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(Dashti *et al.*, 2010)

(Kasiri & Safabakhsh, 2007)

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(Keagy *et*

(1998 & 2000) Shiranita *et al.* , 1996)

(2007) Omid *et al.* .

(2010) Wang *et al.* .(Cheng *et al.*, 2008)

(

(Cetin *et*

(Kulak, 2002; Fan & Xia, 2003)

al., 2004; Pearson, 2001)
(1997) Ghazanfari *et al.*

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(Latif *et al.*, 2000; Lee & Pun, 2000)

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1. Fourier Descriptors
 2. Neural Network
 3. Decision tree

as.shamsi.koshki@gmail.com :

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$$g_{m,n}(x, y) = a^{-m} g(x', y') \quad a > 1 \quad ()$$

$$n = 0, 1, 2, \dots, k-1 \quad m = 0, 1, 2, \dots, s-1$$

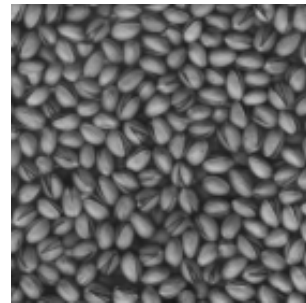
$$x' = a^{-m} (x \cos \theta + y \sin \theta)$$

$$y' = a^{-m} (-x \sin \theta + y \cos \theta)$$

$$\theta = \frac{n\pi}{k}$$

$g_{m,n}$
 a $g(x, y)$
 n m
 y' x'

(Lambert & Bock, 1997; Latif *et al.*, 2000; Lee & Pun, 2000; Fan & Xia, 2003)



(Haley & Manjunath, 1995; Vo *et al.*, 2006)
 (Ahmadian *et al.*, 2004; Clausi & Jernigan, 2000)
 (Allier & Emptoz, 2003) Kuang, 2007)

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 (Clausi & Jernigan, 2000; Smeulders *et al.*, 2000; Ahmadian & Mostafa, 2003; Ahmadian *et al.*, 2004; Nezamabadi-pour *et al.*, 2003)

$$g(x, y) = \frac{1}{2\pi\sigma_x\sigma_y} \exp\left(-\frac{1}{2}\left(\frac{x^2}{\sigma_x^2} + \frac{y^2}{\sigma_y^2}\right)\right) \times \exp(j2\pi u_0 x) \quad ()$$

$$G(u, v) = \exp\left(-\frac{1}{2}\left(\frac{(u-u_0)^2}{\sigma_u^2} + \frac{v^2}{\sigma_v^2}\right)\right) \quad ()$$

dpi
 HP ScanJet 6300c
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$$\begin{aligned}
 & \sigma_y \quad \sigma_x \quad u_0 \quad x \\
 & y \quad x \\
 & \sigma_v = \frac{1}{2\pi\sigma_y} \quad \sigma_u = \frac{1}{2\pi\sigma_x}
 \end{aligned}$$

3. Rotation
4. Orientation
5. Scale
6. k Nearest Neighbors

() $g(x, y)$

1. Gabor Filters
2. Extension

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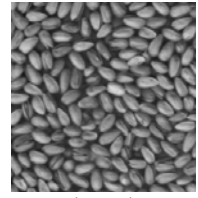
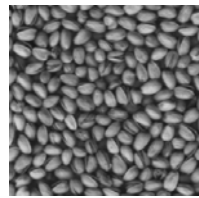
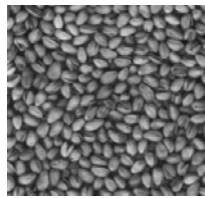
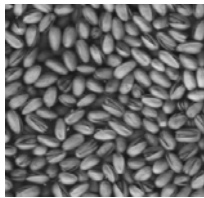
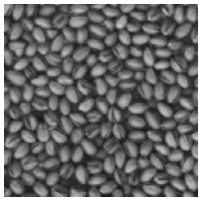
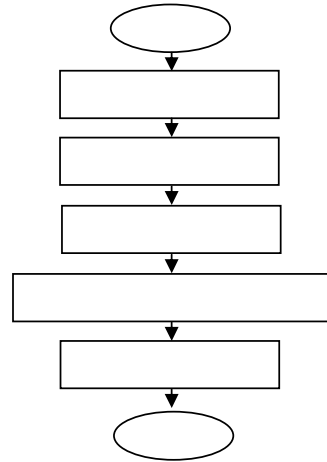
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$$I_{m,n}(x, y) = f^{-1}[I(u, v)G_{m,n}(u, v)] \quad (1)$$

