction and performance of proposed method of CBIR degrades with negligence of DC component.

FIGURE 6: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using Haar Transform
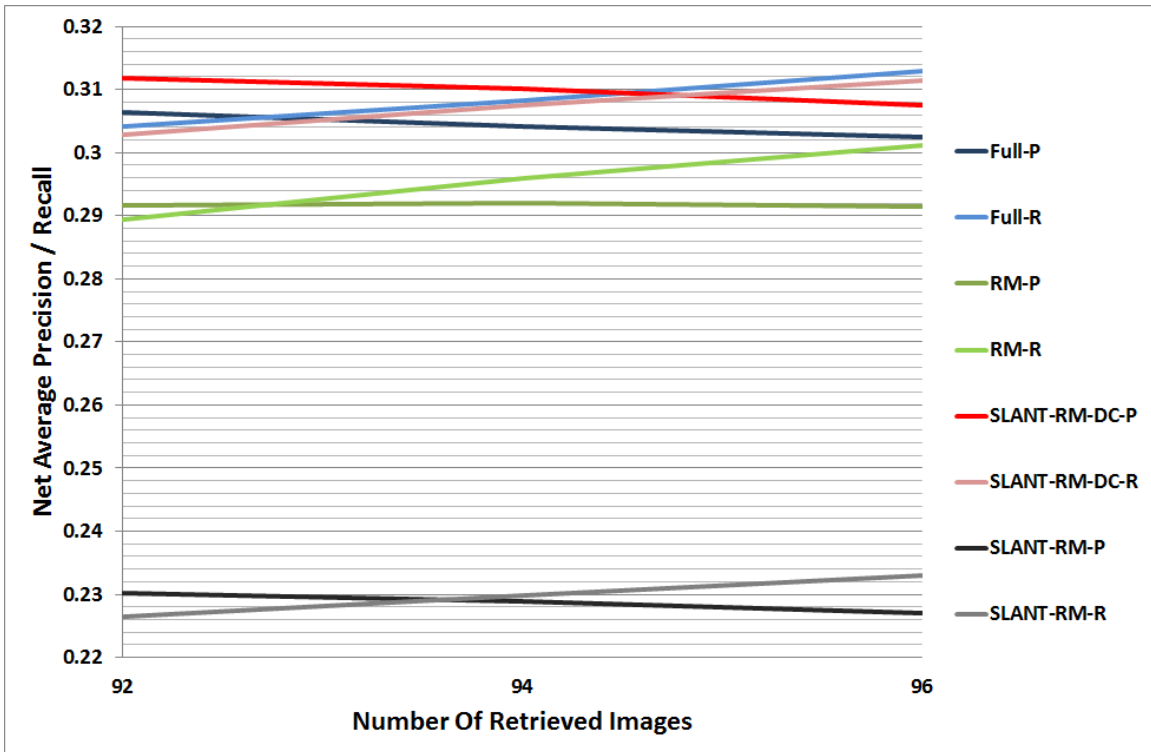
FIGURE 7: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using Slant Transform
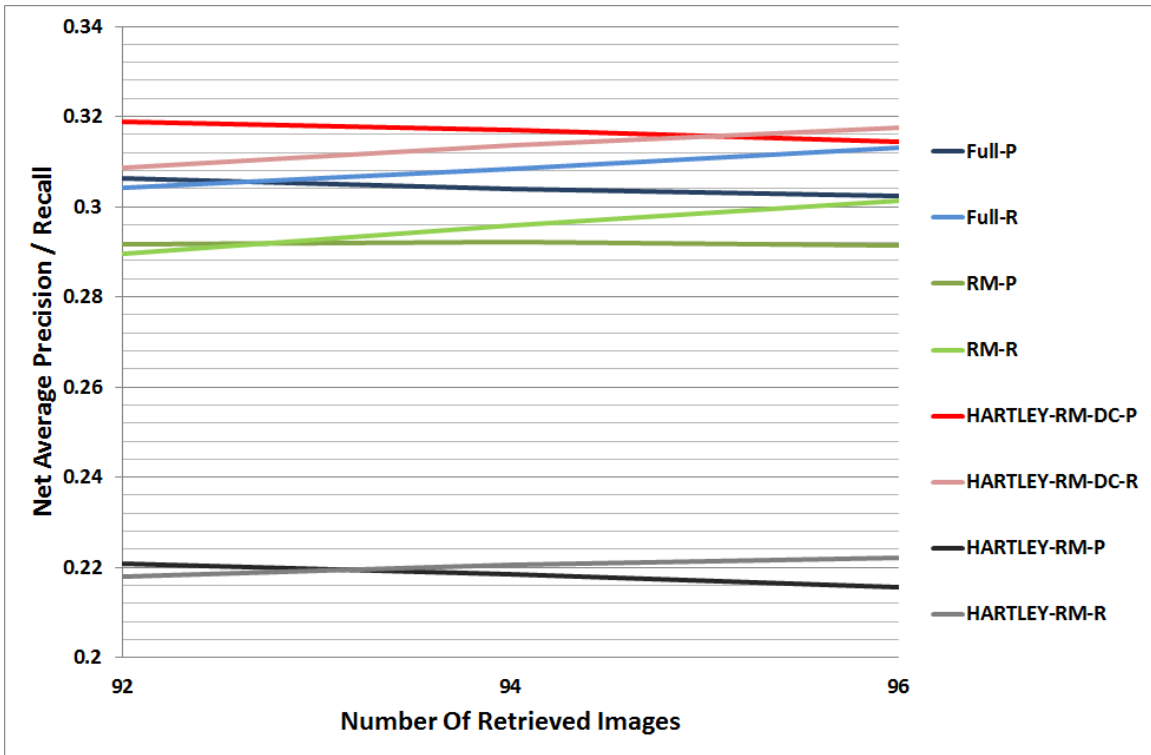
FIGURE 8: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using Hartley Transform
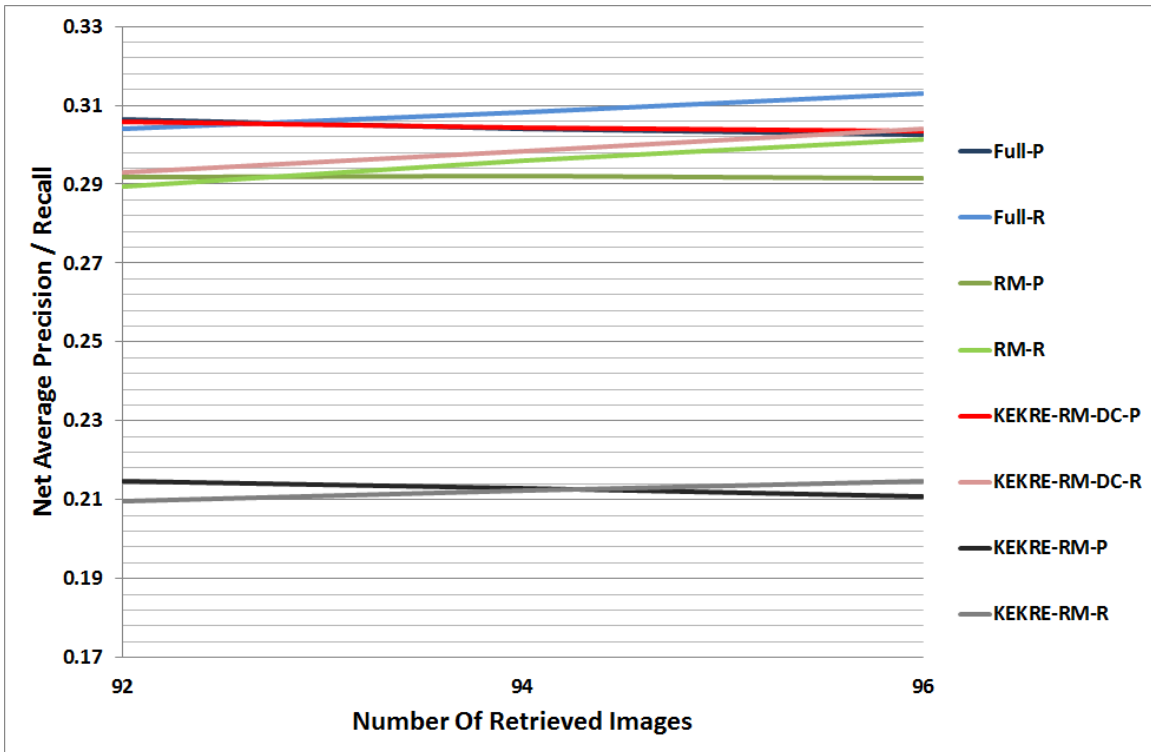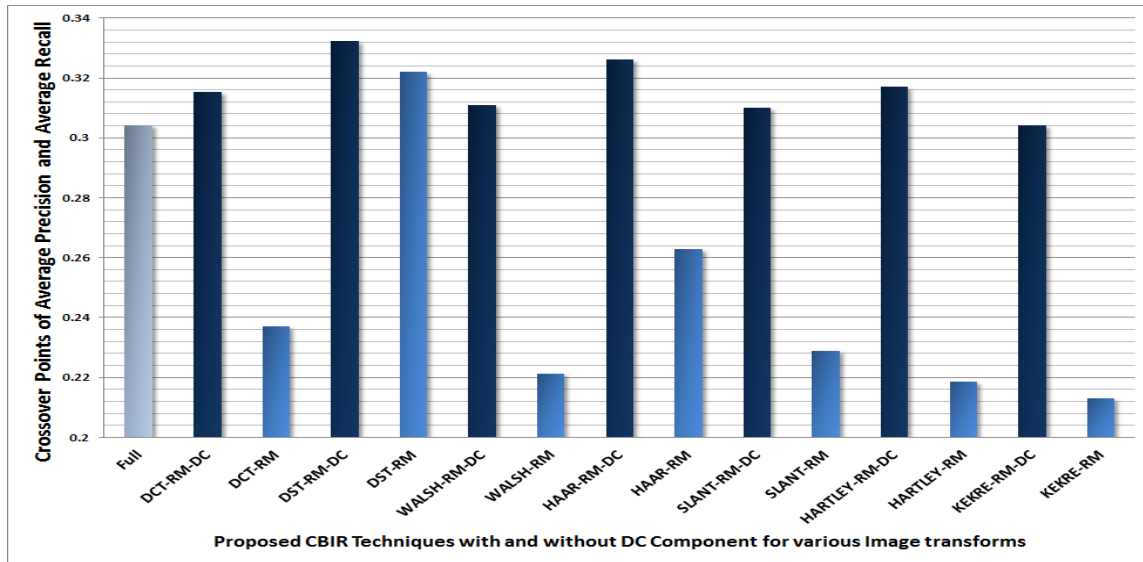

