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Journal Impact Factor Histogram Equalization to Compare Journal Performance across Subject Categories

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***Abstract*— The journal impact factor was devised by Eugene Garfield as a way to count the impact of scientific and research journals. The journal impact factors are computed yearly for all journals that are indexed in Thomson Reuters Journal Citation Reports. This journal impact factor concept is purely research area dependant .People usually disregards this fact while comparing two or more journals from different subjects or categories. Different variants of impact factor have been proposed by different researches to address the problem of subject category dependency. The concept of histogram was introduced by Karl Pearson. The histogram equalization is very useful operation in image processing. Details of histogram equalization can be found in any image processing related book. In the image processing, histogram equalization is a method which uses image histogram to do contrast adjustment. We proposed here, a very simple and elegant method, journal impact factor histogram equalization for finding overall position of a journal across subject categories and to solve the problem of the subject category specificity of citation dynamics of Thomson Reuters Impact factor.**

***Keywords*— Histogram equalization, Scientometrics, Bibliometrics, Impact-factor, Journal evaluation**

I. INTRODUCTION

The concept of journal impact factor is used to compare the journals within a certain field of science or research [1]. The journal impact factor for year Y is given by following formula

$$IF = A/B \quad (1)$$

Where

A= the number of citations in the year Y to items published in Y-1 and Y-2 years.

B= the number of articles, reviews, proceedings, or notes published in the same Y-1 and Y-2 years by that journal [2].

Though ISI impact factor is not a flawless method to judge the journal quality but main advantage of journal impact factor concept is that it is already in use and has being used since long for measuring quality of journals. Due to that it is a good technique for scientific evaluation [3][4]. Impact factor should not be used to compare journals across different subject areas because of citation dynamics in different subject areas are different [5][6]. But many administrators use journal impact factor to compare journal performance across subject categories.

The journal impact factor is highly discipline-dependent. Comparisons of journals across different subject areas should not be made based on impact factor (Amin M, Mabe M 2000) because,

1. In some subject categories, the percentage of total citations in the first two years after publication of article may be higher than in other subject categories [7].
2. The bottom journals in fundamental and basic subject journals may have higher impact factors than the top journals in specialized subject fields [1].
3. Average number of authors per paper varies according to subject area, e.g. social sciences with average two authors per paper and fundamental life sciences where there are over four. There is natural tendency of authors to refer their own work in their other journal papers or articles [1].
4. Citation habits and dynamics can be different in different subject [5][6]. Citation impact of a subject is directly related to average number of references per journal article which varies from subject to subject [5][6]. Very less number of References to articles are used within the arts and humanities [5][8] .
5. In new and rapidly growing research area, the number of articles making citations is large[5][[9][10].
6. There may be comparatively less number of journals available in some areas or there may be only few journals with low impact factor available in some subjects or there may be only few journals with high impact factor available in some subjects.
7. Journals in some field may be heavily cited by adjacent fields [11][[12][13].
8. In some subject categories, more number of conferences is being organized per year. More Alternative mean of publication may be available.
9. Time required to conduct and publish research may be different in different subjects [1][Thomson Scientific 2008].

In the past, many avenues for the ranking of journal impact were researched. The normalized impact factor (NIF) was presented as a comparatively uncomplicated approach empowering the Journal Impact Factors to be used to compare journals across different subject areas[14] .Numerous methods have been proposed to normalize journal impact factor by their field [15][16][17][18][19][20][21].A normalized impact factor method is suggested by Sen and Marshakova-Shaikevich[16][17][21] to compare journal performance across subjects. But these normalized impact factors are not adequate, because it uses only the highest impact factor or a few of the highest Impact factors to calculated normalized impact factor of a journal. Some Highest impact factors are not always representatives of majority of journals in the subject category [15]. Other vital approaches are the rank-normalized journal Impact factors (rNIF) and journal to field impact score (JFIS) [15][18]. The rnIF of any journal j is given by formula (K-Rj+ 1)/K, where Rj is the descending rank of journal j in its JCR category and K is the number of journals in the category [15][22].The "Journal to Field Impact Score" were computed by dividing the journal IFs by the aggregate IFs calculated for their related subject categories [18]. Any of these methods can not reflect the real position of journals in their subject categories because these methods neglect the variation of journal IF distribution within different subject categories [23]. Other alternative methods the source normalized impact per paper (SNIP) and "Journal Impact Factor based on Fractional Counting of Citations" are based on source normalization[24][25]. In SNIP method normalization is performed in the numerator as well as in the denominator, that's why this exercise is complex[25]. According to L. Leydesdorff and T. Opthof [25], SNIP is based on dividing the mean of a distribution by the value of the median of another distribution. Leydesdorff L and Opthof T [25] introduced "Journal Impact Factor based on Fractional Counting of Citations". But in this method, citations from articles with long reference lists are considered less important than those from articles with short reference lists [27].

