CYCLEGANS-
TRANSLATING IMAGES

END-TERM EVALUATION PRESENTATION

SNT Summer Project
2024

ICG

TIMELINE

WEEK 1
Python and its Libraries

WEEK 2
BASICS OF ML - Regression and Classification

WEEK 3
NEURAL NETWORK- From Scratch and Using Libraries

WEEK 4
CNN- Convolutional Neural Network

WEEK 5
Introduction to GANs- DCGAN

WEEK 6
Conditional GANs (cGAN)

WEEK 7
cGAN - Pix2Pix

WEEK 8
CycleGANs

WEEK 1

PYTHON AND ITS LIBRARIES

CycleGans project which is based on Machine Learning kickstarted with the very basics i.e. python and its libraries. We learned about python-syntax and all the tools for writing python programs efficiently.

ASSIGNMENT OVERVIEW

At the end of this week we did our first assignment which was based on setting our hands in python programming, numpy and pandas basics.

WEEK 2

BASICS OF ML ALGORITHMS

TOPICS COVERED

- >> DATA MODELING
- >> REGRESSION
- >> OVERFITTING
- >> REGULARIZATION
- >> CLOSED FORM SOLUTION
- >> GRADIENT DESCENT
- >> LOGISTIC REGRESSION
- >> K MEANS CLUSTERING
- >> PCA(PRINCIPAL COMPONENT ANALYSIS)

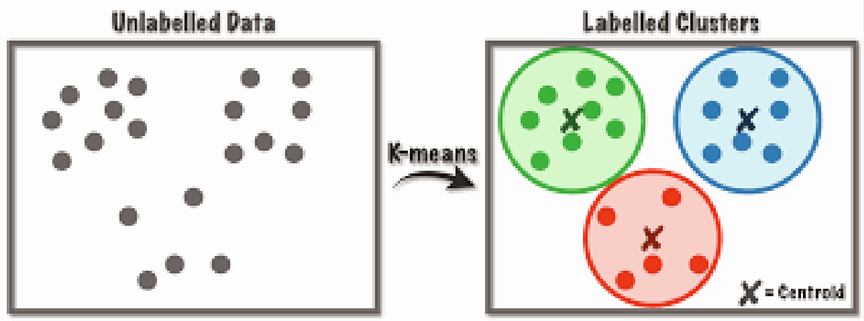
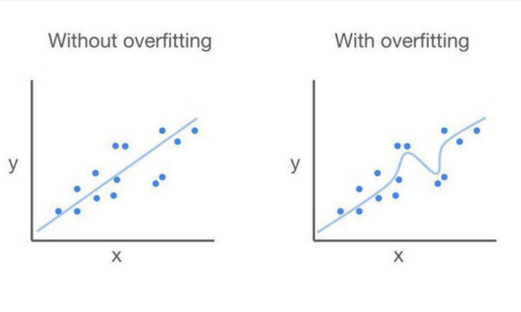
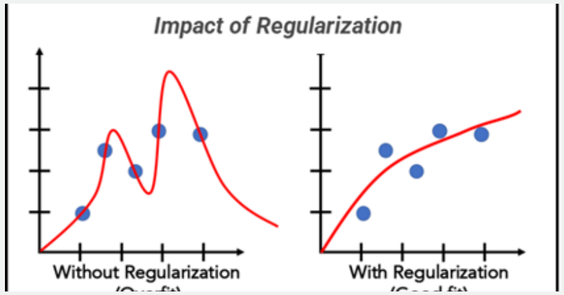


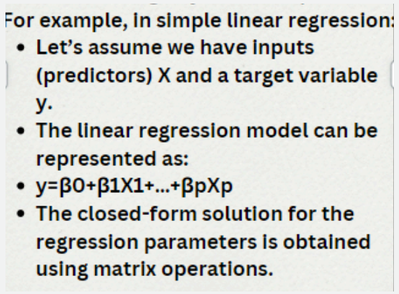
IMAGE EXPLAINING K MEANS CLUSTERING

WEEK 2

BASICS OF ML ALGORITHMS







>> OVERFITTING

>> REGULARIZATION

>> CLOSED FORM SOLUTION

>> CLASSIFICATION

>> BINARY CLASSIFICATION

In binary classification, the task involves categorizing data into two distinct classes.