FIGURE 9: Gray Crossover Point of Precision and Recall v/s Number of Retrieved Images using Kekre Transform

FIGURE 10: Gray Crossover Point of average Precision and Recall v/s Row Mean with & without DC component for all transforms with Full Image

To decide which image transform proves to be the best for proposed gray CBIR methods, the crossover points of proposed gray CBIR techniques with and without DC coefficient are shown in figure 10. Here it is observed that the proposed technique for all transforms is giving better performance in DC component consideration than neglecting it. Also in all transforms proposed gray CBIR method with DC component outperforms the complete transform based gray CBIR technique. Here the best results are obtained using DST-RM-D followed by HAAR-RM-DC. The ranking of transforms for performance in proposed CBIR techniques with DC component consideration can be given as DST, Haar, Hartley, DCT, Walsh, Slant and Kekre. All transforms with proposed gray CBIR technique are showing improvement in performance as compared to gray CBIR based on complete transform of image as feature vector at great reduction in computational complexity. Therefore better and faster image retrieval is achieved using proposed gray CBIR technique.

4.2 *Results on Color Version of Image Database*
The performance comparison of CBIR using Image transformed full image as feature vector (referred as 'Full'), CBIR using simple row mean feature vector of image (referred as 'RM') and the proposed CBIR techniques with DC coefficient (referred as 'Transform-RM-DC') and without DC component (referred as ('Transform-RM') is given in Figure 11 to figure 17 in the form of color crossover points of precision and recall obtained by applying all these image retrieval techniques on color version of image database. In all transforms it is observed that consideration of DC coefficient in feature vector improves the CBIR performance (as indicated by higher precision and recall crossover point values). Also for all image transforms the proposed CBIR method with DC component have given best performance as indicated by uppermost height of crossover point of precision and recall. Even on color version of image database for al image transforms the proposed image retrieval techniques using row mean of column transformed image with DC component gives best performance. Figure 11 to figure 17 are showing the color crossover points of precision and recall plotted against number of retrieved images obtained by firing the queries on color version of image database respectively for image transforms like DCT, DST, Walsh transform, Haar transform, Slant transform, Hartley transform and Kekre transform.

FIGURE 11: Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using DCT

FIGURE 12: Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using DST

FIGURE 13: Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using Walsh Transform

FIGURE 14: Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using Haar Transform

FIGURE 15: Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using Slant Transform

