IOP Conference Series:
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Preface

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Preface

The 6th International Conference on Natural Resources and Technology (ICONART) 2024 beautifully encapsulates the spirit and significance of this esteemed event. Organized by the Center of Excellence for Mangrove (PUI Mangrove) at Universitas Sumatera Utara in collaboration with key academic institutions and organizations, ICONART 2024 continues its tradition of fostering interdisciplinary research and collaboration at the nexus of natural resources, technology, and sustainability.

With the theme, "Natural Resources and Technology for Achieving Sustainable Development Goals through Academia, Industry, and Community", this year's conference underscores its dedication to addressing global challenges through resilience and innovation. The focus on advancing sustainable practices and integrating cutting-edge technologies aligns seamlessly with the Sustainable Development Goals (SDGs), offering a platform for meaningful discourse and impactful solutions. By bridging the gap between academic excellence, industrial innovation, and community engagement, 6th ICONART 2024 aspires to generate transformative outcomes that will contribute to a more sustainable and equitable future.

The hybrid format of 6th ICONART 2024 on 27th August 2024 ensures inclusivity, allowing participants from across the globe to contribute and engage. Hosted at the Grandhika Hotel, Medan, the event also provides an opportunity for in-person attendees to explore the natural beauty of Toba Lake on 28th August 2024, during the post-conference excursion. Beyond being a venue for sharing scientific advancements, the conference fosters an atmosphere of cultural exchange, highlighting Indonesia's rich ecological and cultural heritage, and reinforcing the connection between nature and society. With six interconnected topics, from Natural science and natural product, Natural resource technology, Information systems of tropical resources, Tropical biodiversity, Food science and food technology, and Ethnobotany and ethnozoology, the conference promotes a multidisciplinary approach to sustainable resource management and innovation in technology.

The event boasts an impressive international presence, with 151 submissions from researchers across Germany, Japan, Malaysia, the Philippines, Thailand, and Indonesia. Following a rigorous peer-review process, 139 high-quality papers have been selected, reflecting the diverse and cutting-edge research being undertaken worldwide. These contributions will be published in the IOP Conference Series: Earth and Environmental Science, ensuring broad accessibility and global impact. By choosing this Scopus-indexed publication platform, 6th ICONART 2024 not only elevates the visibility of the research but also underscores its commitment to advancing knowledge sharing on a global scale.

The presence of distinguished keynote and invited speakers further elevates the event. Experts such as Prof. Dr. Martin Zimmer from Germany, Dr. Reiko Omoto from Japan, and His Excellency Tuan Shahril Nizam Abdul Malek, the Consulate General of Malaysia in Medan, Dr. Ahmad Aldrie Amir from Universiti Kebangsaan Malaysia; and Prof. Dr. Etti Sartima Siregar from Universitas Sumatera Utara. Invited speakers include Prof. Putu Deddy Sutrisna, Ph.D. (NUNI), Dr. M. Chanda Sagaran (Malaysia Green Technology Society), and Dr. Syahidah (Universitas Hasanuddin, Makassar), bring invaluable insights from their respective fields, enriching the

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discussions and inspiring participants. Their presentations promise to challenge conventional perspectives and encourage the exploration of innovative pathways in addressing complex environmental and technological challenges. We are also honored to welcome representatives from the Consulate General of Timor Leste in Medan.

This year's conference would not have been possible without the unwavering support of Universitas Sumatera Utara, the Faculty of Forestry at Universitas Hasanuddin, the Nationwide University Network in Indonesia (NUNI), the Malaysia Green Technology Society, and the tireless efforts of the organizing committee. The meticulous planning, teamwork, and dedication of the committee, ensure the event's success. This collective collaboration reflects the high standards of academic excellence and commitment to sustainability that 6th ICONART 2024 embodies.

As 6th ICONART 2024 unfolds, it not only celebrates the achievements of researchers and innovators but also inspires a collective commitment to sustainability. The conference serves as a dynamic platform for groundbreaking discoveries, fostering enduring collaborations and shaping the future of natural resources and technology. This legacy of excellence is a testament to the shared vision of academia, industry, and communities working together for a sustainable tomorrow. It is our hope that the discussions and partnerships formed during this event will leave a lasting impact, driving real-world change and empowering stakeholders to address pressing environmental and societal challenges with confidence and creativity.