MPEG-7

(Manjunath et al., 2002)

$$G_{m,n}(u, v) = \frac{I_{m,n}(x, y) - \mu_{m,n}}{\sigma_{m,n}}$$

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$$\sigma_{m,n} = \sqrt{\iint (I_{m,n}(x, y) - \mu_{m,n})^2 dx dy} \quad (2)$$

$$\mu_{m,n} = \iint |I_{m,n}(x, y)| dx dy \quad (3)$$

θ= °

θ= °

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$$= \frac{\sum_{i=1}^n \sigma_{m,n} \mu_{m,n}}{\sum_{i=1}^n \sigma_{m,n} \mu_{m,n}} \quad () - \quad ()$$

$$i = \frac{\sum_{i=1}^n \sigma_{m,n} \mu_{m,n}}{\sum_{i=1}^n \sigma_{m,n} \mu_{m,n}} \quad \bar{f} = [\mu_{00}, \sigma_{0,0}, \mu_{01}, \sigma_{0,1}, \dots, \mu_{43}, \sigma_{4,3}] \quad ()$$

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(Szummer & Picard, 1998; Guerin-Dugue & Oliva, 2000; Nezamabadi-pour *et al.*, 2003)

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k

(Cover & Hart, 1997)

$$() \quad k = ()$$

(i,i)

k

i
(i,j)

- k

j

i

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$$\chi^2$$

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(Nezamabadi-pour & Kabir, 2004; Nezamabadi-pour & Kabir, 2009; Rubner *et al.*, 2001)

$$() \quad \underline{Y} = (y_1, y_2, \dots, y_n) \quad \underline{X} = (x_1, x_2, \dots, x_n)$$

$$\chi^2 : D(X, Y) = \sum_{i=1}^n \left(\frac{x_i - y_i}{x_i + y_i} \right)^2 \quad ()$$

$$X \quad i \quad y_i \quad x_i \quad Y$$

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k = {1,3,5,7,9,11,13,15,17,19} k

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(2007) Omid *et al.*

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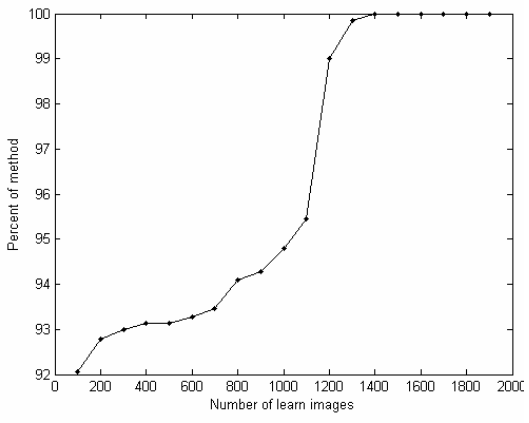
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(Cetin *et al.*,

(2004) Cetin *et al.*, .2004; Pearson, 2001)