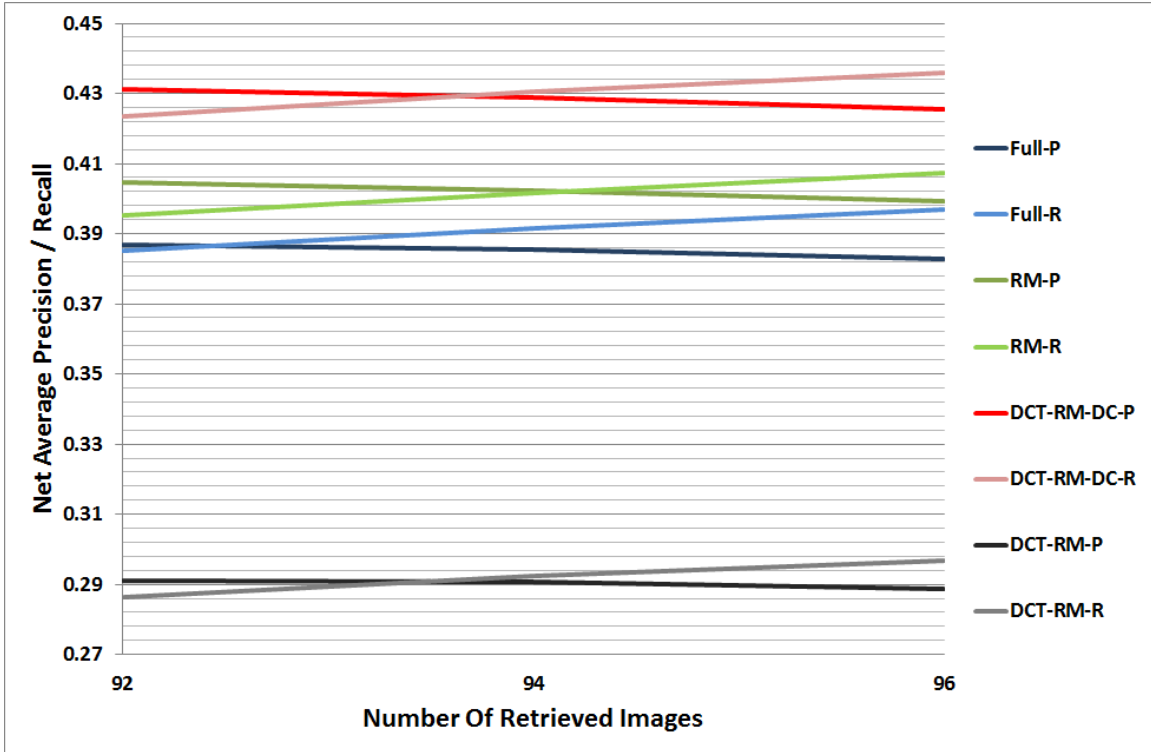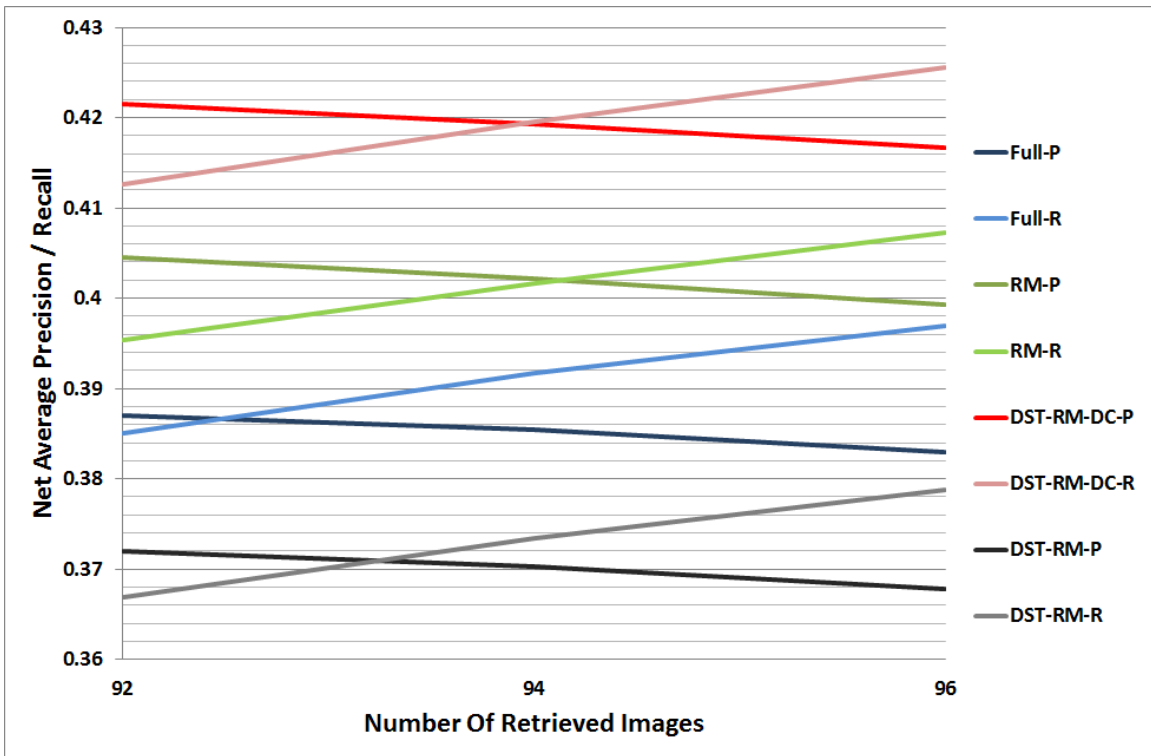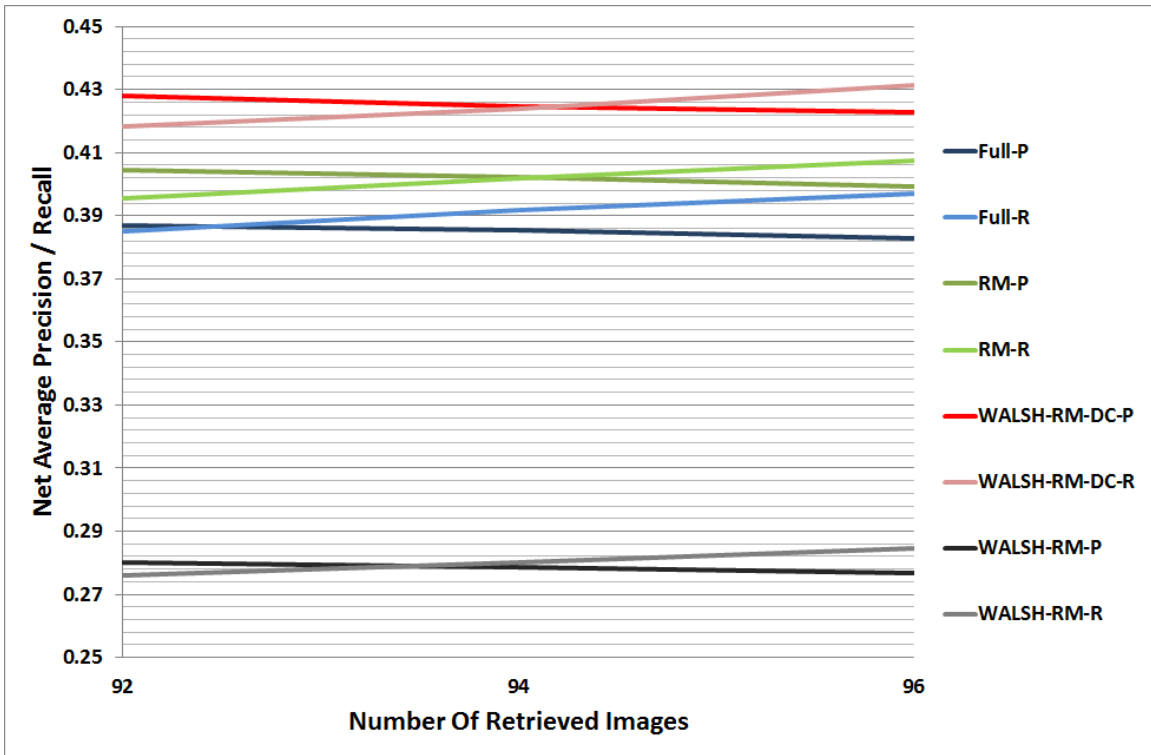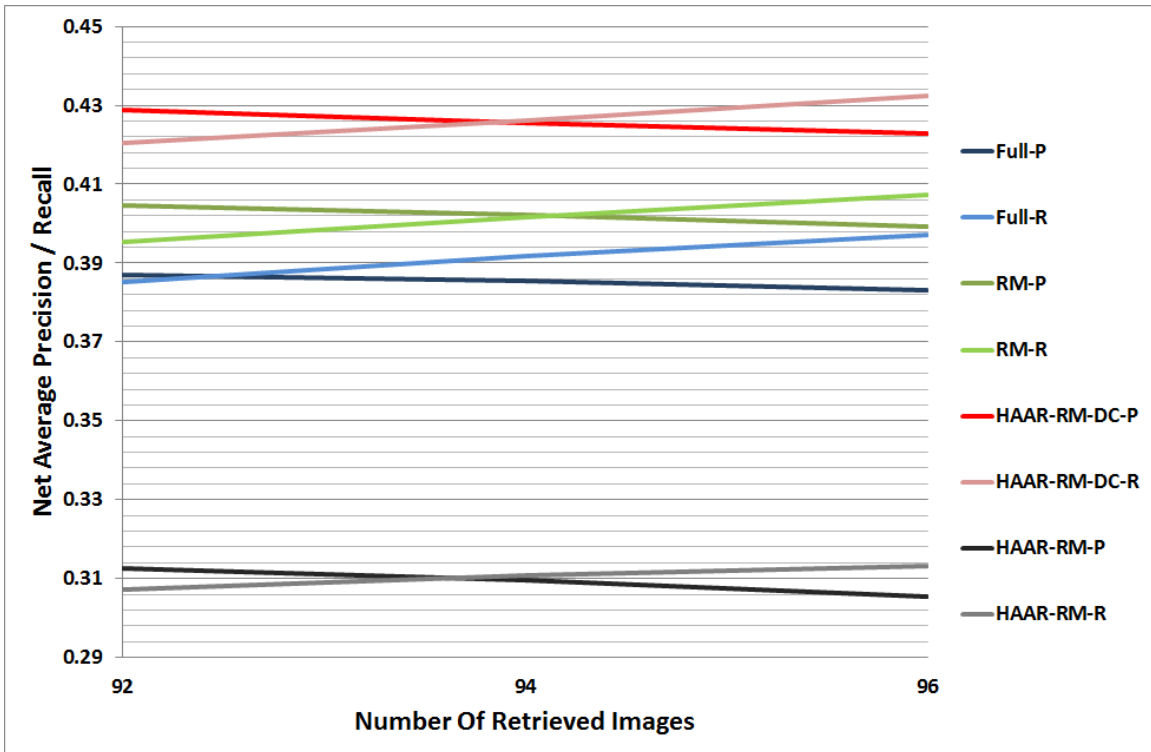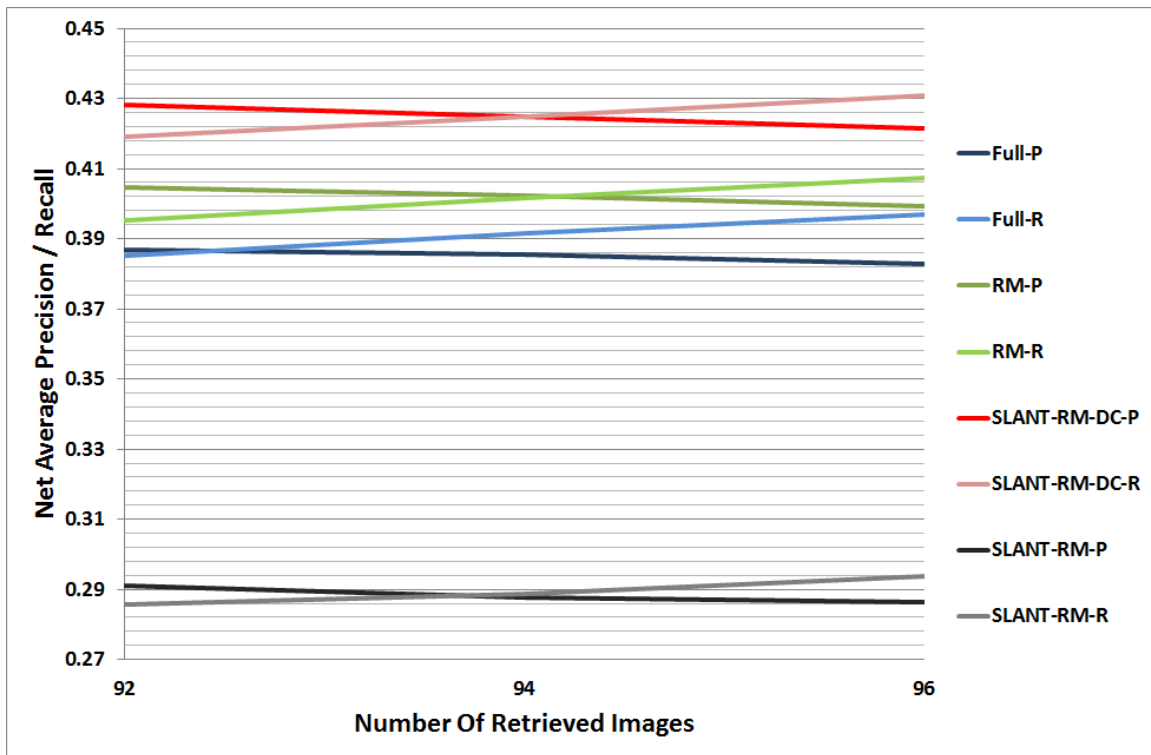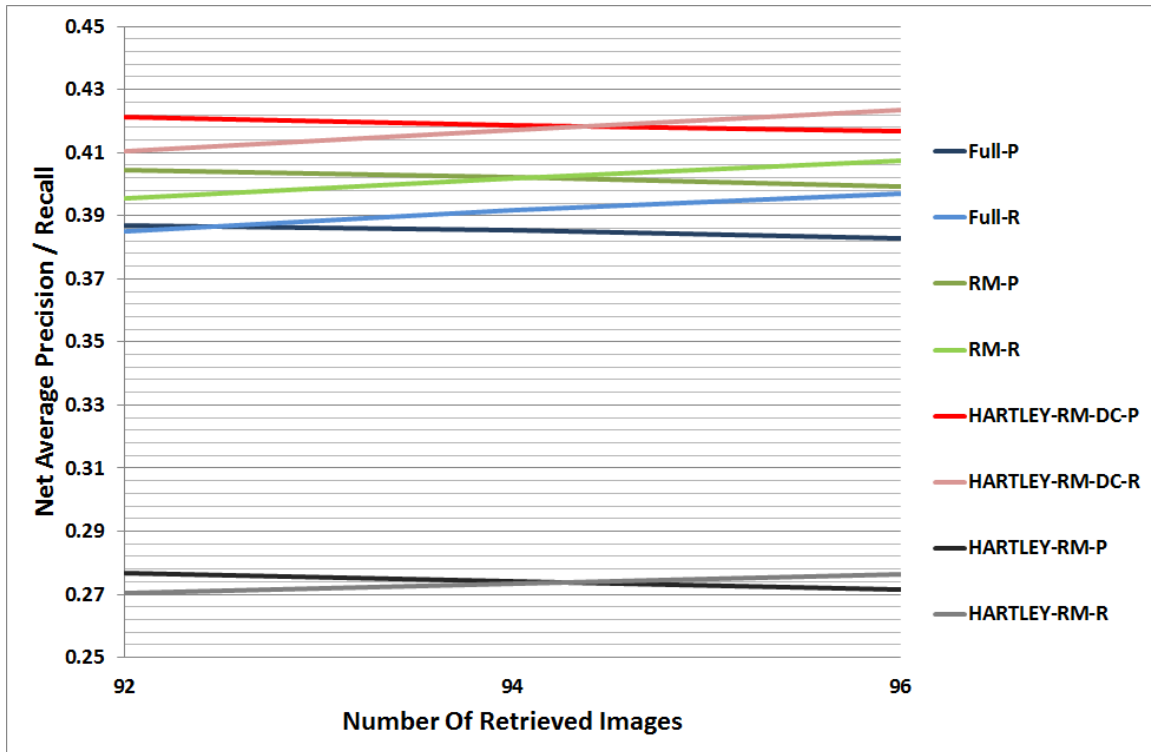**FIGURE 16:** Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using