The editors of 6th ICONART 2024 are:

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5. Dr. Ahmad Aldrie Amir Institute for Environment and Development, Universiti Kebangsaan Malaysia
6. Dr. Syahidah Department of Forest Engineering, Faculty of Forestry, Universitas Hasanuddin, Makassar, Indonesia

Finally, we extend our heartfelt appreciation to the organizing committee for their tireless efforts, teamwork, and meticulous planning, which have ensured the success of this event. We hope that 6th ICONART 2024 will serve as a dynamic platform for meaningful discussions, groundbreaking discoveries, and enduring collaborations. May this conference inspire innovative solutions and a renewed commitment to sustainability.

Dr. Mohammad Basyuni
Chairman of the 6th ICONART 2024
Center of Excellence for Mangrove, Universitas Sumatera Utara, Medan, North Sumatra, Indonesia

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Koi varieties identification based zero parameter simple linear iterative clustering and support vector machine

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Koi varieties identification based zero parameter simple linear iterative clustering and support vector machine

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Abstract. There's currently 120 types of koi fish that has been bred around the world. The types of koi fish depend on the colour patterns and shapes they have. There's alot of patterns that has similarity between one type with another. For example, sanke and showa koi fish will look similar from a non-expert's point of view, because both type has same colour pattern, which is red, black and white. In actuality, sanke koi is dominantly red and white with slight black accent, while showa's dominant colour is red and black, with white accent. In this research, Zero Parameter Simple Linear Iterative Clustering (SLICO) method and Simple Linear Iterative Clustering (SLIC) will be tested and used to process the image segmentation process to eliminate the background of the image. Colour Local Binary Pattern method is used to get the textures on images through the RGB, HSV, and grayscale colour space. Support Vector Machine is used to identify types of koi fish. To test the SVM, two kind of kernel is used, which is linear kernel and Radial Basis Function (RBF) kernel. The results of this study are the program able to recognize types of koi from images. The test results show an accuracy of 36% in grayscale colour space, 50% in RGB colour space, and 48% in HSV colour space.

1. Introduction

There's currently 120 types of koi fish that has been bred around the world. The types of koi fish depend on the colour patterns and shapes they have. There's a lot of patterns that has similarity between one type and another. For example, sanke and showa koi fish looks similar from a non-expert perspective, because both has same colour pattern, which is red, black and white.

In actuality, sanke koi is dominantly red and white with a slight black accent, while showa's dominant colour is black and red, with white accent. To prevent misidentification, a program that can help identifying koi fish types will be useful for the users to find out the koi fish type they going to buy or sell. This program can be made using computer vision.

So far, several researchers have conducted research on the identification of fish species. One of them is a study that identified herring, mackerel, and blue whiting by using CNN and synthetic images, with an accuracy of 94.1% [1]. In research on the identification of koi fish species that have been held, researchers used the SLIC and CNN methods. Although the final result is quite good accuracy, which is 80%, but because the parameters required for each image are different, the researcher must enter the parameters manually [2]. This will certainly affect the final result. If the newly entered image requires new parameters, the results will not be as accurate as before because the parameters do not match.

To create an accurate object identification system, super pixel segmentation method can be used. Super pixel segmentation itself has several methods, where the method will group the pixels in the image into a group of pixels with the same characteristics. Simple Linear Iterative Clustering (SLIC) is one of the super pixel methods that can be used. The weakness of this method is the difficulty of determining the parameters required for each image, especially if the image used has a different quality and texture [3]. To overcome the shortcomings of the SLIC method that has been mentioned, in this study, Zero Parameter Simple Linear Iterative Clustering (SLICO) will be used for segmentation. After the image has been successfully segmented, introduction of koi fish can be done with Local Binary Pattern (LBP) and Support Vector Machine (SVM).