In this paper, we explore an efficient and simple method based on histogram equalization to compare journals across different subject categories. At the follow, the concept of histogram equalization is stated in detail and then our proposed method is given. We have also explained flow of this method with the help of a simple example.

II. HISTOGRAM EQUALIZATION

Histogram equalization (HE) is a very famous method for image contrast enhancement.[28][29][30][31][32]. Histogram equalization technique is based on equalizing the histogram and then increasing the dynamic range corresponding to that image.

It works as follows,

Consider a discrete greyscale image x

$P_x(i)$ = the number of occurrences of gray-level i in the image x (the image's histogram for pixel value i).

L = the total number of gray-levels in the image e.g.256.

M = the highest value of the gray-level = L - 1 = 255.

N = the total number of pixels in the image x.

Then the cumulative distribution function (CDF) corresponding to $P_x(i)$ is given by,

$$CDF_x(i) = \sum_{j=0}^{i} P_x(j) \quad (2)$$

Normalize the cumulative distribution function to [0, M] using equation given below, which gives histogram equalized image. The general histogram equalization formula is

$$HE_x(i) = round(\frac{CDF_x(i) - CDF_{min}}{N - CDF_{min}} \times M) \quad (3)$$

where CDF_{min} is minimum value of cumulative distribution function. This technique can be used to do contrast enhancement in many applications including medical image processing, texture synthesis and speech recognition due to its simplicity and high efficiency[28][31].

III. JOURNAL IMPACT FACTOR HISTOGRAM EQUALIZATION

For any journal j with Impact factor value IFi, in the category c, Histogram equalized Impact factor (heIF) is defined as,

$$heIF_j = HE_c(IFi) = \frac{CDF_c(IFi) - CDF_{c,min}}{N_c - CDF_{c,min}} \times (10) \quad (4)$$

P_c(IFi)=number of occurrences of IFi in the category c.

N_c = number of journals in the category c

$CDF_c(\text{IFi}) = \sum_{k=0}^{i} P_c(\text{IFk})$

$CDF_{c,\,min}$=minimum value of CDF in the category c.

The first step of proposed method is to generate subject wise or category wise histogram of impact factors of journals. Histograms are used here to plot density of impact factors of journals in the particular category. *Pc*(IFi)=number of occurrences of impact factor IFi in the category c. We generate the cumulative distribution function (cdf) for each subject wise histogram.

$$CDF_c(\text{IFi}) = \sum_{k=0}^{i} P_c(\text{IFk})$$

$CDF_{c,\,min}$ =minimum value of CDF in the category c = $CDF_c(IF_0)$

N_c = number of journals in the category c

Then we normalize cumulative distribution function for each subject wise histogram to [0,10] using equation 4, so that we will get 0 for lowest CDF and 10 for highest CDF for each category. These normalized values are nothing but the overall position of a journal across subject categories. Here 10 indicate highest position, 0 indicates lowest position and 5 indicate median position within one and the same subject field and across the subject category also. Note that, we suggested here normalization to [0, 10] for better practical value.

IV. EXAMPLE AND RESULT

We have shown here 3 subject categories Cat I, Cat II and Cat III with 65, 31 and 35 journals respectively. We have hidden actual names of journals and categories in this paper. Because, this is only proposed method and we do not want to defame any journal.

Table 1 shows 65 journals in the category I with their impact factors. The histogram for all impact factor values in category I is shown in the table 2. The cumulative distribution functions (CDFs) and new heIFs for all impact factor values within category I is shown in table 3. The cdfs shows the minimum value for IF 0.52 and the maximum value for IF 1.54. The maximum cdf value 65 for IF 1.54 coincides with the number of journals.