Hartley Transform
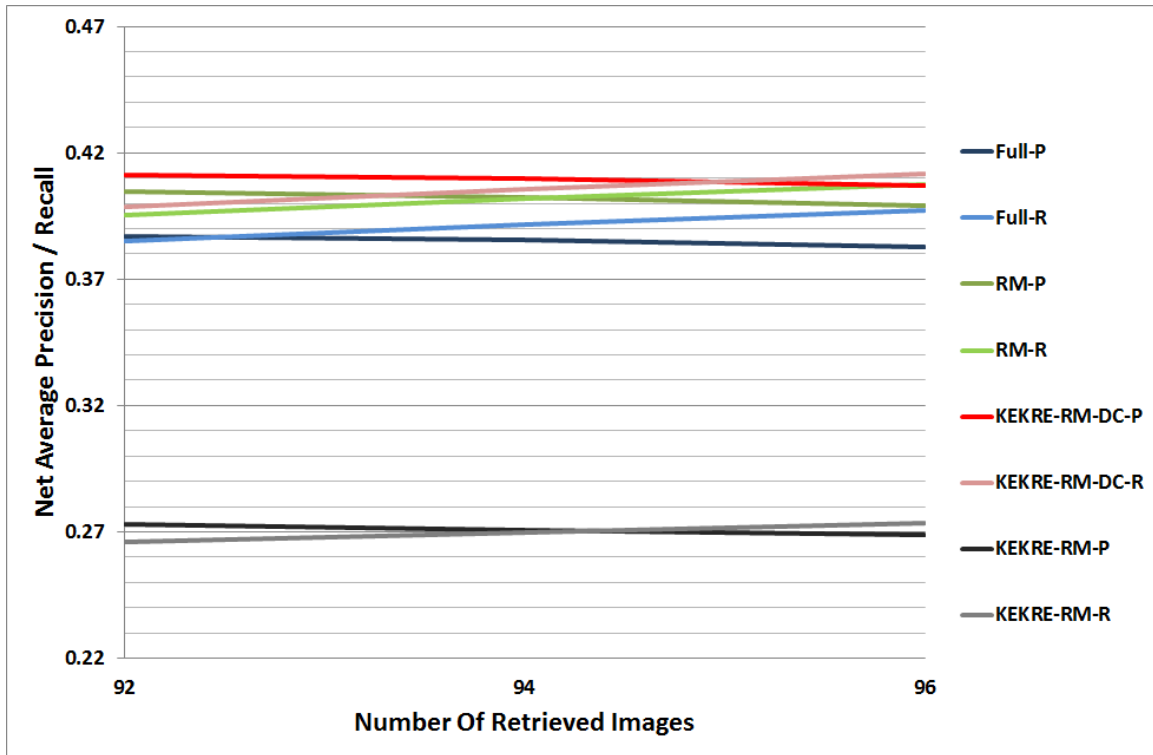
FIGURE 17: Color Crossover Point of Precision and Recall v/s Number of Retrieved Images using Kekre Transform
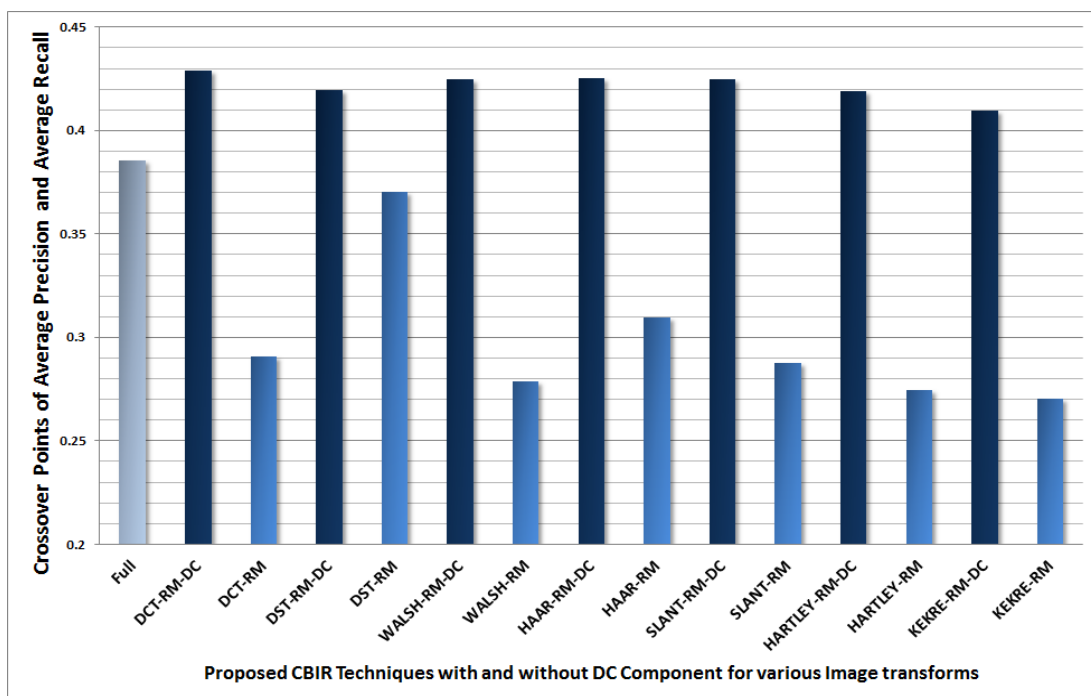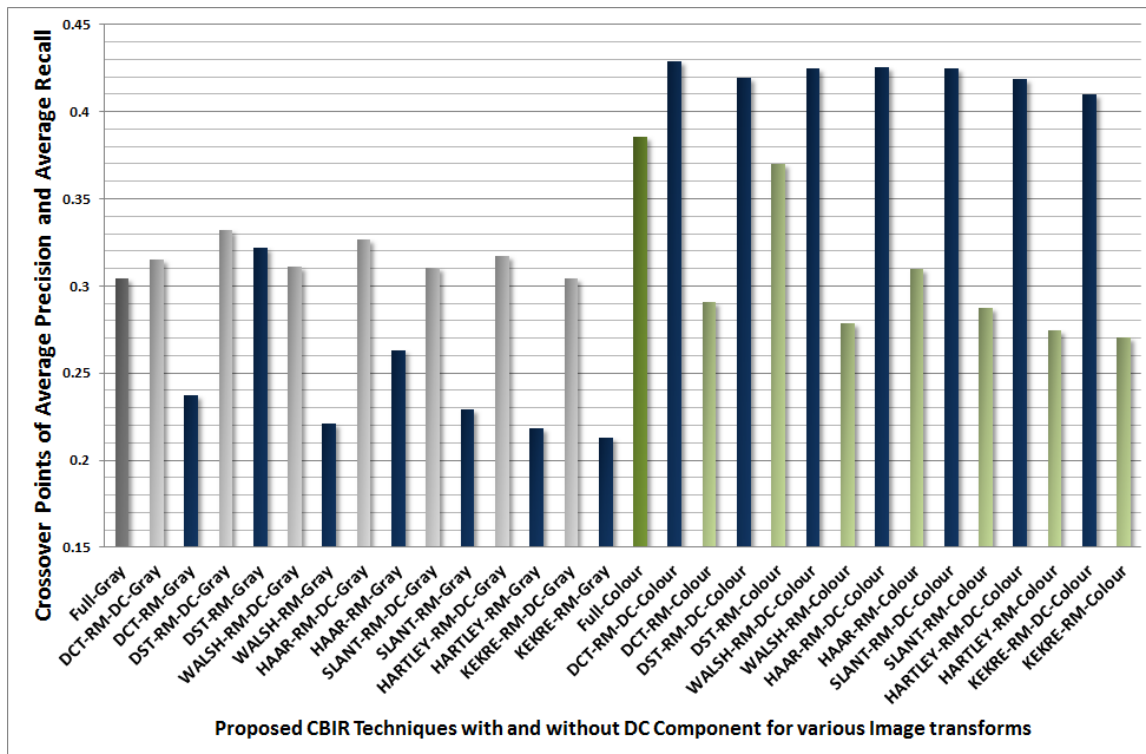