(2001) Pearson *et al.*, %

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REFERENCES

- Ahmadian, A. & Mostafa, A. (2003). An efficient texture classification algorithm using Gabor wavelet. In: Proceedings of 25th Annual International Conference of the IEEE Engineering in Medicine & Biology Society, 17-21 Sept., Cancun, Mexico, Vol. 1, No. 1, pp. 930-933.
- Ahmadian, A., Mostafa, A., Abolhassani, M. D. & Riahi, N. (2004). A method for texture classification of ultrasonic liver images based on Gabor Wavelet. In: Proceedings of 7th International Conference on Signal Processing (icsp04), 31 Aug.-4 Sept., Beijing, China, Vol. 2, No. 1, pp. 971-974.
- Allier, B. & Emptoz, H. (2003). Font type extraction and character prototyping using gabor filters. In: Proceedings of 7th International Conference on Document Analysis and Recognition, 3-6 August., Heriot-Watt University, Edinburgh, Scotland, Vol. 2, No. 1, pp.799-803.
- Cetin, A. E., Pearson, T. C. & Tewfi, A. H. (2004). Classification of closed-and open-shell pistachio nuts using voice-recognition technology. *Transactions of the ASAE*, 47(2), 659-664.
- Cheng, J. D., Da, S., Patrick, J. & Paul, A. (2008). Development of a hybrid image processing algorithm for automatic evaluation of intramuscular fat content in beef M. longissimus dorsi. *Meat Science*, 80(4), 1231-1237.
- Clausi, D. A. & Jernigan, M. Ed. (2000). Designing Gabor filters for optimal texture separability. *Pattern Recognition*, 33(1), 1835-1849.
- Cover, T. M. & Hart, P. E. (1967). Nearest neighbor pattern classification. *IEEE Transactions on Information Theory*, 13(1), 21-27.
- Dashti, GH., Khodavardizade, M. & Rezayee, R. M. (2010). Analysis of comparative advantage and the structure of global pistachio export market. *Journal of Agricultural Economics and Development*, 24(1), 99-106. (In Farsi).
- Fan, G. & Xia, X. (2003). Wavelet-Based texture analysis and synthesis using hidden Markov models. *IEEE Trans Circuits Systems*, 50(1), 106-120.
- Ghazanfari, A., Kusalik, A. & Irudayaraj, J. (1997). Application of a multi structure neural network (MSNN) to sorting pistachio nuts. *International Journal of Neural Systems (IJNS)*, 8(1), 55-61.
- Guerin-Dugue, A. & Oliva, A. (2000). Classification of scene photographs from local orientations features. *Pattern Recognition Letters*, 21(1), 1135-1140.
- Haley, G. M. & Manjunath, B. S. (1995). Rotation invariant texture classification using the modified Gabor filters. In: Proceedings of IEEE International Conference on Image Processing (IEEE ICIP.95), 23-26 Oct., Washington DC, USA, Vol. 1, No. 1, pp. 262-265.
- Han, J. & K-Kuang, Ma. (2007). Rotation-invariant and scale-invariant Gabor features for texture image retrieval. *Image and Vision Computing*, 25(1), 1474-1481.
- Kasiri, s. & Safabakhsh, R. (2007). Identify smiling, low-smiling and non-smiling pistachio using machine vision. In: Proceedings of The Third Conference on Information Technology and Knowledge, 27-29 Nov., Mashhad, Iran.(In Farsi).
- Keagy, P., Parvin, B. & Schatzki, T. (1996). Machine recognition of navel orange worm damage in x-ray images of pistachio nuts., *LWT – Food Science and Technology*, 29(1), 140-145.
- Kulak, E. (2002). *Analysis of textural image features for content based retrieval*. Ph. D. dissertation, University of Sabanci, Istanbul, Turkey.
- Lambert, G. & Bock, F. (1997). Wavelet methods for texture defect detection. In: Proceedings of IEEE International Conference on Image Processing, 26-29 Oct., Washington, DC, USA, Vol. 3, No. 1, pp. 201-204.
- Lee, M. C. & Pun, C. (2000). Texture classification using dominant Wavelet packet energy features. In: Proceedings of 4th IEEE Southwest Symposium, Image Analysis and Interpretation, 2-4 April., Austin, Texas, USA, pp. 301-304.
- Manjunath, B. S., Salembier, P. & Sikora, T. (2002). *Introduction to MPEG-7, multimedia content description standard*. New York: Wiley.
- Nezamabadi-pour, H. & Kabir, A. (2004). Evaluation of dis-similarity measure in retrieve and classification image. *Modares Journal of Engineering*, 1(1), 140-145. (In Farsi).
- Nezamabadi-pour, H. & Kabir, E. (2009). Concept learning by fuzzy k-NN classification and relevance feedback for efficient image retrieval. *Expert System with Application (ESWA)*, 36(3), 5948-5954.
- Nezamabadi-pour, H., Saryazdi, S. & Ebrahimi, A. (2004). Farsi font recognition by gabor filters . In: Proceedings of 9th Yearly Conference of Iranian Computer Society, 17-19 Feb., Sharif University of Technology, Tehran, Iran, pp. 371-378. (In Farsi).
- Omid, M., Mahmoudi, A., Aghagolzadeh, A. & Borghae, A. M. (2007). Separating Pistachio

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- varieties using automatic trainable classifier. In: Proceedings of *The 3th IEEE International Conference on Autonomic and Autonomous Systems (ICAS'07)*. 19-25 June., Athens, Greece, PP. 44.
- Pearson, T. C. (2001). Detection of pistachio nuts with closed shells using impact acoustics. *Applied Engineering in Agriculture*, 17(2), 249-253.
- Rubner, Y., Puzicha, J., Tomasi, C. & Buhmann, J. M. (2001). Empirical evaluation of dissimilarity measures for color and texture. *Computer Vision and Image Understanding*, 84(1), 25-43.
- Shiranita, K., Hayashi, K. & Otsubo, A. (2000). Grading meat quality by image processing. *Pattern Recognition Letters*, 33(1), 97-104.
- Shiranita, K., Miyajima, T. & Takiyama, R. (1998). Determination of meat quality by texture analysis. *Pattern Recognition Letters*, 19(1), 1319-1324.
- Smeulders, A. W. M., Worring, M., Santini, S., Gupta, A. & Jain, R. (2000). Content-based image retrieval at the end of the early years. *IEEE Transaction Pattern Analysis and Machine Intelligence*, 22(12), 1349-1380.
- Szumner, M. & Picard, R. W. (1998). Indoor-outdoor image classification. In: Proceedings of *IEEE International Workshop on Content-Based Access of Image and Video Database*, 3 Jan., Bombay, India, pp. 42-51.