



IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 Issue: VIII Month of publication: August 2022 DOI: https://doi.org/10.22214/ijraset.2022.46384

www.ijraset.com

Call: 🕥 08813907089 🔰 E-mail ID: ijraset@gmail.com



Geometrical Analysis of White Blood Cells by Using Image Segmentation Algorithm

Saurabh Mishra¹, Archana Kumari²

^{1, 2}Department of Computer Science, Himachal Pradesh Technical University

Abstract: The technique behind image analysis is based on machine learning. In order for the software to recognize specific irregularities, it doesn't matter what field of medicine (or other industry) we're thinking about. The way AI learns differs dramatically from how humans learn. It makes use of enormous image databases that the software must interpret and analyze. In the present work, geometrical features of White Blood Cells such Area, Perimeter, Orientation, and Equivalent Diameter are calculated by using Image Segmentation approach.

Keywords: Image Segmentation; White Blood Cells; Image Processing; Machine Learning; Artificial Intelligence; Healthcare

I. INTRODUCTION

Using sample data or prior knowledge, machine learning is the process of programming computers to maximize a performance criterion. We have a model that has been developed up to a certain point, and learning is the application of a computer program to maximize the model's parameters using training data or prior knowledge. The model may be descriptive to learn from the data or predictive to make future predictions. How to build computer programs that gradually get better with experience is a topic of research in the field of machine learning [1-5]. Tens of millions of compounds need to go through a series of tests in order to manufacture or find a new medicine, which is an expensive and time-consuming process. One and only one could produce a usable medication.

The lengthy multi-step process can be sped up in one or more of these processes using machine learning [6-10]. The field of personalized medicine has enormous development potential in the future, and machine learning may be key in identifying the types of genetic markers and genes that are responsive to a given therapy or medication. As it allows for improved disease assessment, customized medication or treatment based on a person's health information combined with analytics is a popular study topic. Another data flood may be beneficial for treatment efficacy with the rise in sensor-integrated technology and mobile applications with advanced monitoring system and health-measurement capabilities. Health optimization is made possible by personalized care, which also lowers overall healthcare expenses [11-15].

Machine Learning also finds application in manufacturing sectors for defects identification and material properties optimization [16-22]. Medical professionals all across the world are inundated with data of every description, which they must gather, handle, and analyze.

Image Processing approach is finding a wide range of applications [31-35]. As individuals, they are limited in their abilities and prone to weariness, which is bad for both their health and their capability to care for patients. In the healthcare industry, medical photographs make up about 90% of the data.

The amount of data that needs to be analyzed is growing along with the demand for medical imaging. It's crucial to keep in mind that machine learning-based solutions can and, in some instances, already have outperformed human doctors in terms of diagnosis accuracy. Of course, there will always be a need for some degree of expert oversight. When dealing with photos that are defective, partial, or otherwise of poor quality, the software can occasionally suffer. At that point, a human doctor's expertise and the capacity to view an image without turning it to ones and zeros may be required [23-30].

II. EXPERIMENTAL PROCEDURE

In the recent work, the Python programming has been developed for image segmentation purpose which was executed on SPYDER platform. The approach to image segmentation is based on a topological interpretation of the boundaries of the image. The closure process aids in filling in tiny cracks or tiny dark spots on the foreground objects. Morphological dilatation fills in small holes in the objects and increases object visibility. The Euclidean distance formula is used to calculate the distance transform.

A distance matrix is created once these distance values are computed for each and every pixel in a picture. It serves as a watershed transform input.



International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue VIII August 2022- Available at www.ijraset.com

Figure 1 shows the input image of White Blood Cells which will be subjected to the image segmentation algorithm.



Figure 1: White Blood Cells Microscope Image

The reference Python code for the subjected algorithm is shown below:

SEGMENTATION

import numpy as np import cv2 from matplotlib import pyplot as plt img = cv2.imread(r'C33P1thinF_IMG_20150619_114756a_cell_181.png') b,g,r = cv2.split(img) rgb_img = cv2.split(img) gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY) ret, thresh = cv2.threshold(gray,0,255,cv2.THRESH_BINARY_INV+cv2.THRESH_OTSU) plt.subplot(211),plt.imshow(closing, 'gray') plt.title("morphologyEx:Closing:2x2"), plt.xticks([]), plt.yticks([]) plt.subplot(212),plt.imshow(sure_bg, 'gray') plt.imsave(r'dilation.png',sure_bg) plt.title("Dilation"), plt.xticks([]), plt.yticks([]) plt.tight_layout() plt.show()

plt.subplot(211),plt.imshow(dist_transform, 'gray')
plt.title("Distance Transform"), plt.xticks([]), plt.yticks([])
plt.subplot(212),plt.imshow(sure_fg, 'gray')
plt.title("Thresholding"), plt.xticks([]), plt.yticks([])
plt.tight_layout()
plt.show()