FIGURE 18: Color Crossover Point of average Precision and Recall v/s Row Mean with & without DC component for all transforms with Full Image

FIGURE 19: Gray and Color Crossover Point of average Precision and Recall v/s Row Mean with & without DC component for all transforms with Full Image

To decide which image transform proves to be the best for proposed color CBIR techniques, the crossover points of proposed gray CBIR methods with and without DC coefficient are shown in figure 18. Here it is observed that the proposed technique for all transforms is giving better performance in DC component consideration than neglecting it. Also in all transforms proposed color CBIR method with DC component outperforms the complete transform based color CBIR technique. Here the best results are obtained using DCT-RM-DC followed by HAAR-RM-DC. The ranking of transforms for performance in proposed color CBIR techniques with DC component consideration can be given as DCT, Haar, Walsh, Slant, DST, Hartley and Kekre. All transforms with proposed color CBIR technique are showing improvement in performance as compared to color CBIR based on complete transform of image as feature vector at great reduction in computational complexity. So better and faster image retrieval is achieved using proposed color CBIR technique.

Figure 19 shows the performance comparison between gray and color images, we can see a considerable improvement in performance using color images.

5. CONCLUSION

The thirst for improvising content based image retrieval techniques with respect to performance and computational time has still not been satisfied. The herculean task of improving the performance of image retrieval and simultaneously reducing the computational complexity is achieved by proposed image retrieval technique using row mean of transformed column image. The performance of proposed techniques is compared with CBIR using complete transformed image as feature vector and row mean of image as feature vector. Total seven image transforms like DCT, DST, Haar, Hartley, Kekre, Walsh and Slant are considered.

The techniques were tested on generic image database with 1000 images spread across 11 categories. Experimental results show that in all transforms proposed CBIR technique with DC component outperforms other methods with great reduction in computation time. Consideration of

DC component in proposed image retrieval techniques gives higher performance as compared to neglecting it.

In all transforms DST gives best performance for proposed gray image retrieval method with DC component and DCT proves to be the best for color image retrieval method with DC component. The ranking of transforms for performance in proposed gray CBIR techniques with DC component consideration can be given as DST, Haar, Hartley, DCT, Walsh, Slant and Kekre. In case of proposed color CBIR methods he performance ranking can be given as DCT, Haar, Walsh, Slant, DST, Hartley and Kekre.

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Adaptive Sliding Piece Selection Window for BitTorrent Systems

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Abstract

Peer to peer BitTorrent (P2P BT) systems are used for video-on-Demand (VoD) services. Scalability problem could face this system and would cause media servers not to be able to respond to the users' requests on time. Current sliding window methods face problems like waiting for the window pieces to be totally downloaded before sliding to the next pieces and determining the window size that affects the video streaming performance. In this paper, a modification is developed for BT systems to select video files based on sliding window method. Developed system proposes using two sliding windows, High and Low, running simultaneously. Each window collects video pieces based on the user available bandwidth, video bit rate and a parameter that determines media player buffered seconds. System performance is measured and evaluated against other piece selection sliding window methods. Results show that our method outperforms the benchmarked sliding window methods.

Keywords: BitTorrent, Sliding Window, Video-on-Demand, Peer-to-Peer.

1. INTRODUCTION

Video on Demand (VoD) applications are used to deliver different video files to many users. In recent years, VoD applications are widely used for many types of networks with different organizations. Due to the development of computing resources, communications, data storage, and presentations' methods as video websitesa user can select and show any video file from huge sets of videos at any time.

Users can share their resources by using peer-to-peer file sharing or streaming across a network instead of using classical centralized video server[1]. So a limited number of video servers will be required to provide the main service for users. The idea of P2P system is to use computer to computer data transmission not a traditional client server application. P2P applications share different resources as storage, content or any resources available between users. The resources are not centralized but are distributed across the network. P2P is an unpredictable environment [2] for content delivery. However, many P2P file sharing applications were developed such as bitTorrent [3] and FastTrack [4].

BT protocol is one of the most effective mechanisms for P2P content distribution and one of the most popular file transfer protocols over the internet. It is a hybrid P2P system using a dedicated central server for controlling peers' communication. The server building information and the metadata lookups are about the shared contents at each peer node. Metadata is used by a peer's request to identify the nodes having the requested data. Communication channels and data

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transfers will be handled by the peers not the servers. The main issue is the failure of the central server.

BitTorrent is a file sharing protocol that applies the hybrid mechanism. It is composed of a central server called tracker that stores torrent file containing information about the file shared, as length, hash information and URL of the tracker server[5]. Tracker server has updated information about the peers' list having the requested file and can link the peers to start transferring the pieces of the file to the request issuer.

Many researches were done to build P2P systems for audio and video streaming so that the user can download and upload a video stream in the same time[1]. A P2P systemis scalable, as it will be constructed by users in a network not only by the video server. The video streaming network will be defined by users' locations and network topology that affects the system performance, scalability, fault tolerance and how the system will be maintained [4-6].

BT effectiveness comes from its ability to transfer files quickly by managing peers' bandwidth. Current implementation of BT does not support time based data as video streaming [6]. BT implementation supporting video streaming for P2P systems will add two important features to the users:
1- Minimizethe time required to start the video.
2- Distribute the load of an overloaded server among peers.

Using other network resources, like client upload bandwidth, is one of the main targets for using peer to peer systems. BT uses swarm technique by building a torrent file containing information about the data distributed and how it is split in pieces or chunks. Peers download the chunks from other peers and in the same time upload the requested chunks. Transmitting peers are dynamically connected by a centralized server called tracker server that is used to manage peers, find them, store information about peers' bandwidth usage, and store torrent file information as the number of parts a file is split into.

Peer States is one of the main strong points in BT protocol. Peer has two main states while joining a swarm. These states are known as the choked and interested states.

Choking is a signal that a peer (P1) is not intending to send any data to P2 until un-choked. This could be because the peer is not ready, or not willing to fulfill the requests. Interested means that peer has data that P2 does not have, and wishes to acquire. New connections to peers always begin as choked and not interested. Peers will un-choke connected peers who upload fast but are not interested. If the fast uploading peers subsequently become interested, then the worst up-loader gets choked. It is not possible for every peer to share data with every other connected peer at the same time.

The TCP-Protocol used in BitTorrent to connect to other peers gets easily congested, and performs badly when sharing data over many connections at once. So choking is used to limit that congestion, and to help make sharing faster. Choking is also used to make sharing fairer to all, by ensuring that peers who upload more data faster to others get more data uploaded to them. So the more you upload, the more you can download from other peers. And the less you upload, the more likely you are to be choked.

