109年學年度深度學習期末專案
-臺灣牧場乳量預測-

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Deep Learning Final Project

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Introduction

This project focuses on predicting milk volume using different methods of deep learning. According to our pre-processing on our data, we not only manual reduce the blank sheet in csv, but also use feature extraction and quantization, the training data set will become 32494 cows and 10 features, then put the result into conventional SVM and LSTM training. Our final result on Aldea system, achieve loss of 5.591

Framework

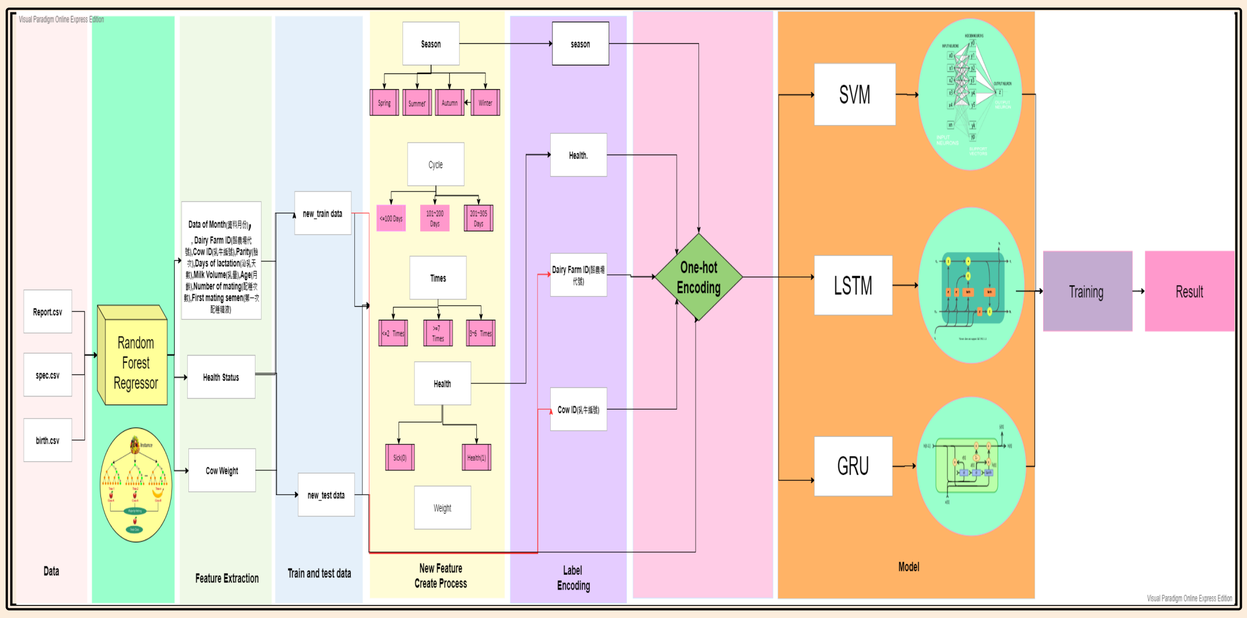

Fig. 1 Model flowchart

- Description

◆ Feature Extraction

According to our Random Forest Regressor Result, We choose the Data of Month(資料月份), Dairy Farm ID(酪農場代號),Cow ID(乳牛編號),Parity(胎次),Days of lactation(泌乳天數),Milk Volume(乳量),Age(月齡),Number of mating(配種次數),First mating semen(第一次配種精液) from the report file; Then use the Female Cow of Weight(母牛體重) from birth file. Besides, we also distinguish the cow health status from spec file.

◆ Create New feature

We create new 'season','cycle','times','health','weight' column in our train dataset

- Season- Use the month from report to divide into 4 season: Spring(3~5), Summer(6~8), Autumn(9~11), Winter(12~2)
- Cycle-Use the Days of lactation(泌乳天數) to divide them into three cycle: Cycle 1(<=100 Days), Cycle 2(101~200) , Cycle3(201~305)
- Times-Use the Parity(胎次) to divide them into three times:Time1(<=2), Time2(>=7), Time3(3~6)
- Health-Use the Health Status(健康狀況) to divide them into two cases: Sick(0), Health(1)
- Weight-Use the Female Cow of Weight(母牛體重) to our train data

◆ Label encoding

We will use label encoding to let different categorical to the number, so we use this way on Dairy Farm ID(酪農場代號), Cow ID(乳牛編號), Season, Health.