TABLE I
65 JOURNALS IN CATEGORY I WITH IMPACT FACTORS

Journal	IF	Journal	IF	Journal	IF
Cat I A	0.59	Cat I W	0.66	Cat I AS	1.09
Cat I B	0.61	Cat I X	0.58	Cat I AT	1.13
Cat I C	0.59	Cat I Y	0.71	Cat I AU	1.22
Cat I D	0.62	Cat I Z	0.70	Cat I AV	0.73
Cat I E	0.63	Cat I AA	0.75	Cat I AW	0.61
Cat I F	0.65	Cat IAB	0.77	Cat I AX	0.61
Cat I G	0.66	Cat I AC	0.78	Cat I AY	0.64
Cat I H	0.58	Cat I AD	0.87	Cat I AZ	0.64
Cat I I	0.69	Cat I AE	1.06	Cat I BA	0.68
Cat I J	0.70	Cat I AF	0.73	Cat I BB	0.68
Cat IK	0.71	Cat I AG	0.61	Cat I BC	0.68
Cat I L	0.79	Cat I AH	0.55	Cat I BD	0.68
Cat I M	0.83	Cat I AI	0.63	Cat I BE	0.79
Cat I N	0.85	Cat I AJ	0.65	Cat I BF	0.70
Cat I O	0.85	Cat I AK	0.67	Cat I BG	0.76
Cat I P	1.04	Cat I AL	0.68	Cat I BH	0.90
Cat I Q	0.60	Cat IAM	0.69	Cat I BI	1.04
Cat I R	0.52	Cat I AN	0.69	Cat I BJ	1.26
Cat I S	0.55	Cat I AO	0.72	Cat I BK	1.44
Cat I T	0.55	Cat I AP	0.70	Cat I BL	1.54
Cat I U	0.59	Cat I AQ	0.88	Cat I BM	1.54
Cat I V	0.65	Cat I AR	0.94		

The cdf must be normalized to [0,10] using equation 4. After that the values of the equalized data are directly taken from the normalized cdf to yield heIF values: Notice that the minimum IF value (0.52) is now 0 and the maximum IF value (1.54) is now 10. The heIF value of median journals, whose cdf is 33, is exactly 5. Table 4 shows all 65 journals in the category I with their new heIFs. Similarly, we applied proposed method to Cat II and Cat III.Table 5 and 6 shows 31 journals from category II and 35 journals from category III along with their IFs, cdfs and final heIFs.

For each category, heIF values of lowest journals are 0,heIF value of Highest journals are 10 and that of median journals are 5. The HeIF of journal whose position is above median is greater than 5 and below median is less than 5.In Overall result, Cat I BL, Cat I BM, Cat II D, Cat III G with HeIF 10 are highest journals not only in there subject category but also across category. Cat I R, Cat II K, Cat III AE with heIF 0 are lowest journals in there subject category and across category. Similarly median journals are Cat I I, Cat I AM, Cat I AN, Cat II U, Cat III S. Hence, this method gives the real position of journals in their subject categories. Like rnIF, The heIF also lessens large differences in absolute values of TRIF while retaining the position of journals. (See top journal of category I and category III are having impact factor values 1.54 and 28.415 but their heIF values are 10)[22]

V. CONCLUSION

People those are not familiar with citation behavior of research area use impact factors to compare journals across subjects. We proposed here a journal impact factor histogram equalization method for overall ranking of a journal across subject categories. We claim that proposed new Impact factor histogram equalization approach is a better way to compare journal performance across subject categories. The subject category specificity may be significantly reduced when using Journal Impact Factor Histogram Equalization based Impact Factor (heIF) suggested in this paper.

TABLE II
HISTOGRAM OF CATEGORY I

IF	Count	IF	Count	IF	Count
0.52	1	0.69	3	0.88	1
0.55	3	0.70	4	0.90	1
0.58	2	0.71	2	0.94	1
0.59	3	0.72	1	1.04	2
0.60	1	0.73	2	1.06	1
0.61	4	0.75	1	1.09	1
0.62	1	0.76	1	1.13	1
0.63	2	0.77	1	1.22	1
0.64	2	0.78	1	1.26	1
0.65	3	0.79	2	1.44	1
0.66	2	0.83	1	1.54	2
0.67	1	0.85	2		
0.68	5	0.87	1		