The main strong point of BT is its ability to select only the best peers to transfer the file. This is done by classifying the peers as seeds and leeches where a seed has the entire file and a leech has only parts of the file. BT has become a popular method but due to this popularity, it is facing some issues as:

• High load on the central tracker due to tracking the status of a huge number of connected peers and updating it.

• Initial sharing delay problem.If a torrent has big-sized pieces; the time taken by a peerto download a piece and tostart sharing that piece could be long.

Scalability is another performance issue facing BitTorrent like VoD systems [1].It is important to make the P2P protocol as efficient as possible, and provide a high initial service capacity (number of seeds). Once the P2P system has reached sufficient seeders to downloaders' ratio, the initial service capacity is not necessary anymore, as the system has become self-sustainable.

The proposed systemin this paper modifies the BT protocol and uses buffered time slots to be transferred between peers.The slots collect the video data using a dynamic adaptive sliding piece selection window.

The paper is organized in the following way. Sections 2 and 3shows piece selection methods and windowing selection algorithms respectively. Section 4 presents the proposed dynamic adaptive window piece selection method.Section 5presents the simulation results and section 6is the conclusion of our work.

2. CURRENTPIECE SELECTION METHODS

Selecting pieces to download in an optimizedorder is very important for the performance. A poor piece selection can result in receiving pieces which are not important for the current playing position.

Many piece selection methods were introduced in bit torrent systems,but which one will be appropriate for media streaming?

2.1 Strict Priority
If a single sub-piece (of a piece P), has been selected, the remaining sub-pieces (of P)will be selected before sub-pieces from any other piece. This does a good job of getting complete pieces as quickly as possible[3]

2.2 Rarest First
Peers download pieces that exist the least first. So the player will make sure that the least common pieces requested exist before starting to download the pieces that are common among peers. These common pieces are left for later.

If a swarm has low number of seeds, rarest first method will be applicable. All peers will be interested in downloading the pieces in the seed and not in any other peers[6]. Rarest pieces mostly will exist in seed and may not exist in any other peers especially at the start of a streaming process. Rarest first handles seeds disconnection by replicating the rarest pieces as quickly as possible, before the peers that have this piece stop uploading or stop responding to other peers or before it gets disconnected from the swarm. Thus the risk of losing any piece is reduced.

2.3 Random First Pieces
Ifa peer downloads a file for the first time, the peer will have nothing to upload. It's important to get a complete piece as quickly as possible. Pieces to be downloaded are selected at random until the first complete piece is assembled. The strategy then changes to rarest first. Rare pieces method would collect rare pieces, regardless of their relevance, so it would download a full piece very slowly.

2.4 Endgame Mode
Sometimes a piece will be requested from a peer with very slow transfer rate. This piece will face delay to finish its download. To prevent that delay, the peersends requests to all peers asking for all the needed sub-pieces. Once a sub-piece arrives to the requesting peer, cancels are sent for that sub-piece to save the bandwidth from being wasted on redundant sends. In practice not much bandwidth is wasted this way, since the Endgame period is very short, and the end of a file is always downloaded quickly.

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3. WINDOWING SELECTION ALGORITHMS

BitTorrent has one major drawback when it comes to VoD systems. The peer has to wait for the whole video to download before starting to watch the video, because BitTorrent splits the file to be downloaded into pieces that are downloaded in a non-sequential order using rarest-first method [6].

Peers in different video playing positions are interested in different pieces. BT selection algorithm should be replaced by something else in order to get VoD to work well.

Many researches proposed the rarest-first piece selection only within a small window that slides through the file to be downloaded [7]. In order to implement this kind of "windowing", only minor changes to BitTorrent clients are needed, and the modified clients are compatible enough to be used for downloading data from standard BitTorrent swarms [6].

Windowing BitTorrent for VoD depends on two factors:
1- The choice of windowing algorithm.
2- The importance of piece and window sizes.

Performance gains can be achieved by carefully optimizing the client behavior in each of the above factors. The selection window methods are divided into:

3.1 Fixed Size Window Algorithm

Window size is measured in number of pieces that will be set to a fixed number[8] and will include both the arrived and non-arrived pieces. Pieces are only requested from within the window.

The beginning point of the window is defined as the first piece that has not yet been downloaded but has not missed its playback deadline.

Fixed size use $w = db/c$ where
d is the playback delay,
b is the video consumption rate
c is the chunk size.

3.2 BiToS

A window will be formed from non-arrived pieces only, which means that the distance of the first and the last piece in the BiToS [6]window can grow large. Pieces can be requested from outside the window according to the available bandwidth.

Pieces are requested from within the window with probability p (a value of p=0.8 was recommendedand from outside the window with probability 1- p) [6].

All pieces of the file must be downloaded including missed pieces, because users need to have the entire file at end of download.

Suppose a piece missed: BiToS will continue to download subsequent pieces by expanding its window to reach the end of the video, whereasfixed size window will stop until the piece is downloaded.

3.3 Stretching Window
Is an extension to BiToS.It uses a maximum number of non-arrived pieces in the window.The maximum window size is calculated by the same formula as that in Fixed Size [7]and it represents the distance between the first and the last piece in the window. Thus Stretching Window has two maximum sizes, BiToS-like maximum number of non-arrived pieces in the window and the fixed-window like represents maximum absolute distance between the first and the last piece in the window that are enforced simultaneously.Pieces are still requested from within the window.

4. THE PROPOSED ALGORITHM
As shown in the previous sliding window methods, window size plays an important factor for the streaming performance. The proposed sliding window method builds two sliding windows that run simultaneously for collecting pieces. Windows are sized dynamically and adapted to the user available bandwidth, video bitrate and a system parameter that determines the media player buffered seconds.The buffered seconds will be of a variable length data and will represent the piece size in the window.

The open question in P2P based VoD system discussed in [5] is to which peer, among all peers that have that piece, should a node send a request for a data piece? Standard BT tracker algorithm returns a list of peers having the requested file. A peer is selected at random from that list. Peers start communicating with each other using chocked and interested methods to share the file.

Selecting such a peer at random has the disadvantage that older peers (nodes which arrived earlier and have large data content) receive more requests from many newly arrived peers. Another disadvantage is that peers will request pieces from the fastest response peers which usually have higher bandwidth than other peers that have the same requested piece.

The proposed selection model will build two lists of peers, classified by the upload bandwidth. Lists will be used in piece selection method. The main purpose is maintaining fairness between the peers and the well distribution for piece requests over network peers such that the peer that has high bandwidth will not be overloaded all the time by other peers' requests. The two lists are:

    1.Same or lower speed peers list (SPL):containing peers that have the same speed as the peer requesting the video.
    2.Higher speed peers list (HPL):containing peers whose upload bandwidth is higher than the peer requesting the video.

The algorithm developed is shown in
figure **1** andbased on the following:
- Window size will have a variable data length according to the number of pieces in the window.
- Two windows will be created, one for the current pieces requested for Download (RDW), and a second separate window for Missed pieces (MW).
- RDW initial window size will be calculated for each peer session requesting a video by using the following formula.

RDWS = B/N*D

WhereRDWS is the window size measured in number of pieces.
    B is peer download bandwidth.
    N buffered number of seconds.
    D video bitrate/second.
- MW has unlimited size and include all missed parts while the video is downloading.Pieces will be requested in reverse sequential order, trying to collect pieces before their end play time. Missed pieces will be requested from high peer list (HPL).

