Techno Nusa Mandiri: Journal of Computing and Information Technology
Vol. 20, No. 2 September 2023 | DOI https://doi.org/10.33480/techno.v20i2.4735

REAL TIME DETECTION OF CHICKEN EGG QUANTITY USING GLCM AND SVM CLASSIFICATION METHOD

Cut Lika Mestika Sandy[1*], Asmaul Husna[2] , Reyhan Achmad Rizal[3], Muhathir[4]

Sistem Informasi[1], Teknik Informatika[2]
Universitas Islam Kebangsaan Indonesia[1,2]
www.uniki.ac.id[1,2]

Sistem Informasi[3]
Universitas Prima Indonesia[3]
www.unprimdn.ac.id[3]

Teknik Informatika[4]
Universitas Medan Area[4]
www.uma.ac.id[4]

likaclms@gmail.com[1*], asmaulhusna1@gmail.com[2], reyhanachmadrizal@unprimdn.ac.id[3],
muhathir@staff.uma.ac[4]

Abstract— *A common problem currently being faced in the chicken egg production home industry is difficulty in counting the number of eggs. Currently, calculating the number of eggs is still done manually, which is less than optimal and prone to errors, so many entrepreneurs often experience losses. The manual system currently used also has the potential for this to happen. The use of technology on an MSME scale among laying hen breeders has not been widely adopted, this is due to limited access and understanding of technology. One alternative solution to deal with this problem is to build a real-time computerized system. The system that will currently be built in this research uses GLCM feature extraction and the SVM classification method. This system will detect egg production via CCTV cameras and will be stored in a database to be displayed on the website. The advantage of this system is that egg entrepreneurs can monitor chicken egg yields in real time. The results of trials that have been carried out using GLCM feature extraction and the SVM classification method in calculating the number of eggs using the SVM method with a polynomial kernel are highly recommended for use in this research because it can achieve 95% accuracy.*

Keywords: *Automation, Chicken Egg, GLCM, SVM*

Intisari—*Permasalahan umum yang sedang dihadapi pada home industri produksi telur ayam saat ini yaitu mengalami kesulitan di dalam menghitung jumlah telur. Saat ini perhitungan jumlah telur masih dilakukan secara manual,dimana hal tersebut kurang optimal serta rentan terjadi kesalahan sehingga banyak pengusaha sering mengalami kerugian. Sistem manual yang digunakan saat ini juga berpotensi terjadinya. Penggunaan teknologi pada skala umkm di peternak ayam petelur belum banyak diadopsi, hal itu disebabkan oleh akses dan pemahaman pada teknologi yang masih terbatas. Salah satu solusi alternatif untuk menangani permasalahan tersebut adalah dengan membangun sistem yang terkomputerisasi secara realtime. Sistem yang saat ini akan dibangun pada penelitian ini menggunakan ekstraksi fitur GLCM dan metode klasifikasi SVM, sistem ini akan mendeteksi produksi jumlah telur melalui kamera CCTV dan akan disimpan pada database untuk ditampilkan pada website. Keunggulan dari sistem ini yaitu pengusaha telur dapat memantau hasil telur ayam secara realtime. Hasil uji coba yang telah dilakukan menggunakan ekstraksi fitur GLCM dan metode klasifikasi SVM dalam menghitung jumlah telur penggunaan metode SVM dengan kernel polinomial sangat direkomendasikan untuk digunakan pada penelitian ini dikarenakan dapat mencapai akurasi 95%.*

Kata Kunci: *Otomatisasi, Telur Ayam, GLCM, SVM*

INTRODUCTION

The egg-laying chicken farming business is one of the poultry farms that is important to pay attention to because this business is able to provide employment opportunities not only limited to rural areas but also in urban areas. To stabilize and strengthen the laying hen farming business, farmers must make improvements in various aspects including production, management and marketing aspects. Currently, UMKM scale farms are managed conventionally, this is due to limited access and understanding of technology. Conventional management is prone to fraud and often causes errors.

With the development of increasingly advanced technology, innovation is needed in UMKM egg-laying chicken farms that are able to calculate the number of egg production in real time and can make it easier for business owners to monitor the number of egg production every day. It is important to have a system that can provide real-time information to business owners, with real-time information being able to predict egg production in order to fulfill supplier orders.

Apart from that, business owners can also monitor chicken productivity, where chickens that are no longer laying eggs can be moved to another place to save feed. System development trials will be carried out at one of Min's father's small-scale home industries in Gampong Blang Buloh, Blang Mangat District, Lhokseumawe City, North Aceh, where based on initial observations that have been made so far, the calculation of the number of chicken egg production and egg grouping is still done manually by employee. However, due to the large number of eggs, errors often occur in calculating the eggs before they are distributed, so many suppliers cannot be sure of their orders.