SVM is a method that is often used in the classification of data, images, and text. SVM is a compact model, so the memory used is relatively small. In addition, by using a kernel that can convert inputs into the required format, so that SVM is able to adapt to various data. There are various types of kernels, including linear kernels and RBF. Linear kernels are the simplest kernels, which are often used when the data entered can be separated only by a single line. This kernel is also often used when in a dataset there are a large number of features. Radial Basis Function (RBF) is a kernel that is often used for classification, where the boundaries are hypothesized to have a curve shape. The kernel has parameters that are easy to calibrate so it's easy to use.

In this study the SLIC and SLICO method will be tested and compared. After the image is successfully segmented, the SVM method is used to identify species of fish. Identification using SVM will be assisted by the kernel, which in this study will compare the final results of two types of kernels, which is linear kernel and RBF kernel.

The purpose of this study is to create a program that is able to identify the types of koi fish based on their pattern and shape using images. It is expected that from this research, people who do not understand the types of koi fish can recognize the existing koi fish species, also in order to help koi fish buyers and sellers to check or cross-check back the fish they bought or sell.

2. Materials and methods

2.1 Koi

Koi fish are an omnivore type of freshwater fish. They mostly active during the summer, spring and fall season. They hibernate during winter. Koi fish itself is a type of goldfish. The difference between koi and ordinary goldfish is koi’s torpedo-like body shape. They can live for 30 years or even more than 100 years if properly taken care of.

The type of koi fish are determined not only by shape, but also their colour pattern. They usually kept in a medium or large pond, unlike other ornamental fish that kept in an aquarium. Therefore, the upper body pattern determines their types. These colour patterns or types affect the quality and price of the fish. The colour patterns of each type always differs from one to another, making each fish unique and varied.

2.2 Zero Parameter Simple Linear Iterative Clustering (SLICO)

Superpixel is an algorithm that groups pixels in the same area with the same characteristic. By using superpixel as segmentation method, the quality of the final result will increase dramatically, and the program will run faster. Superpixel itself has several method, one of which is SLIC.

SLIC can be considered as one form of k-means, but SLIC has difference where the number of distance calculations is reduced by the size of the superpixel. The color and spatial relationship will then be combined to update the size and density of the superpixel [4]. SLIC uses the same parameters for all superpixels in the image. In this study, optimized version of SLIC is used, which is SLICO. This method doesn't require users to set the parameter for each superpixel. That way, the result of the segmentation will be smoother than SLIC. To get the right size for each superpixel in an image, the superpixel center will be needed.

Segmentation refers to the process of partitioning images into segments, which aim to simplify and change the representation of images to be more meaningful. Segmentation is commonly used to find objects and image boundaries [5]. The result of image segmentation is a set of segments that collectively cover the whole image, or a set of contours extracted from the image.

Gaussian Blur function is commonly used to reduce noise and detail, which will be used at the pre-processing stage to improve image structure [5]. Region Adjacency Graph (RAG) is a method that is able to provide an overview of the relationship between each region obtained from segmentation [6]. This segmentation method is commonly used for colour image segmentation [7]. Graph cut is an efficient graph-based segmentation technique that can function as a powerful energy minimization tool that produces optimal solutions globally [2].

2.3 Color Local Binary Pattern (CLBP) Support Vector Machine

Color Local Binary Pattern (Color LBP) is an adaptation of the Local Binary Pattern (LBP) method. The method for taking a descriptor for LBP Color is the same as the usual LBP method, but adding color to the process. Color LBP is a LBP method that is intended for color images, and is used as a descriptor for color.

The result of Local Binary Pattern is a color histogram which is an effective descriptor of a color image [8]. There are a variety of color spaces that can be used to capture features for Color LBP namely, RGB, HSV and YIQ. RGB is the color space that is most often used in color images. HSV is a color space that represents the human vision system. Whereas YIQ represents luminance, chrominance blue and chrominance red [9].

2.4 Support Vector Machine (SVM)

Support Vector Machine (SVM) is a learning model with an algorithm that analyzes data for classification, identification, and analysis. This method is able to minimize empirical misclassification and maximize geometric margins, so that SVM is known as the maximum margin classifier [10]. The creation of the SVM model is assisted by a kernel that is used to convert inputs into the required format.