◆ One hot encoding

After we use the label encoding, we will use the one-hot encoding to produces a vector with length equal to the number of categories in the data set

◆ Model

Optimizer use adam. Learning rate initial is 0.001. Batch size is 64. Max epochs is 20.

- **SVM**

  A Support Vector Machine (SVM) is a supervised machine learning algorithm that can be employed for both classification and regression purposes.

- **LSTM**

An LSTM has a similar control flow as a recurrent neural network. It processes data passing on information as it propagates forward.

- **GRU**

The GRU is the newer generation of Recurrent Neural networks and is pretty similar to an LSTM. GRU's got rid of the cell state and used the hidden state to transfer information.

Results

- **Feature Extraction-RandomForest Regressor**

Variable	10	4_C	5	9	14	3	2	18	4_A	4_B	17
Importance	0.32	0.15	0.04	0.04	0.04	0.03	0.02	0.01	0.01	0.01	0.01

- **Our best model-LSTM**

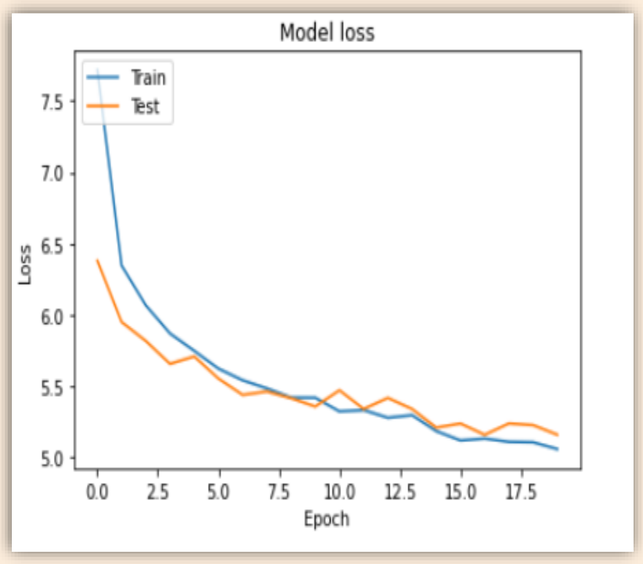

Fig.2 Model Loss

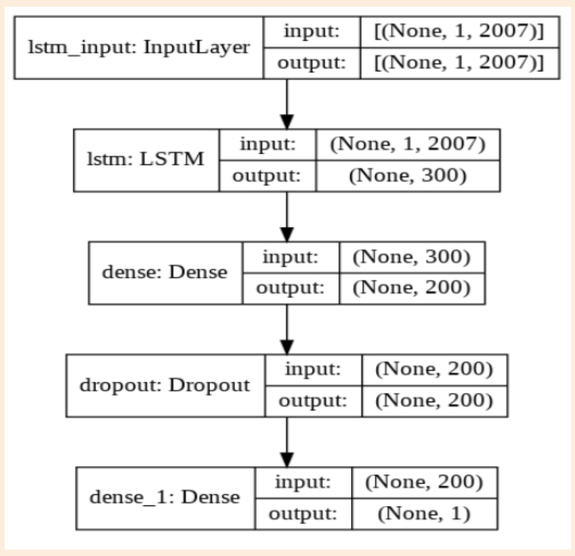

Fig.3 LSTM architecture

- **Compare Rmse loss in different method**

Method	RMSE Loss
SVM	5.665
LSTM	5.591
GRU	5.977

Table 1. Comparison of the proposed method with other methods

Conclusion

We use three method to train our model, The first method SVM is the conventional method, it's also our first way to build the complete model to see our pre-process of data. Then, we also adopt the TA suggestion to use the LSTM train our model. It's result better than our previous SVM model. Besides, we also use the new way-GRU which is similar to the LSTM. Although the result we experiments didn't work better than the result, we found its process time is short than LSTM. To sum up, our experiments reduce RMSE to 5.591.

In the future, maybe we still try to adopt embedding layer in our model to experiment this way can increase our model accuracy.