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue VIII August 2022- Available at www.ijraset.com

III. RESULTS AND DISCUSSION

Picture segmentation entails breaking an image down into a number of pixel-rich sections that are each represented by a mask or labeled image. We can analyze only the key portions of an image by segmenting it rather than processing the whole thing. In contrast to classifiers, which typically use a single encoder network, most image segmentation models in computer vision use an encoder-decoder network.

Figure 2 shows the segmented image of the white blood cell image and Table 1 shows the geometrical parameters used to define these cells.



Figure 2: Segmented image of White Blood Cells

The encoder transforms the input into a latent space representation, which the decoder transforms into segment maps, or, more precisely, maps indicating the positions of each object in the image. One of the simplest techniques for segmenting images is thresholding, which establishes a threshold for categorizing pixels into two groups. The threshold value determines which pixels are set to 1 and which pixels are set to 0. Pixels with values below the threshold value are set to 0. Thus, the image undergoes a process known as binarization in which it is transformed into a binary map. When the difference in pixel values between the two target classes is quite great, image thresholding is highly helpful since it is simple to select an average value as the threshold. When binarizing a picture, threshold is frequently employed to enable the employment of additional, binary-only algorithms like contour detection and identification.

Grai	Area	equivalent_diam	orientati	MajorAxisLe	MinorAxisLe	Perimet	MinIntens	MeanIntens	MaxIntens
n #		eter	on	ngth	ngth	er	ity	ity	ity
1	40313.	226.5592	-	366.4697	244.3068	10375.	26	187.5385	254
	75		86.5197			38			
2	12.5	3.989423	-	5.013444	3.549842	13.363	221	238.12	250
			16.7172			96			
3	27.5	5.91727	14.6143	6.524303	5.517493	19.778	180	221.9364	238
			3			17			
4	128.25	12.77861	57.5573	21.36487	9.52316	59.559	183	234.3645	249
			8			4			



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue VIII August 2022- Available at www.ijraset.com

5	15	4.370194	-	4.603842	4.269683	14.156	213	232.4	242
			51.8828			85			
6	49.75	7.958873	87.1888	10.61013	6.758335	30.606	218	236.7487	249
						6			
7	28.25	5 997418	6 40969	6 861229	5 508213	20.485	190	228 7965	239
,	20.25	5.557 110	3	0.00122)	5.500215	20.105	170	220.7903	237
8	248.25	17 77860	5	30.61481	15 58574	104.15	212	236 1631	250
0	240.23	17.77009	-	50.01461	15.36374	104.15	212	230.1031	230
0	49.5	7.050252	15.3023	0.267156	7.400012	15	210	222.9505	245
9	48.5	1.838232	40.9005	9.20/150	7.400012	51.215	210	233.8505	245
10	21.5	6.000010	5	6.05400		2	105	220 5	
10	31.5	6.333012	-	6.97432	5.862567	20.071	185	220.5	235
			80.3133			07			
11	7.25	3.038254	-75.819	4.879077	2.131152	10.346	219	229.3793	236
						19			
12	20.5	5.108954	76.9909	5.620377	4.833732	16.778	200	229.1585	243
						17			
13	114.75	12.08736	85.4397	21.44607	10.15126	62.855	211	235.8235	250
			1			34			
14	342.25	20.87501	89.9138	45.25056	13.36606	126.29	208	234.7166	251
			4			65			
15	24.5	5.585192	-	6.246855	5.073935	17.778	201	224.0306	238
			52.2997			17			
16	16 75	4 618091	82 2040	5 560907	4 56569	16 863	222	237 6716	248
10	10.75	1.010091	8	5.500707	1.50505	96	222	237.0710	210
17	11.75	3 867880	0	4 125164	3 665105	11 535	205	230 4255	242
17	11.75	5.007007	-	4.123104	5.005105	52	203	230.4233	242
10	104	11 50725	74.1306	14 70021	0.02207	35	201	224 5024	249
18	104	11.50725	2.22244	14./8831	9.92207	46.230	201	234.5024	248
10	20.5	5 100051			1 120255	97	10.6		22.5
19	20.5	5.108954	-	5.946613	4.420366	16.071	196	226.2927	236
			17.2041			07			
20	16.5	4 583498	53 4512	6.076332	3 622213	16 192	214	235 8333	249
20	10.5	1.505150	7	0.070332	5.022215	39	211	20010000	219
21	30.75	6 257165	-	7 132449	5 805/19/	23 313	157	210 8862	2/13
21	50.75	0.257105	72 7752	7.152++)	5.005474	71	157	210.0002	245
22	21.25	6 207921	24 4744	0.605111	1 572575	24.840	214	226.861	240
22	51.25	0.507851	24.4744	9.095111	4.373373	24.049	214	230.804	249
22	262	19 26441	9	21 24190	15 42027	24	200	222.9692	247
23	202	18.20441	23.0895	51.54189	15.43937	94.222	209	232.8083	247
24	141.75	12 42 425	0	21 56127	0.710.000	35	212	024.2500	0.47
24	141.75	13.43435	81.3578	21.56137	9.718689	62.370	212	234.3598	247
			1			06			
25	26.25	5 781223	+	10 21916	3 553977	23 020	215	237 /10	249
23	20.23	5.701225	-	10.21910	5.555711	82	215	231.417	249
			22.0213			02			
26	33.25	6.506552	-76.499	6.924228	6.175373	20.899	201	228.218	239
						49			
27	13 75	4 184142	-	6.001737	3 259617	15 674	210	234 2182	244
	13.13	7.107172	12 9516	0.001/3/	5.257017	62	210	237.2102	<u>~</u>
			12.7510			02			



