딥러닝을 이용한 돼지 얼굴 인식

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Pig Face Recognition Using Deep Learning

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The development of livestock faces intensive farming results in a rising need for recognition of individual animals such as cows and pigs is related to high traceability. In this paper, we present a non-invasive biometrics systematic approach based on the deep-learning classification model to pig face identification. Firstly, in our systematic method, we build a ROS data collection system block to collect 10 pig face data images. Secondly, we proposed a preprocessing block in that we utilize the SSIM method to filter some images of collected images that have high similarity. Thirdly, we employ the improved image classification model of CNN (ViT), which uses the finetuning and pretraining technique to recognize the individual pig face. Finally, our proposed method achieves the accuracy about 98.66%.

1. Introduction

The identification of individual animals has become an important topic in recent years to monitor the animals' health. With the number of people increment, the need for meat is growing. Hence, it is urgent to recognize the pig's face to monitor the pig. The main method to recognize the livestock animal is that use Radio Frequency IDentification (RFID) tags. The RFID tags are usually fixed in the animal's ears via piercing, which is time-consuming and impaired for the animal. However, the animal can be recognized and activated by this method which is limited by distance range(less than 120cm).

Human face recognition has attracted much attention in five decades[1]. Hence some researchers employ deep learning-based image classification to recognize cattle [2], sheep [3], and pig faces.

In our paper, we employ the ROS data collection system to collect 10 pigs' faces in a Korean pig farm. And we utilize a deep learning-based model named ViT to recognize pig faces. Then we use data augmentation to increase the number of images in our data, such as rotation, contrast, and flipping. Finally, we obtain the 99% accuracy.

2. ROS Pig Face Collection System

Robot Operating System [12] is an open-source, meta-operating, and highly flexible software architecture for programming robot software programs. It have the services you would expect from an operating system, including hardware abstraction, low-level device control, implementation of commonly-used functionality, message-passing between processes, and package management. It also offers tools and libraries for obtaining, building, writing, and running code across multiple computers. In our ROS, we use Jetson AGX Xavier as the development platform of ROS and we collect pig data by ROS in a Korean pig farm. We show the ROS system workflow in figure 2.

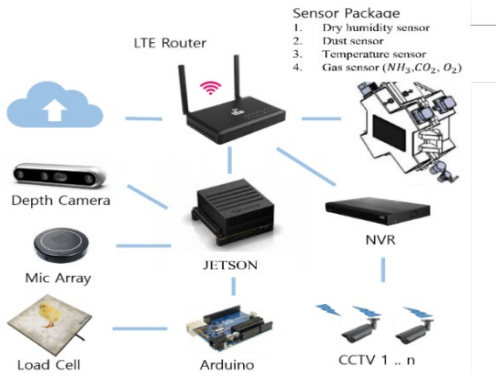

Figure 1. ROS Pig Face System Collection.

3. Pig Face Dataset

Figure 2. Sample of 10 Pigs Faces dataset.

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In our paper, we collected 10 pigs face in our pig face dataset.

Class	N_total	N_training	N_valid	N_test
1	68	40	14	14
2	20	12	4	4
3	270	162	54	54
4	70	42	14	14
5	70	42	14	14
6	31	19	6	6
7	120	72	24	24
8	70	42	14	14
9	99	59	20	20
10	90	54	18	18
11	213	128	43	42

4. Method

In our paper, we employ a deep learning-based classification model named ViT [4] which is a transformer model with self-attention. The transformer is an important model in NLP and the ViT achieved better performance compare to the CNN model in CV. ViT can be viewed as a new backbone that directly extracts global feature information don't need stack layers in CV tasks, such as classification, detection, and segmentation.

5. Experiment

In this paper, we utilize the ViT model to recognize the pig face. Firstly, we are pretraining on ImageNet. And then we use the batch size with 64, 00 epochs and 0.0003 learning rate to train the ViT model.

Model	BS	Epoch	LR	Accuracy	precision	Recalll
ViT	64	300	0.003	98.66	98.78	96.45

6. Conclusion

In our paper, firstly, we built the ROS pig face dataset collection system. And then we collect 10 pig face images as the dataset. We employ the deep learning-based method named ViT to recognize the 10 pig face in our pig face dataset. Finally, we obtain the 98.66 Top-1 accuracy.

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