The system for calculating the number of egg production in real time is one of the object recognition concepts, where the system can recognize objects by mapping objects that have gone through a previous training process. Object recognition is one area of research that can be applied in various fields such as (Sandy et al., 2019) real-time height measurement, (Rizal, Girsang, et al., 2019) face recognition, (Sandy et al., 2023) real-time recognition of 3D geometric objects. Several previous studies regarding chicken egg detection can be seen in table 1.

Table 1. Several studies on chicken egg detection that have been carried out

Author	Data/ sample	Method	Category	Results Study
(Cirua et al., 2020)	Egg Chicken taken by camera	Connected Component Labeling algorithm , Threshold process, segmentation ,	System intelligent , processing image , segmentation	Results test try to show that the object picture egg is very influenced by size image , intensity light , and distance taking image .
(Fadchar & Dela Cruz, 2020)	Take picture egg chicken five (5) days old (150 images)	Segmentation threshold limit , conversion RGB color , Network Nerves Imitation	Processing Image , Segmentation , Classification	Predictive models own accuracy whole by 97%. Predictive models own ratio more mistakes _ low compared to with predictions made _ through a manual candling process
(Narushin et al., 2020)	40 items egg chicken fresh purchased from Woodlands Farm, Canterbury and Staveley's Eggs Ltd, Coppull , England	Hügelsch€affer model , contour egg chicken And count repeat variable the geometry	Non-destructive measurement System automatic	Application And its validity For measure egg
(Saifullah & Andiko Putro Suryotomo, 2021)	Egg chicken on system hatching egg	K-means segmentation , space color L*a*b, scale	Segmentation Image , Processing Picture	K-means based segmentation room L*a*b

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Author	Data/ sample	Method	Category	Results Study
		gray , Histogram Equalization , morphology		color available used For stage beginning detection embryo
(Nyalala et al., 2021)	Studies other	Reviews	Classification non-destructive measurement	Overview challenge And potency trend period front in estimation size , weight , and production volume poultry
(Saifullah et al., 2022)	Chicken egg on hatching egg systems	K-means Segmentation, L*a*b color space, grayscaling, Histogram Equalization, morphology	Image Segmentation, Image Processing	K-means segmentation based on L*a*b color space can be used for the initial stages of the embryo detection process

MATERIALS AND METHODS

A. Research Stage

In Figure 1 you can see the detection process for identifying the number of egg production that will be carried out. Starting with the stages of image acquisition using a CCTV camera, segmentation is then carried out to separate the object from the background. and cropping which functions to get the characteristics of the egg image (Yennimar et al., 2019)(Rizal & HS, 2019).

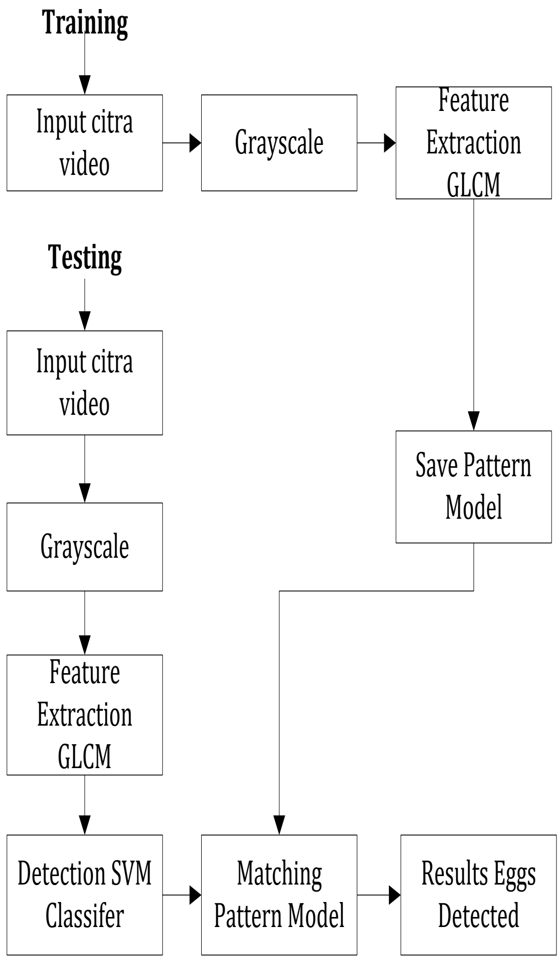

Figure 1. Framework of the Proposed Method

Next, the image will be pre-processed grayscale to make three intensity values into 1 intensity value which is useful for saving computation. Feature extraction stages using GLCM with 6 parameters, namely: Energy (En), Contrast (Ct), Entropy (Et), Variance (V), Correlation (Cr), and Homogeneity (H). The final stage of detecting the number of eggs is processed using SVM by applying 3 kernel models to deal with nonlinear data because not all data in the dataset can be separated linearly.