>> MULTICLASS CLASSIFICATION

In multiclass classification,the goal is to categorize data into more than two classes.

ASSIGNMENT OVERVIEW

In this week we did assignments based on linear and logistic regression from scratch and as well as using libraries along with K-means clustering, closed form solution. It comprised of implementing Evaluation Metric(MSE, accuracy), Multiple Linear Regression, Normalization and use of Newton Raphson Method.

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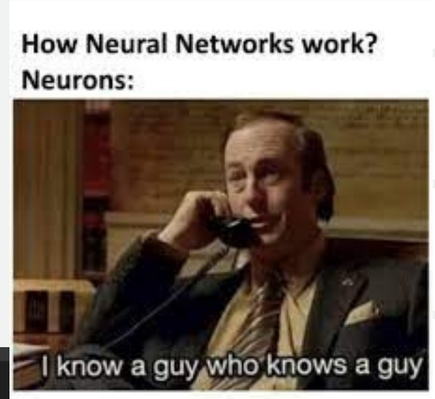
WEEK 3

NEURAL NETWORK

In week 3, we started neural networks and basic terminologies used optimizers (Adam, SGD, mini batch gradient descent),regularization techniques (L1, L2, dropout) and implemented neural networks from scratch and using libraries.




```
model=models.Sequential()

model.add(layers.Dense(2056,input_shape=(9,),activation='relu'))
model.add(layers.Dropout(0.2))

model.add(layers.Dense(1028,activation='relu'))
model.add(layers.Dropout(0.2))

model.add(layers.Dense(512,activation='relu'))
model.add(layers.Dropout(0.2))

model.add(layers.Dense(16,activation='softmax'))

model.compile(optimizer='adam',loss='sparse_categorical_crossentropy',metrics=['accuracy']
```

NEURAL NETWORK MODEL(CODE SNIPPET)

WEEK 3

NEURAL NETWORK

ASSIGNMENT OVERVIEW

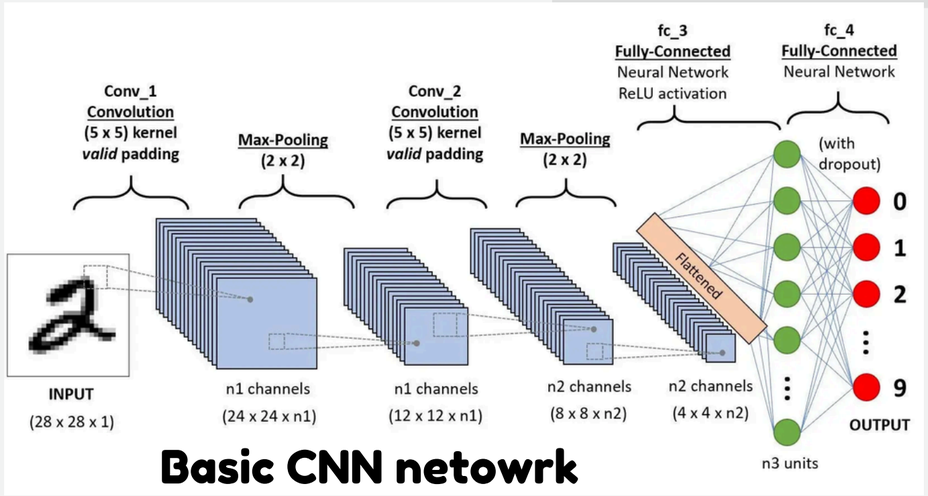
In this week, we did assignment which was divided into three parts. First part was based on theoretical part of neural networks and deep learning. Second part was based on implementation of neural network from scratch in a multiclass classification problem and third part involved data preprocessing, visualization and then training a neural network using tensorflow framework..