International Journal for Research in Applied Science & Engineering Technology (IJRASET)

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue VIII August 2022- Available at www.ijraset.com

28	53.75	8.272643	-	9.34455	7.652943	30.056	156	214.3209	236
			47.1824			35			
29	24	5.527906	29.4269	6.639078	5.136199	20.571	196	221.0521	238
			2			07			
30	195.25	15.76705	-	27.39234	11.74929	82.287	184	233.5109	249
21	260.25	10 20221	29.3814	24.00005	10,10050	32	210	224.0240	249
31	260.25	18.20331	26.7843	34.80895	18.10859	119.89	210	234.8348	248
22	12.25	4 107262	2	4 901209	2 620651	12 656	200	215 4529	224
52	15.25	4.107302	-	4.891308	5.059051	15.050	200	213.4328	224
33	43	7 399277	-	7 835882	7.035527	23 485	193	218 814	237
55	15	1.377211	41,9691	1.033002	1.033321	28	175	210.011	237
34	28.75	6.050259	-	6.56379	5.709375	19.899	196	226	236
			89.8364			49			
35	32.5	6.432751	-	7.637598	5.474168	21.071	187	222.1769	236
			14.0582			07			
36	12.75	4.02912	-40.719	4.564416	3.940106	14.449	189	212.9804	224
						75			
37	29.25	6.102643	53.1820	6.520251	6.090788	20.967	180	216.1795	233
			5			51			
38	54	8.29186	57.2643	9.999262	7.455027	33.452	217	235.963	246
	220	15.05540	2	22.55205	1.6.1.667.5	8	207		0.51
39	229	17.07548	45.1559	22.75205	16.16675	81.133	207	235.3352	251
40	17.25	1 686511	0	5 600150	1 565338	51	208	232.8406	244
40	17.23	4.080311	20.0004	5.009159	4.303338	73	208	232.8400	244
41	144	13.54055	70.7290	17.49112	11.30449	53.852	189	234.6528	250
		1010 1000	3		1100119	29	107	20	200
42	23.5	5.470021	59.4729	6.127201	5.03862	18.363	185	221.6383	241
			2			96			
43	14.75	4.333622	31.5658	4.914604	4.142612	14.363	218	236.5085	247
			9			96			
44	33.25	6.506552	81.3254	6.780398	6.399029	22.381	204	228.4211	240
			8			73			
45	90.25	10.7196	-	19.28615	8.199797	51.973	205	234.1551	250
	100		63.0984			61			
46	100	11.28379	88.7459	20.84885	8.354498	55.526	210	234.4075	249
47	0.25	2 241022	1	2 550501	2 100274	91	207	224.0202	221
4/	8.25	3.241022	-45	5.550501	5.109274	9.9497	207	224.0303	231
18	35.5	6 723005	70 7027	7 2885/6	6 203022	4/	18/	210 160	240
+0	55.5	0.123093	6	1.200340	0.293922	22.905	104	217.107	270
49	23.5	5.470021	-	6.395976	4,982227	18 899	222	236 4787	247
		2	13.2796	0.020270		49			
50	60.25	8.758578	0.21996	14.88387	7.177956	41.920	202	234.7593	248
			7			31			
	1	1		1	I		1	I	