TABLE III
CDFS AND HEIFS FOR ALL IFS WITHIN CATEGORY I

IF	cdf	heIF	IF	cdf	heIF
0.52	1	0	0.76	44	6.7187
0.55	4	0.4687	0.77	45	6.875
0.58	6	0.7812	0.78	46	7.0312
0.59	9	1.25	0.79	48	7.3437
0.6	10	1.4062	0.83	49	7.5
0.61	14	2.0312	0.85	51	7.8125
0.62	15	2.1875	0.87	52	7.9687
0.63	17	2.5	0.88	53	8.125
0.64	19	2.8125	0.9	54	8.28125
0.65	22	3.2812	0.94	55	8.4375
0.66	24	3.5937	1.04	57	8.75
0.67	25	3.75	1.06	58	8.90625
0.68	30	4.5312	1.09	59	9.0625
0.69	33	5	1.13	60	9.21875
0.7	37	5.625	1.22	61	9.375
0.71	39	5.9375	1.26	62	9.53125
0.72	40	6.0937	1.44	63	9.6875
0.73	42	6.4062	1.54	65	10
0.75	43	6.5625			

Using the advised normalization the uppermost journals, the median journals and lowest journals in each field have heIF equal to 10, 5 and 0 respectively. The heIF lessens large differences in values of TRIF while retaining the position of journals. This may help administrators to find the place of journals across subject categories. This also helps different libraries to manage journals from different subject areas. Compare to other normalized Impact factor approaches, this method gives great practical value. This method does not use highest or few highest impact factor values for normalization. This method is very simple and elegant compare to other proposed methods of computing journal impact across categories. This method considers the variation of journal IF distribution within different subject categories. Due to that, heIF reflects the actual position of journals in their subject categories.

TABLE IV
65 JOURNALS IN CATEGORY I WITH THEIR NEW HEIFS

Journal	heIF	Journal	heIF	Journal	heIF
Cat I A	1.25	Cat I W	3.5938	Cat I AS	9.0625
Cat I B	2.0313	Cat I X	0.7813	Cat I AT	9.2188
Cat I C	1.25	Cat I Y	5.9375	Cat I AU	9.375
Cat I D	2.1875	Cat I Z	5.625	Cat I AV	6.4063
Cat I E	2.5	Cat I AA	6.5625	Cat I AW	2.0313
Cat I F	3.2813	Cat I AB	6.875	Cat I AX	2.0313
Cat I G	3.5938	Cat I AC	7.0313	Cat I AY	2.8125
Cat I H	0.7813	Cat I AD	7.9688	Cat I AZ	2.8125
Cat I I	5	Cat I AE	8.9063	Cat I BA	4.5313
Cat I J	5.625	Cat I AF	6.4063	Cat I BB	4.5313
Cat I K	5.9375	Cat I AG	2.0313	Cat I BC	4.5313
Cat I L	7.3438	Cat I AH	0.4688	Cat I BD	4.5313
Cat I M	7.5	Cat I AI	2.5	Cat I BE	7.3438
Cat I N	7.8125	Cat I AJ	3.2813	Cat I BF	5.625
Cat I O	7.8125	Cat I AK	3.75	Cat I BG	6.7188
Cat I P	8.75	Cat I AL	4.5313	Cat I BH	8.2813
Cat I Q	1.4063	Cat IAM	5	Cat I BI	8.75
Cat I R	0	Cat I AN	5	Cat I BJ	9.5313
Cat I S	0.4688	Cat I AO	6.0938	Cat I BK	9.6875
Cat I T	0.4688	Cat I AP	5.625	Cat I BL	10
Cat I U	1.25	Cat I AQ	8.125	Cat I BM	10
Cat I V	3.2813	Cat I AR	8.4375		