OFFLINE TEST

An offline test was also conducted at the end of this week which involved predictions of a feature from given many features by implementing neural network so as to ensure better understanding of the concept.

WEEK 4

CONVOLUTIONAL NEURAL NETWORK



Basic CNN netowrk

```
model=Sequential()

model.add(layers.Conv2D(filters=32,kernel_size=(3,3),input_shape=(128,128,3),activation='relu'
model.add(layers.MaxPooling2D((2,2)))

model.add(layers.Conv2D(filters=32,kernel_size=(3,3),activation='relu'))
model.add(layers.MaxPooling2D((2,2)))

model.add(layers.Flatten())

model.add(layers.Dense(64,activation='relu'))

model.add(layers.Dense(32,activation='relu'))

model.add(layers.Dense(3,activation='softmax'))
```

Code Snippet
(Representing CNN model)

In Week 4 , we learned about CNN which is mainly used to find patterns in images to recognize objects, classes and categories. We learned how to build a CNN model by applying convolution layers, pooling layers and then how to train the dataset using the created model. Before this we also learnt about data augmentation.

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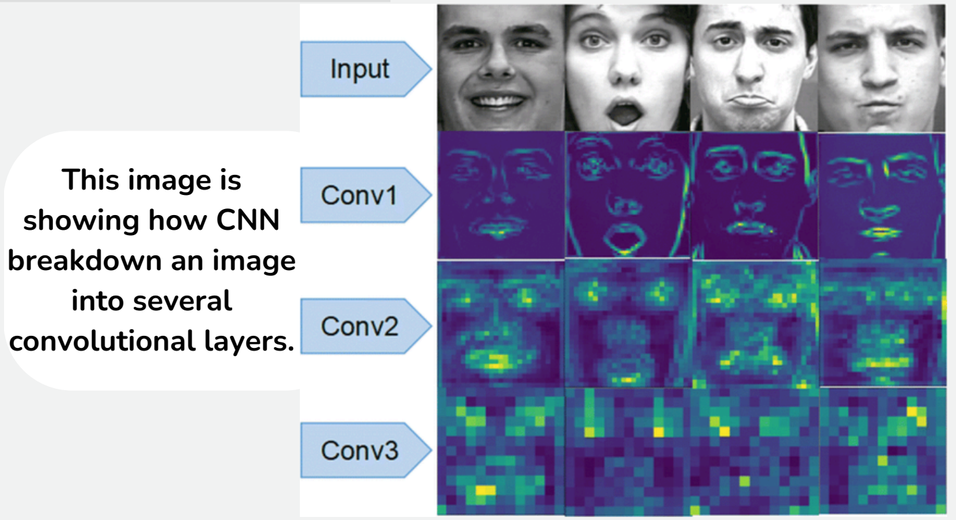
WEEK 4
CONVOLUTIONAL NEURAL NETWORK

ASSIGNMENT OVERVIEW

In this week, we are working on assignment which was divided into two parts. First part was based on implementing convolution filters and pooling layers. Second part was based on using visualization libraries to see how data augmentation works and training a CNN model and evaluating test data using multiple models(Transfer Learning also)



This image is showing how CNN breakdown an image into several convolutional layers.

OFFLINE TEST

An offline test was also conducted which involved predictions of a disease of plants from given testing dataset images features by training a CNN model on given training dataset images.

