Final Project Proposal

Project: Milk yield prediction

Team 15

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-Methods

1. Data preprocessing

(1) Label encoding:

Here, one-hot encoding for the label encoding according to label type features (ex. 精液編號、酪農場代號…), and normalized the continuous ones in the range of [0, 1].

(2) Convert features into image:

In order to apply ResNet into non-image dataset, we have to design a kind of way converting source dataset into image-like dataset. After doing some literature review, we found a methodology, DeepInsight, to transform non-image data to image from Scientific Reports. The general concept of this method is putting the features that are highly “similar” to each other as neighbors on the image. (See the left part of figure below)

Recently, the most popular methods to measure the similarity between features within dataset are t-distributed stochastic neighbor embedding (t-SNE) and kernel principle component analysis (kPCA). We choose to apply t-SNE to dataset as the same method used in the essay. After t-SNE processing, we could get a 2D plane with lots of points that represent the location of features with respect to their similarities. Next we apply the convex hull algorithm to find the smallest rectangle containing all the points. Last but not least, because the image should be framed in a horizontal or vertical, we perform rotations to the convex hull, and finally get images which indicate transformation information from non-image data to image-like data. (figure

1.)

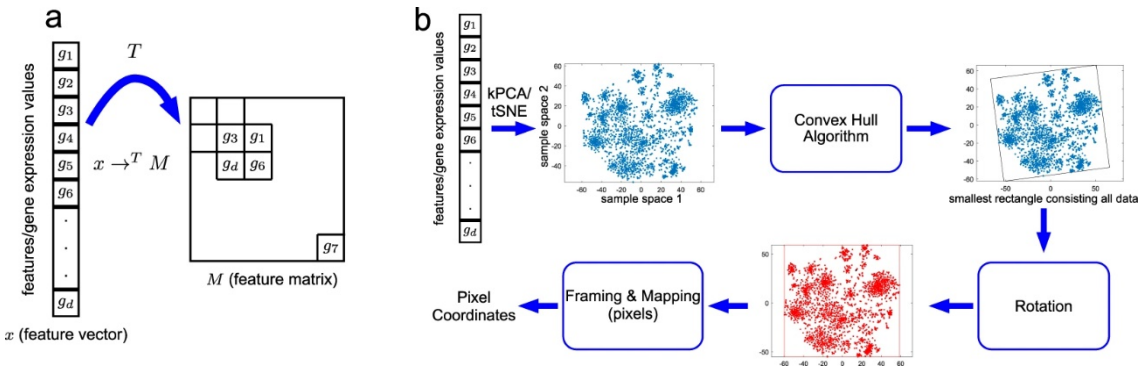

Figure 1.

2. Model

(1) ResNet framework:

Introducing ResNet into model has been successfully confirmed to take image classification problem into another level via the residual function and shortcut connection. Therefore, apply the network on the image-like input data is inferred to enhance model performance. The framework is showed in figure 2.

(2) Feed forward neural network:

After the residual network and down-sampling (average pooling), the high dimensional feature map ($\frac{k}{4} \times \frac{k}{4} \times 4m$) enters a feed-forward neural network, and returns an output with size 1.

(3) Prediction:

Mean squared error is chosen as the loss function according to the regression problem. Also, applying ensemble methods to optimize the model performance by aggregating 3~5 candidate models (e.g. averaged), it could result a more comprehensive model.

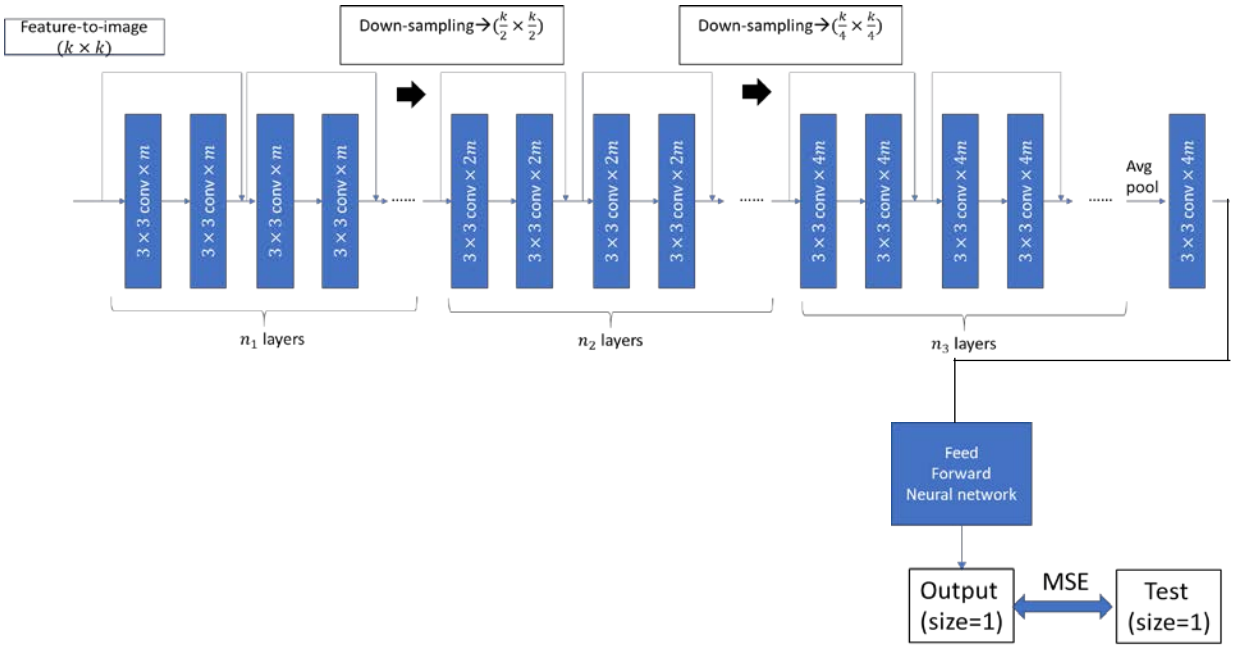

Figure 2.

[Reference]

1. DeepInsight: A methodology to transform a non-image data to an image for convolution neural network architecture https://www.nature.com/articles/s41598-019-47765-6)

2. Inception-v4, Inception-ResNet and the Impact of Residual Connections on Learning (Christian Szegedy Google Inc. 1600 Amphitheatre Pkwy, Mountain View, CA et.al) https://arxiv.org/pdf/1602.07261.pdf%3C/span%3E%3Cspan%3E)%3C/span%3E%3C/p%3E%3Cp%3E%3Cspan%3ECCF-GAIR