B. Data Collection

At this stage, data is collected using a smartphone camera with a black background. There were two types of images taken, namely images of domestic chicken eggs and images of village chicken eggs, with a total of 212 eggs. There are 106 images of domestic chicken eggs and 106 images of free-range chicken eggs. When taking pictures, the room lights are turned off to produce the desired image. The image results (Rizal et al., 2020), can be seen in Table 2.

Table 2: Image of Domestic Chicken Eggs and Village Chicken Eggs

No	Image of National Chicken Eggs	Village Egg Image
1		
		
...	...	...
106		

RESULTS AND DISCUSSION

Pre-processing

At the image pre-processing stage, the first step is to resize the egg image. At this stage, the image is resized to 250 x 250 pixels. Next, the image is converted from RGB (Red, Green, Blue) format to grayscale image. As an illustration, for example, we take the pixel values in the n5.jpg image which have RGB values of 354, 225, and 81, then these values are converted to a grayscale image with the following procedure:

$$Grayscale = (0{,}299\ R\ x\ 354) + (0{,}857\ G\ x\ 225) + (\ 0{,}114\ B\ x\ 81) = 307$$

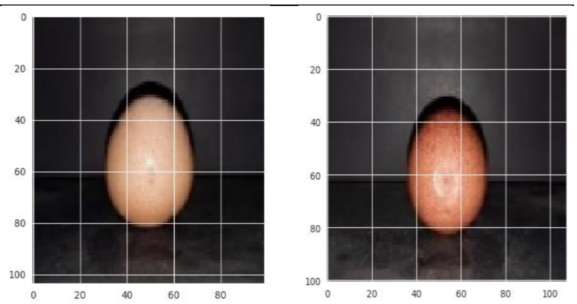

Figure 2. Pre-processing process

In Figure 2, you can see an illustration of the pre-processing process that has been applied to all images, which have been resized to 255x255 pixels (Dewantoro et al., 2022). The next stage is the implementation of the dataset training process, and the results can be observed in Figure 3.

Segmentation

In this segmentation process, the algorithm used is k-means clustering. At this segmentation stage, the original image is divided into three cluster objects that have different pixel values and contrast. Next, the pixel value is used as the cluster center or centroid, where the number of centroids is the same as the number of clusters, namely 3. Table 3 provides a description of the cluster center values in the n5.jpg image (Saifullah et al., 2021).

Table 3: Cluster Center Values

Cluster 1	2.52763023825525	3.75771240271425
Cluster 2	73.8299170082992	23.1751824817518
Cluster 3	111.1531701192272	32.0932203389831

Table 3, which describes the cluster center values above, refers to the cluster center values in one of the images, namely n5.jpg. Next, the value of each pixel in the results of the K-means Clustering algorithm is labeled according to the corresponding cluster. K-means Clustering returns the index corresponding to the respective cluster.

Next, each pixel value is summed according to its cluster, producing three cluster objects. After these objects become three cluster objects, the number of pixels in each cluster area is calculated. Then, the lowest value from the cluster is taken and used as the resulting clustered data value. The results are then converted into a binary image. The next process is masking, where the binary image is multiplied by a grayscale image. After segmentation with K-means Clustering is complete, the results can be used in the texture feature extraction process.

Feature Extraction

After the segmentation stage is complete, the feature extraction process continues. The method used for feature extraction is GLCM (Gray Level Cooccurence Matrix)(Rizal, Gulo, et al., 2019). The resulting segmentation image is processed by considering the features and direction in GLCM. There are three features from the Gray Level Cooccurence Matrix that are used for feature extraction, namely contrast, homogeneity and energy. The distance taken in this process is d=1, with degrees 450, 900, and 1350.

Techno Nusa Mandiri: Journal of Computing and Information Technology
Vol. 20, No. 2 September 2023 | DOI https://doi.org/10.33480/techno.v20i2.4735

Table 4: Gray Level Co-Occurrence Matrix Contrast Values

Citra	Kontras 45°	Kontras 90°	Kontras 135°
1	0.381800293543653	0.297413654618474	0.376864889275979
2	0.368735988129224	0.275244979919679	0.369187593748488
3	0.232899469363397	0.181204819277108	0.234544604119288
4	0.388284059934517	0.283373493975904	0.376703601554814
5	0.216319091627554	0.148530120481928	0.224447992774310
6	0.475831034983307	0.375357429718876	0.453186238931630
7	0.236060708698247	0.186891566265060	0.239641296108127
8	0.242867050531443	0.196562248995984	0.243931549491137
9	0.312898179061628	0.210666666666667	0.313027209238561
10	0.225383461557072	0.150393574297189	0.218802922533508

Classification

Data that has gone through the feature extraction process will then be directed to the classification stage. In this stage, the method used is SVM (Support Vector Machine)(Muhathir et al., 2019). Classification is carried out by comparing training data and test data in a ratio of 60:40. Details of the composition of this data comparison are explained in Table 5.