There are several kernels that can be used, one of which is a linear kernel [11]. Linear kernels are the simplest kernels which are often equivalent to non-kernels. This kernel is often used when the data entered can be separated only by a single line, or when in a dataset there are a large number of features.

SLIC can be considered as one form of k-means, but SLIC has difference where the number of distance calculations is reduced by the size of the superpixel. The color and spatial relationship will then be combined to update the size and density of the superpixel [5]. SLIC uses the same parameters for all superpixels in the image. In this study, optimized version of SLIC is used, which is SLICO. This method doesn't require users to set the parameter for each superpixel. That way, the result of the segmentation will be smoother than SLIC. To get the right size for each superpixel in an image, the superpixel center will be needed.

3. Result and discussion

3.1 Testing of training results
The training was conducted using SLICO and SLIC segmentation results and descriptions in the pictures using LBP. The description results are then used to conduct training on SVM. The LBP parameter values tested are numPoint 24 with a radius of 1 to 5. The parameters used for SLICO are region size 20, minimum element size 10, and number of iterations 500 and 300. For SLIC, a ruler parameter of 10.0 is added.

Data is tested in two SVM kernels, namely linear and RBF. The C parameter to be tested is 1000. The parameters for the RBF to be tested are 1 and 0.5. In the table, variable A represents the SLICO method with the parameters region_size 20, min_element_size 10, and num_iteration 500. Variable B represents the SLICO method with the parameters region_size 20, min_element_size 10 and num_iteration 300. Variable C represents the SLIC method with the parameters region_size 20, min_element_size 10 and num_iterze 10 and num_iteration 300. 500, and the D variable represents the SLIC method with the parameters region_size 20, min_element_size 10, and num_iteration 300. Furthermore, numPoint will be abbreviated to NP and the radius is abbreviated to R. Table 1 is the results of testing using the SVM model that has been trained. Highlighted columns are those that have the smallest overfit value of each variable. From the test results it can be concluded that for trials with grayscale and linear SVM colour space with a cost of 1000, the D variable has the smallest ratio between the accuracy of training and testing, which is equal to 1. However the D variable has a small accuracy value compared to the others.

3.2 Testing of program
This process is used to remove the background and take on the shape and pattern of koi fish. This process is carried out with this segmentation process which has stages, namely Gaussian Blur administration, SLICO application in images, RAG application and Graph Cut in images, replace background, bounding box objects, crop objects and scaling [12]. After the description process using LBP is complete, the histogram is then classified using the Support Vector Machine (SVM).

Table 1. Testing result on linier SVM with cost 1000.

Linier SVM	NP	NP	NP	NP	NP
A	26%	31%	28%	32%	32%
B	24%	34%	27%	35%	34%
C	25%	23%	20%	21%	20%
D	23%	21%	20%	24%	20%

From the test results it can be concluded that for trials with RGB colour space and RBF SVM at a cost of 1000, the D variable with gamma 0.5 has the best accuracy, where the training results are 41% and testing is 35%, with a difference of 6. This variable was chosen because among the results Another trial, variable D with gamma 0.5 has the smallest overfit value compared to other variables. Figure1 is an example of the results of predictions using SVM.

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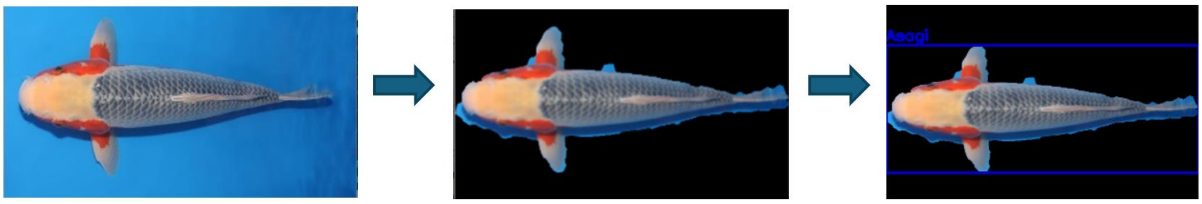

Figure 1. Identification and segmentation Koi Fish result using SVM.