- RDW and MW will be updated by a timer T = 2* RDWS, updates will take the following actions
  - Move downloaded pieces to the video player buffer.
  - Move missed pieces list from RDW to MW.
  - Calculate RDW size according to current peer bandwidth.
  - Move RDW sliding window to next pieces.
  - The window RDW will slide to the next time frame pieces, after all window pieces' download is complete or timer is exhausted.
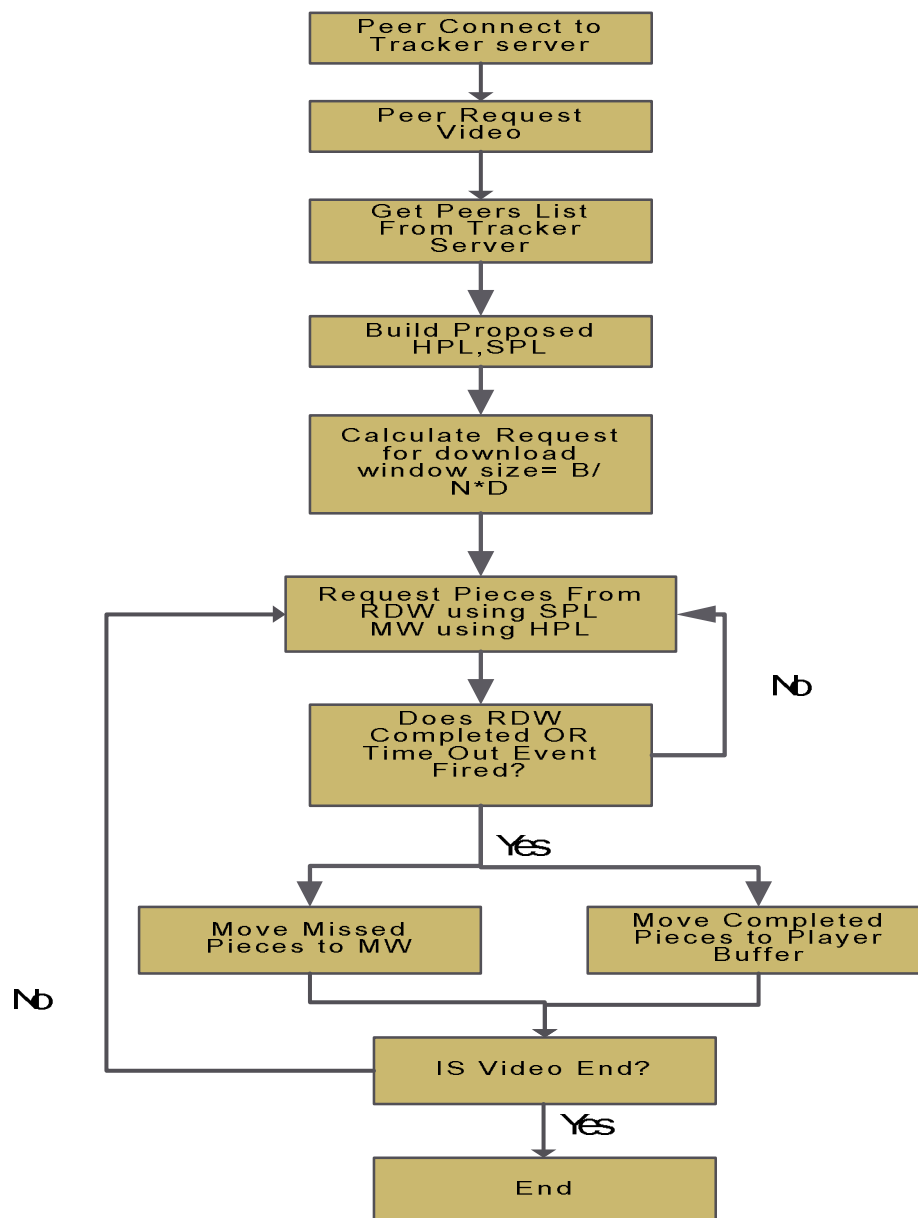
FIGURE 1: Proposed Piece Selection Method

5. SIMULATION

Simulator results were based on running the proposed method four times on a total number of 167 nodes on a system configuration of 2.5 processor core 2 due, 3 MB cache and 3 GB memory.Event-based P2P simulator called PeerSim[9]has been selected to simulate our model. Simulation parameters used in the simulation of the proposed algorithm are listed in table **1**.Fixed, BiTos and Stretching windowing methods were also simulated, each ran for 4 times to be compared with the proposed model and with normal BitTorrent.

| Parameter	value
Video File size	100 Megabyte
Video Bitrate	512 kb\s
Video Time	26 Minute
Piece size	256 Kbyte
Number of pieces	390 piece
Max swarm size	200 Node
Peer set size	50 Node
Network size	100 Node
Max growth	20 Node
Seeder distribution	10%-20%-30%-40%-50%
Step	10 Seconds
Add	10 Nodes
remove	5 Nodes
Simulation Time	1 Hour

TABLE 1: P2P Network Simulation Parameters

TABLE2shows the number of peers for each bandwidth, which is generated randomly by the simulator in the first time. To be able to measure the system performance and to compare it versus other systems, we force the simulator to work with the same peers' distribution for all other methods (total of 167 peers starting with 100 peers and reaching 167 peers by the end of one hour simulation.

Bandwidth KB/s	Number of Nodes
512	36
1024	49
2048	43
4096	39

TABLE2: Nodes Bandwidth Distribution

The system is tracked for different seeds to peer ratio S/P for 10%, 20%, 30%, 40% and 50%.As shown in figure2,when the number of seeds is 50%, half of the network nodes have the complete video file so the number of pieces transferred in the network is small. For 10% seeds, the piece transfers will be lower, because of the low percentage of seed/peer. When the S/P is 20% the network transfers a number of pieces greater than other distributions. Therefore S/P 20% is selected for the simulation run of all other sliding window methods.The figure also shows the network behavior.Initially, the network piece transfer grows gradually then the transfer becomes stable and with the effect of leaving and entering of new peers with time the number of pieces in the network steps up and down with time.
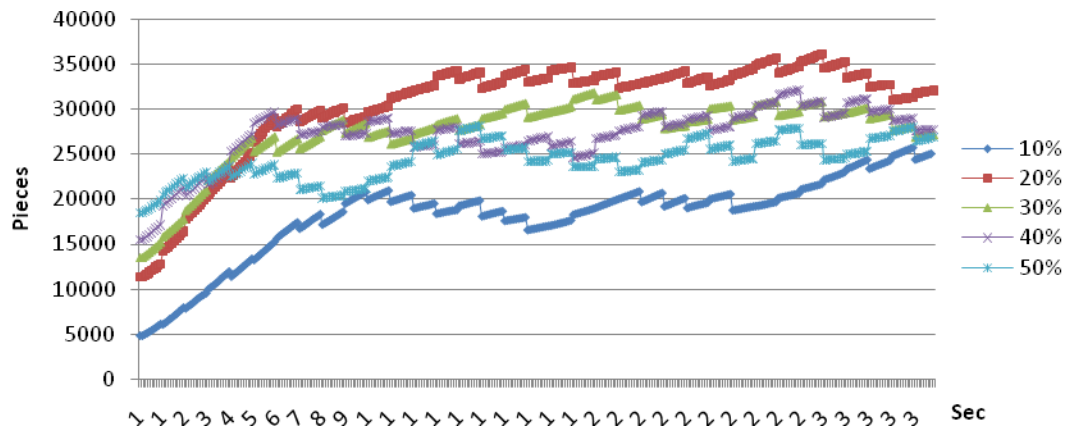
FIGURE2: Proposed Seed Distribution Effect

TABLE3shows the sliding windowing methods running for nodes' bandwidths of 512, 1024, 2048 and 4096. As the difference in bandwidth did not show any significance in the relative performance of the proposed sliding window method compared to others, only the results of 512kb are shown in figure3. Measurements in table 3 are taken for S/P ratio of 20% for all sliding window methods with a random seed distribution

Nodes Bandwidth	Sliding Method	Number of Downloaded pieces	Average joining duration/Min
512	BT	9307	27
	Proposed	8084	34
	Stretch	7438	35
	Bitos	7066	33
	Fixed	6453	34
1024	BT	18822	32
	Proposed	15357	34
	Stretch	14347	31
	Bitos	11255	22
	Fixed	12834	28
2048	BT	8598	10
	Proposed	9670	36
	Stretch	8571	29
	Bitos	3149	3
	Fixed	7031	26
4096	BT	20801	27
	Proposed	14250	34
	Stretch	12184	25
	Bitos	11732	25
	Fixed	11211	35

TABLE3: Proposed Sliding Window Simulation Measurements

FIGURE3 shows that the proposed dynamic adaptive sliding window piece selection method has lower number of pieces compared to the conventional bit torrent selection method. This is normal because BT has no constraints of getting pieces by using rarest first.FIGURE3also shows that the

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proposed method is superior to other sliding window methods based on bit torrent as it has a greater number of pieces downloaded. FIGURE3 also shows the average joining time for the nodes for each sliding method based on the simulator.
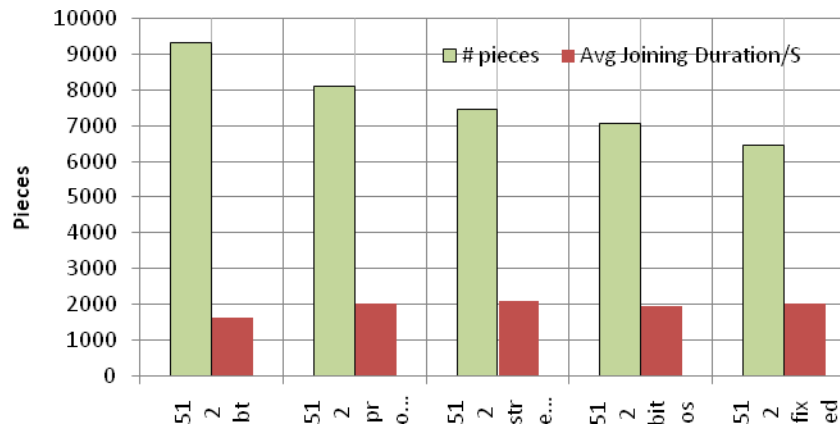