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 10 Issue VIII August 2022- Available at www.ijraset.com

IV. CONCLUSION

Medical digital image processing can increase the quality of the image and lessen the impact of noise. Images that have been processed can clearly communicate the image's pathological and medical information as well as the ailment that is being focused on. The use of digital images is essential on a daily basis.

The handling of images with a computer is referred to as medical imaging processing. This processing entails a wide range of methods and actions, including image acquisition, archiving, presentation, and communication. The image is a function that denotes a measure of the properties of an observed sight, such as illumination or color. The advantages of digital photos include quick and inexpensive processing, simple transmission and storage, immediate quality assessment, many copies while maintaining quality, quick and inexpensive reproduction, and flexible manipulation. Digital photos' drawbacks include copyright infringement, the inability to resize while maintaining quality, the necessity for high-capacity memory, and the requirement for a quicker processor for modification.

REFERENCES

- [1] Mitchell, T., Buchanan, B., DeJong, G., Dietterich, T., Rosenbloom, P. and Waibel, A., 1990. Machine learning. Annual review of computer science, 4(1), pp.417-433.
- [2] Jordan, M.I. and Mitchell, T.M., 2015. Machine learning: Trends, perspectives, and prospects. Science, 349(6245), pp.255-260.
- [3] Dietterich, T.G., 1990. Machine learning. Annual review of computer science, 4(1), pp.255-306.
- [4] Shavlik, J.W., Dietterich, T. and Dietterich, T.G. eds., 1990. Readings in machine learning. Morgan Kaufmann.
- [5] Mohri, M., Rostamizadeh, A. and Talwalkar, A., 2018. Foundations of machine learning. MIT press.
- [6] Dimitri, G.M. and Lió, P., 2017. DrugClust: a machine learning approach for drugs side effects prediction. Computational biology and chemistry, 68, pp.204-210.
- [7] Menden, M.P., Iorio, F., Garnett, M., McDermott, U., Benes, C.H., Ballester, P.J. and Saez-Rodriguez, J., 2013. Machine learning prediction of cancer cell sensitivity to drugs based on genomic and chemical properties. PLoS one, 8(4), p.e61318.
- [8] Eitrich, T., Kless, A., Druska, C., Meyer, W. and Grotendorst, J., 2007. Classification of highly unbalanced CYP450 data of drugs using cost sensitive machine learning techniques. Journal of chemical information and modeling, 47(1), pp.92-103.
- [9] Winkler, D.A., 2021. Use of artificial intelligence and machine learning for discovery of drugs for neglected tropical diseases. Frontiers in Chemistry, 9, p.614073.
- [10] Gerdes, H., Casado, P., Dokal, A., Hijazi, M., Akhtar, N., Osuntola, R., Rajeeve, V., Fitzgibbon, J., Travers, J., Britton, D. and Khorsandi, S., 2021. Drug ranking using machine learning systematically predicts the efficacy of anti-cancer drugs. Nature communications, 12(1), pp.1-15.
- [11] Char, D.S., Shah, N.H. and Magnus, D., 2018. Implementing machine learning in health care—addressing ethical challenges. The New England journal of medicine, 378(11), p.981.
- [12] Panch, T., Szolovits, P. and Atun, R., 2018. Artificial intelligence, machine learning and health systems. Journal of global health, 8(2).
- [13] Futoma, J., Simons, M., Panch, T., Doshi-Velez, F. and Celi, L.A., 2020. The myth of generalisability in clinical research and machine learning in health care. The Lancet Digital Health, 2(9), pp.e489-e492.
- [14] Jain, V. and Chatterjee, J.M., 2020. Machine learning with health care perspective. Cham: Springer, pp.1-415.
- [15] McDermott, M.B., Wang, S., Marinsek, N., Ranganath, R., Foschini, L. and Ghassemi, M., 2021. Reproducibility in machine learning for health research: Still a ways to go. Science Translational Medicine, 13(586), p.eabb1655.
- [16] Mishra, A., 2020. Artificial intelligence algorithms for the analysis of mechanical property of friction stir welded joints by using python programming. Welding Technology Review, 92(6), pp.7-16.
- [17] Mishra, A. and Morisetty, R., 2022. Determination of the Ultimate Tensile Strength (UTS) of friction stir welded similar AA6061 joints by using supervised machine learning based algorithms. Manufacturing Letters, 32, pp.83-86.
- [18] Mishra, A., 2021. Supervised machine learning algorithms to optimize the Ultimate Tensile Strength of friction stir welded aluminum alloy. Indian J. Eng, pp.122-133.
- [19] Mishra, A., Sefene, E.M. and Tsegaw, A.A., 2021. Process parameter optimization of Friction Stir Welding on 6061AA using Supervised Machine Learning Regression-based Algorithms. arXiv preprint arXiv:2109.00570.
- [20] Thapliyal, S. and Mishra, A., 2021. Machine learning classification-based approach for mechanical properties of friction stir welding of copper. Manufacturing Letters, 29, pp.52-55.
- [21] Mishra, A., 2020. Machine learning classification models for detection of the fracture location in dissimilar friction stir welded joint. Applied Engineering Letters.
- [22] Mishra, A. and Vats, A., 2021. Supervised machine learning classification algorithms for detection of fracture location in dissimilar friction stir welded joints. Frattura ed Integrità Strutturale, 15(58), pp.242-253.
- [23] Razzak, M.I., Naz, S. and Zaib, A., 2018. Deep learning for medical image processing: Overview, challenges and the future. Classification in BioApps, pp.323-350.
- [24] Liu, L., Chen, W., Nie, M., Zhang, F., Wang, Y., He, A., Wang, X. and Yan, G., 2016. iMAGE cloud: medical image processing as a service for regional healthcare in a hybrid cloud environment. Environmental health and preventive medicine, 21(6), pp.563-571.
- [25] Agrawal, S. and Jain, S.K., 2020. Medical text and image processing: applications, issues and challenges. In Machine Learning with Health Care Perspective (pp. 237-262). Springer, Cham.
- [26] Bengtsson, E., 2005, June. Computerized cell image processing in healthcare. In Proceedings of 7th International Workshop on Enterprise networking and Computing in Healthcare Industry, 2005. HEALTHCOM 2005. (pp. 11-17). IEEE.