Table 5. Training and Testing Data Distribution Structure

Datasets	Image of the National Chicken	Image of Kampung Chicken
Training	200	200
Testing	600	600
Validation	200	200

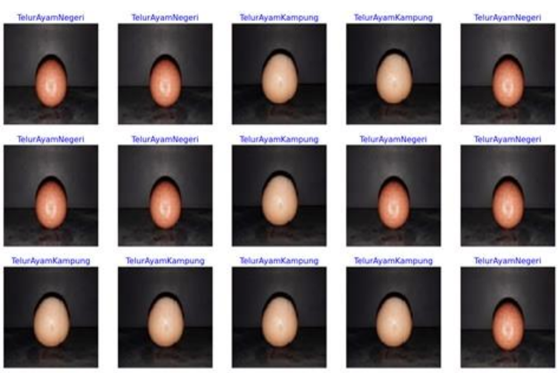

Figure 3. Training dataset for detection of domestic chicken eggs and free-range chicken eggs

Figure 3 is an illustration of the training dataset process which aims to obtain image characteristics to differentiate domestic chicken eggs from village chicken eggs, the results of classification using SVM, which can be seen in Figure 4.

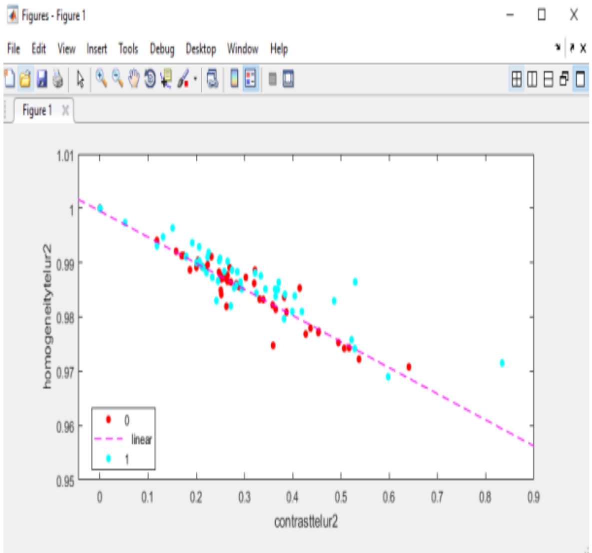

Figure 4. Hyperplane in Support Vector Machine

Data for domestic chicken eggs in class 0 is depicted with red dots, while data for free-range chicken eggs in class 1 is depicted with light blue dots. The hyperplane lines used in the representation are presented as pink dotted lines. After seeing the distribution of this data, the system will display the value of the confusion matrix, which will indicate how many predictions are correct or incorrect. Confusion matrix is used to calculate accuracy, recall and precision values. The evaluation results of this model can be found in Table 6.

Table 6. Model Evaluation Results

	Accuracy	Precision	Recall	F1-Score
Kernel Linear	0.833333333	0.846153846	0.833333333	0.885714
Kernel Polynomial	0.95	0.863636364	0.95	0.904762
Kernel RBF	0.8916666665	0.854895105	0.8916666665	0.895238

Table 6 shows the results of the model evaluation carried out in this research using GLCM feature extraction and the SVM calcification method. In testing using a linear kernel the results were accuracy: 0.83, precision: 0.84, recall: 0.83 and F1 score: 0.88. Meanwhile, testing using the polynomial kernel results are Accuracy: 0.95, Precision: 0.86, Recall: 0.95 and F1 Score: 0.91 and testing using the RBF kernel results are Accuracy: 0.89, Precision: 0.85, Recall: 0.89 and F1 Score: 0.89.

CONCLUSION

This research aims to detect the number of eggs based on their type. Based on the results of tests carried out, the system was only able to detect eggs from domestic and free-range chickens. The highest accuracy results in this research were using a polynomial kernel with an accuracy of 0.95 (95%). The results of this research show that the SVM method with a polynomial kernel is highly recommended for use because it can achieve 95% accuracy. To get even better results in the future, increasing the number of chicken egg samples is highly recommended to increase the best accuracy which will then be tested using deep learning with architectures such as Mo-bileNetV2, VGG16 ADAM, ADAGRAD, and SGD, etc.

ACKNOWLEDGMENTS

1. Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi who have provided assistance in the form of financial support.
2. University Islam Kebangsaan Indonesia who have provided motivational support and facilities.

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