FIGURE3: Sliding Windows Average Usage

FIGURE 4shows the number of pieces summed for all the used bandwidths. It shows that the proposed system is effective for all bandwidthsused.
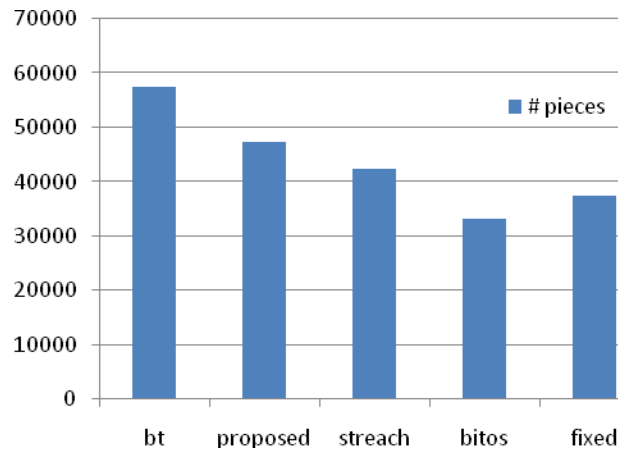

FIGURE 4: Sliding Window Downloaded Pieces

The number of downloaded pieces is not only the critical factor in evaluating the proposed system performance but also the average piece download rate is a critical factoras well.FIGURE 5showsthe average piece download rate for the proposed method withdifferent seeds distribution. It shows that increasing the percentage of seeds generally increases the number of downloaded pieces which is a normal expected performance.
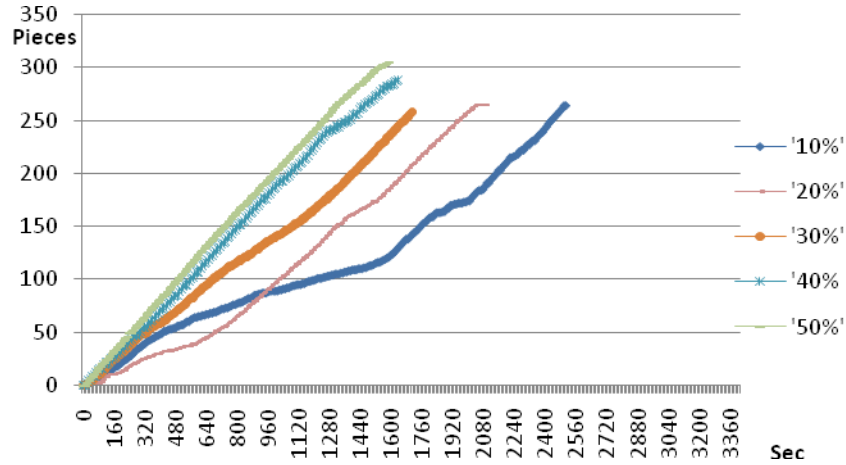
FIGURE 5: Average Piece Download Rate for Different Seeds Distribution

FIGURE 5 can be divided into 2 zones, the first one is from 0 to 900 sec and the second zone is from 900 to the end of the simulation time. In the first zone, the rate of download pieces is random due to random behavior of BT. In the second zone, sliding window method is dominant and the behavior of downloading is as expected i.e increases with the increase in seeds number.

FIGURE 6 shows a comparison of the number of downloaded pieces using the proposed system compared to other methods at a fixed percentage of seeds/peers of 20%. During simulation time the"Stretch" has the least overall performance since it has 2 constraints. It consumes a percentage of bandwidth for downloading out of window pieces as well as it has fixed size window thus limiting the sliding window size.

Bitos comes the second least performance as it has the same first constraint as that of the Stretch. Fixed has the third least performance. Although it has the adaptive capability to adjust the window size, it still has constraints.Firstly, the window size is fixed and secondly, it stops the download if a requested piece has stopped during its download.In the fourth place, just before the BT comes the performance of the proposed algorithm.Since it has no constraints, there ismore flexibility in downloading as the proposed algorithm has two windows: one is open window size as in standard Bittorrent and the other having two lists of peers to select the piecesFigure 6 shows that the proposed method outperforms the 3 methods of Fixed, Bitos and Stretch.It is expected that the proposed algorithm performance is less than that of BT because it uses "rarest first" while downloading the pieces.
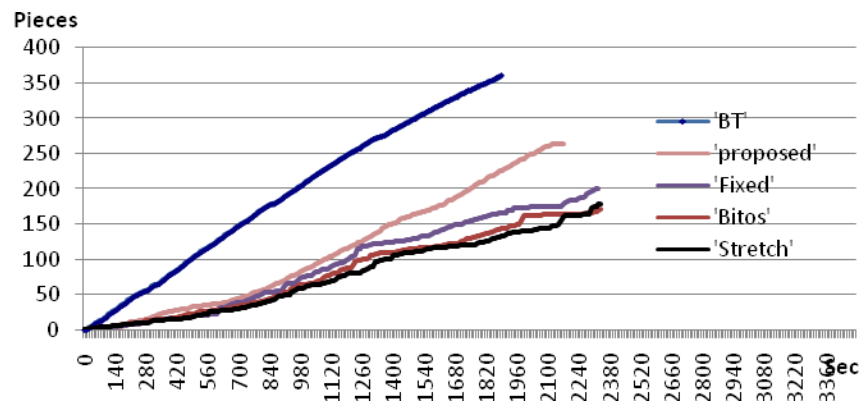

FIGURE 6: Average Piece Download Rate for Different Sliding Window Methods

FIGURE 7show the average downloaded pieces per minute for each bandwidth using different sliding window methods. The measurements are taken after the sliding window networks have become stable in downloading the pieces. Network stability has been achieved after about 5 minutes from running the simulation process as shown in figure 2.
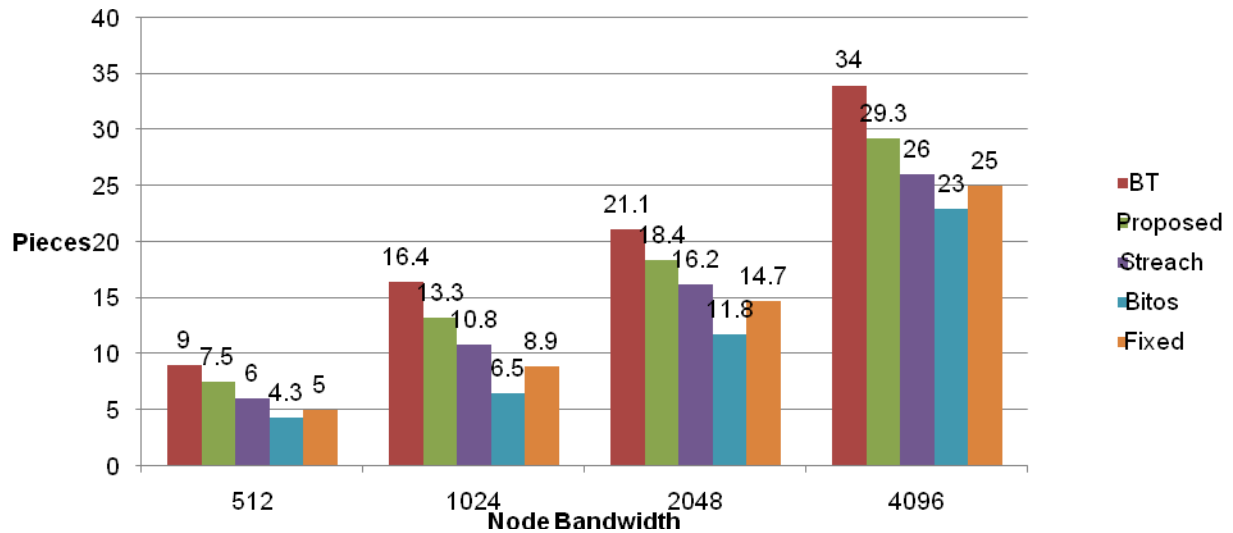

FIGURE 7: Sliding Methods Average Downloaded Piece per Minute

6. CONCLOSION

Due to the deficiency of BT systems in handling timed data, a P2P BT system was proposed to overcome this deficiency. The proposed system presented extensions to the BitTorrent protocol which enhances the video on demand functionality.

The modified BitTorrent protocol is applicable for media streaming by introducing a dynamic adaptive sliding window for selecting the pieces of the video file in faster and in order within a frame of a window buffered seconds.

The simulation results show that the system can efficiently reduce the streaming time and allow more file pieces to be downloaded under the constraint of a sliding window mechanism. The results outperformed the famous window sliding techniques thus proving the efficiency of our proposed system.

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To build its International reputation, we are disseminating the publication information through Google Books, Google Scholar, Directory of Open Access Journals (DOAJ), Open J Gate, ScientificCommons, Docstoc and many more. Our International Editors are working on establishing ISI listing and a good impact factor for AMIJ.

The initial efforts helped to shape the editorial policy and to sharpen the focus of the journal. Starting with volume 2, 2011, AMIJ appears in more focused issues. Besides normal publications, AMIJ intend to organized special issues on more focused topics. Each special issue will have a designated editor (editors) – either member of the editorial board or another recognized specialist in the respective field.

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- Computer Vision
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- Synthesis
- Multimedia Compression
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