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538

Volume 10 Issue VIII August 2022- Available at www.ijraset.com

- [27] Krupinski, E.A., Williams, M.B., Andriole, K., Strauss, K.J., Applegate, K., Wyatt, M., Bjork, S. and Seibert, J.A., 2007. Digital radiography image quality: image processing and display. Journal of the American College of Radiology, 4(6), pp.389-400.
- [28] Erden, F., Velipasalar, S., Alkar, A.Z. and Cetin, A.E., 2016. Sensors in assisted living: A survey of signal and image processing methods. IEEE Signal Processing Magazine, 33(2), pp.36-44.
- [29] Tamir, A., Jahan, C.S., Saif, M.S., Zaman, S.U., Islam, M.M., Khan, A.I., Fattah, S.A. and Shahnaz, C., 2017, December. Detection of anemia from image of the anterior conjunctiva of the eye by image processing and thresholding. In 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC) (pp. 697-701). IEEE.
- [30] Kong, Z., Li, T., Luo, J. and Xu, S., 2019. Automatic tissue image segmentation based on image processing and deep learning. Journal of healthcare engineering, 2019.
- [31] Mishra, A. and Pathak, T., 2020. Estimation of grain size distribution of friction stir welded joint by using machine learning approach. ADCAIJ: Advances in Distributed Computing and Artificial Intelligence Journal, 10(1), pp.99-110.
- [32] Mishra, A. and Patti, A., 2021. Deep Convolutional Neural Network Modeling and Laplace Transformation Algorithm for the Analysis of Surface Quality of Friction Stir Welded Joints.
- [33] Aparna, P. and Kishore, P.V.V., 2019. Biometric-based efficient medical image watermarking in E-healthcare application. IET Image Processing, 13(3), pp.421-428.
- [34] Mishra, S., Tripathy, H.K. and Acharya, B., 2021. A precise analysis of deep learning for medical image processing. In Bio-inspired neurocomputing (pp. 25-41). Springer, Singapore.
- [35] Marwan, M., Kartit, A. and Ouahmane, H., 2018. Security enhancement in healthcare cloud using machine learning. Procedia Computer Science, 127, pp.388-397.











45.98



IMPACT FACTOR: 7.129







INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 🕓 (24*7 Support on Whatsapp)