In the grayscale colorspace, the highest value was obtained by the Asagi fish type at 52%, and the lowest was obtained by the Hikarimoyomono fish type at 0%. The average precision value in the grayscale colourspace was 32.8%. In the RGB colourspace, the highest value was obtained by the Shusui fish type at 88% and the lowest was obtained by the Matsuba fish type at 20%. The average precision value in the RGB colorspace was 52.9%. In the HSV colourspace, the highest value was obtained by the Shusui fish type at 75% and the lowest was obtained by the Tancho fish type at 24%. The average precision value in the HSV colourspace was 47%.

The Figure 2 is a histogram for the colour RGB channel on the colour space obtained by Local Binary Pattern (LBP). The results of testing using the SVM model that has been trained. Highlighted columns are those that have the smallest overfit value of each variable.

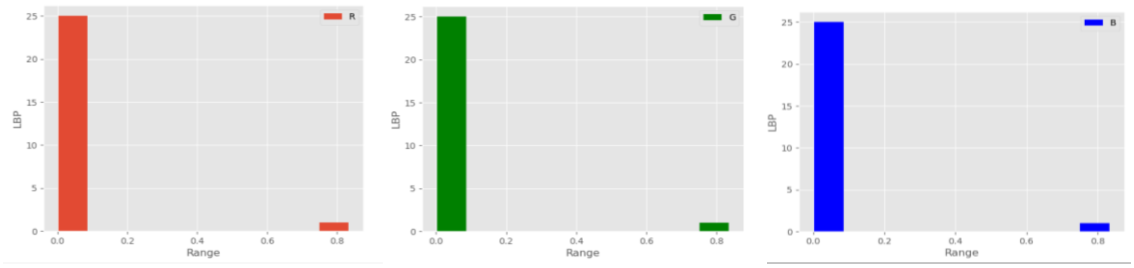

Figure 2. Histogram result for channel RGB on colour space using Local Binary Pattern.

The test in Figure 3 is done using Local Binary Pattern with SLICO parameters namely region_size 20, min_element_size 10, and num_iteration 300. These parameters were selected because they have the highest amount of accuracy in the RGB colorspace by 50% based on the results of comparisons that have been done before. This process is used to create graphs based on labels that have been formed from the previous process. Figure 3 is a mask image resulting from the RAG and graph cut processes. The value is obtained by using the metrics classification from the sklearn library. The higher the precision value, the lower the possibility of false positives during testing. The average value of precision in grayscale colorspace is 32.8%. The average precision in the HSV colorspace is 47%.

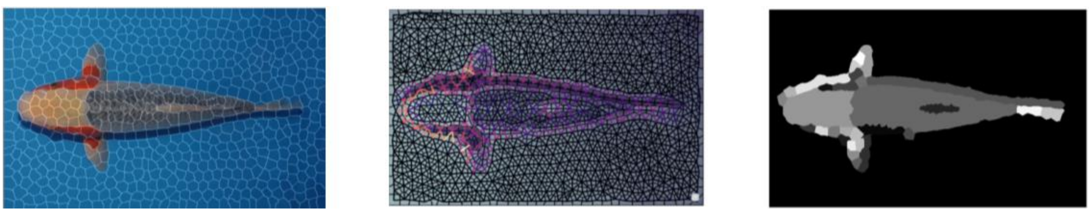

Figure 3. The Result of SLICO Segmentation on colour space using Local Binary Pattern.

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4. Conclusion

Based on implementation and discussion, it can be concluded that: The collected koi fish dataset has reflections of light, shadows or water ripples, causing some images to not be segmented to the maximum. The SLICO method can replace the SLIC method efficiently. The SLICO method is able to give higher accuracy results compared to the SLIC method. In the RGB colour space, while the best accuracy of the SLIC method is 35%. The most suitable type of colour space used in doing the description using the Colour Local Binary Pattern method is the RGB colour space with the highest accuracy of 50%.

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