TABLE V
31 JOURNALS IN CATEGORY II WITH IFS AND HEIFS

journal	IF	cdf	heIF	journal	IF	cdf	heIF
Cat IIA	3.913	28	9	Cat IIQ	3.491	27	8.6667
Cat IIB	0.72	10	3	Cat IIR	1.547	19	6
Cat IIC	0.925	12	3.6667	Cat II S	1.234	15	4.6667
Cat IID	4.947	31	10	Cat II T	0.671	8	2.3333
Cat II E	2.139	23	7.3333	Cat IIU	1.259	16	5
Cat II F	0.69	9	2.6667	Cat IIV	3.25	25	8
Cat IIG	0.59	6	1.6667	CatIIW	0.734	11	3.3333
Cat IIH	1.964	22	7	Cat IIX	3.138	24	7.6667
Cat II I	3.942	30	9.6667	Cat IIY	1.226	14	4.3333
Cat II J	1.211	13	4	Cat II Z	1.344	17	5.3333
Cat IIK	0.315	1	0	CatIIAA	0.465	2	0.3333
Cat II L	1.95	20	6.3333	CatIIAB	0.56	6	1.6667
CatIIM	0.522	4	1	CatIIAC	1.964	22	7
Cat IIN	1.442	18	5.6667	CatIIAD	3.942	30	9.6667
Cat IIO	0.496	3	0.6667	CatIIAE	3.491	27	8.6667
Cat II P	0.609	7	2				

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TABLE VI
35 JOURNALS IN THE CATEGORY III WITH IFS AND HEIFS

journal	IF	cdf	heIF
Cat III A	7.878	26	7.3529
Cat III B	18.778	33	9.4118
Cat III C	19.238	34	9.7059
Cat III D	12.245	30	8.5294
Cat III E	16.106	31	8.8235
Cat III F	10.412	29	8.2353
Cat III G	28.415	35	10
Cat III H	18.288	32	9.1176
Cat III I	8.609	28	7.9412
Cat III J	1.328	14	3.8235
Cat III K	0.829	8	2.0588
Cat III L	0.694	6	1.4706
Cat III M	3.144	24	6.7647
Cat III N	8.609	28	7.9412
Cat III O	1.328	14	3.8235
Cat III P	0.829	8	2.0588
Cat III Q	0.694	6	1.4706
Cat III R	1.547	16	4.4118
Cat III S	1.802	18	5
Cat III T	1.186	11	2.9412
Cat III U	0.947	10	2.6471
Cat III V	0.88	9	2.3529
Cat III W	1.393	15	4.1176
Cat III X	2.044	21	5.8824
Cat III Y	1.611	17	4.7059
Cat III Z	2.087	22	6.1765
Cat III AA	1.968	20	5.5882
Cat III AB	0.56	4	0.8824
Cat III AC	1.964	19	5.2941
Cat III AD	3.942	25	7.0588
Cat III AE	0.356	1	0
Cat III AF	0.488	3	0.5882
Cat III AG	1.207	12	3.2353
Cat III AH	0.383	2	0.2941
Cat III AI	2.304	23	6.4706

VII. REFERENCES

1. *Amin M., Mabe M.(2000) Impact factor: use and abuse, Perspectives in Publishing, No. 1, October, pp.1-6*
2. *Garfield, E. (2006) The History and Meaning of the Journal Impact Factor.Journal of the American Medical Association, 293:90-93*
3. *Hoeffel C.(1998) Journal impact factors. Allergy, 53:1225,doi: 10.1111/j.1398- 9995.1998.tb03848.x*
4. *Garfield E.(2007) Panel on Evaluative Measures for Resource Quality: Beyond the Impact Factor, Presented at the Medical Library Association Meeting, Philadelphia, May 22, 2007,Available at: http://www.garfield.library.upenn.edu/papers/mla2007.pdf*

5. *Seglen PO (1997)Why the impact factor of journals should not be used for evaluating research, BMJ, 314,497-502*
6. *Narin F,Hamilton KS (1996) Bibliometric performance measures. Scientometrics, 6:293310*
7. *Erjen van Nierop (2009) Why do statistics journals have low impact factors?. Statistica Neerlandica,volume 63, issue 1: 52-62*
8. *Hamilton DP. (1991) Research papers: who´s uncited now. Science, 251:25*
9. *Hargens LL, Felmlee DH (1984) Structural determinants of stratification in science. Am Sociol Rev, 49:68597*
10. *Vinkler P. (1996) Relationships between the rate of scientific development and citations.The chance for a citedness model. Scientometrics, 35:37586*
11. *Seglen PO (1989) Bruk av siteringsanalyse og andre bibliometriske metoder i evaluering av forskningsaktivitet. Tidsskr Nor Laegeforen ,31:322934*
12. *Narin F, Pinski G, Gee HH (1976) Structure of the biomedical literature. J Am Soc Inform Sci ,27:2545*
13. *Folly G, Hajtman B, Nagy JI, Ruff I(1981)Some methodological problems in ranking scientists by citation analysis. Scientometrics, 3:1354*
14. *P. Owlia ,M. Vasei,B. Goliaei,I. Nassiri (2011) Normalized impact factor (NIF): An adjusted method for calculating the citation rate of biomedical journals . Journal of biomedical informatics, Vol. 44, No. 2. (13 April 2011), pp. 216-220, doi:10.1016/j.jbi.2010.11.002*
15. *Pudovkin AI and Garfield E. (2004), Rank-normalized Impact Factor: A way to compare journal performance across subject categories, Presented at the American Society for Information Science and Technology Annual Meeting, Providence, RI. November 17, 2004 , Published in Proceedings of the 67th Annual Meeting of the American Society for Information Science and Technology, vol:41, p.507-515*
16. *Marshakova-Shaikevich I.(1996) The standard impact factors an evaluation tool of science fields and scientific journals. Scientometrics, 35, 283-90*
17. *Sen, B.K.(1992) Normalized impact factor. Journal of Documentation, 48, 318-25*
18. *Van Leeuwen T. N., Moed H. F. (2002) Development and application of journal impact measures in the Dutch science system. Scientometrics, 53, 249-266.*
19. *Sombatsompop N, Markpin T (2005) Making an equality of ISI impact factors for different subject fields. JASIST 56(7): 676-683*
20. *Sombatsompop N, Markpin T, Premkamolnetr N (2004) A modified method for calculating the Impact Factors of journals in ISI Journal Citation Reports: Polymer Science Category in 1997-2001. Scientometrics 60(2): 217-235*
21. *Fromter, E., et al.(1999) Evaluierung publizierter forschungsbeitrage in der medizin. Deutsche medizinische wochenschrift,124, 910-15. In Citation rates, knowledge export and international visibility of dermatology journals listed and not listed in the Journal Citation Reports, edited by J. Stegmann and G. Grohmann, Scientometrics, 50, 483-02,(2001)*
22. *A. I. Pudovkin, Eugene Garfield (2012) Rank normalization of impact factors will resolve Vanclay´s dilemma with TRIF. Scientometrics 92:409-412*
23. *Nasrollah Rezaei-Ghaleh MD, Fereidoun Azizi MD (2007) The Impact Factor-Based Quality Assessment of Biomedical Research Institutes in Iran: Effect of Impact Factor Normalization by Subject. Arch Iranian Med 10(2): 182-189*
24. *Moed, H. F. (2010) Measuring contextual citation impact of scientific journals. Journal of Informetrics, Volume 4, Issue 3,Pages 265-277*
25. *Leydesdorff L, Opthof T (2010) Scopus´s source normalized impact per paper (SNIP) versus a journal impact factor based on fractional counting of citations. Journal of the American Society for Information Science and Technology 61: 2365-2369*
26. *L. Leydesdorff, T. Opthof (2011) Scopus? SNIP Indicator: Reply to Moed. Journal of the American Society for information Science and Technology, 62, 214-215.*
27. *Henk F. Moed (2011) The source normalized impact per paper is a valid and sophisticated indicator of journal citation impact. JASIST 62(1): 211-213*
28. *R. C. Conzalez, R. E. Woods(2001) Digial Image Processing. New Jersey: Prentice-Hall, Inc.*
29. *Y. T. Kim (1997) Contrast enhancement using brightness preserving bihistogram equalization. IEEE Trans. Consumer Electron., vol. 43, pp. 1-8*
30. *S. D. Chen, A. R. Ramli (2003) Contrast enhancement using recursive mean-separate histogram equalization for scalable brightness preservation, IEEE Trans. Consumer Electron., vol. 49, no. 4, pp. 1301-1309.*
31. *Wan Zakiah Wan Ismail, Kok Swee Sim (2011) Contrast enhancement dynamic histogram equalization for medical image processing application. International Journal of Imaging Systems and Technology archive, Volume 21 Issue 3*
32. *V.B.Nikam,Vinod kadam, B.B.Meshram Image Compression Using Partitioning Around Medoids Clustering Algorithm IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 6, No 1, November 2011.ISSN1694-0814.*