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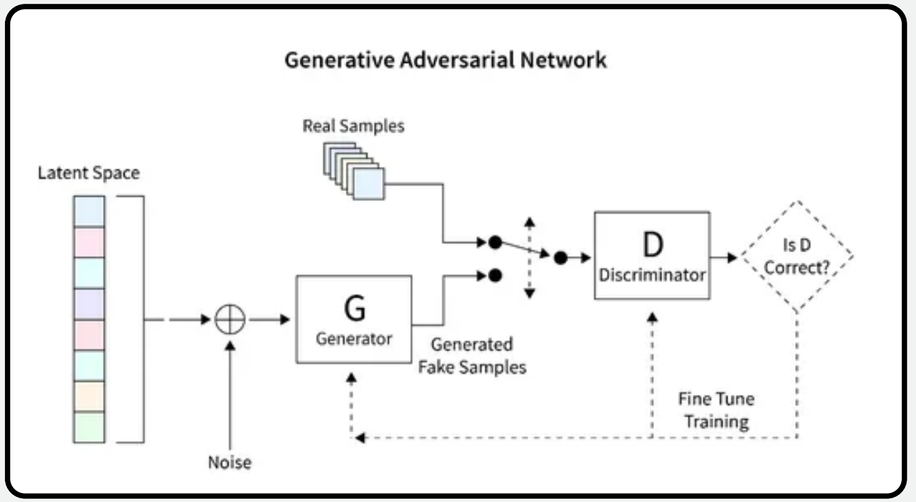
WEEK 5

Intro to GANs- DCGANs

Generative Adversarial Networks (GANs) are one of the most interesting ideas in computer science today. Two models are trained simultaneously by an adversarial process. A generator learns to create images that look real, while a discriminator learns to tell real images apart from fakes.

During training, the generator progressively becomes better at creating images that look real, while the discriminator becomes better at telling them apart. The process reaches equilibrium when the discriminator can no longer distinguish real images from fakes.



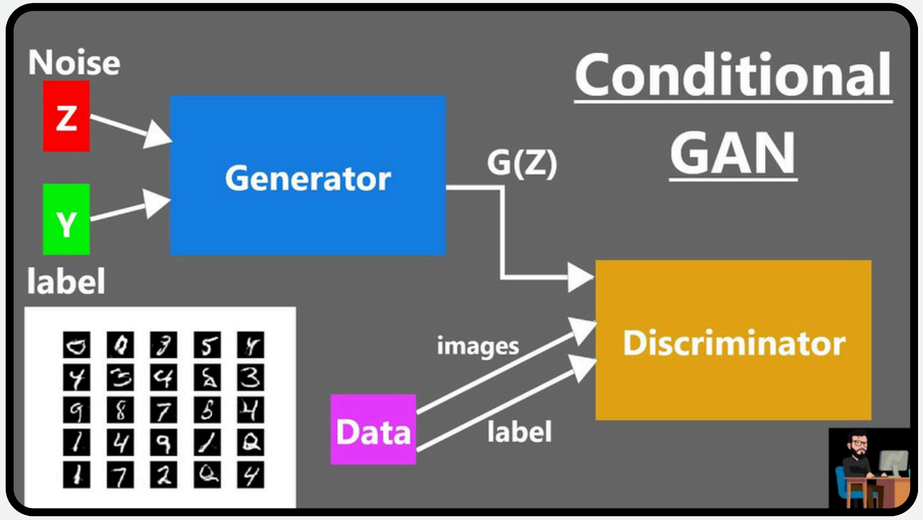
ASSIGNMENT OVERVIEW

In this week we implemented GANs on a dataset of typed letters in various fonts of the English alphabet. The task was to train a model which could generate images of English letters. Preprocessing steps included normalisation. A '.h5' file was obtained by training for approximately 1000 epochs which could be used for generating the required images.

WEEK 6
Conditional GANs(cGAN)

Conditional GANs are an extension of traditional GANs that incorporate additional information, or a condition, into the generation process. This condition can be anything from a class label, text description, or even another image. Both the generator and discriminator receive the condition as input along with their usual inputs (random noise for the generator, real or fake images for the discriminator).

The generator learns to produce outputs that match the given condition and the discriminator learns to distinguish between real and fake images while also considering the given condition.

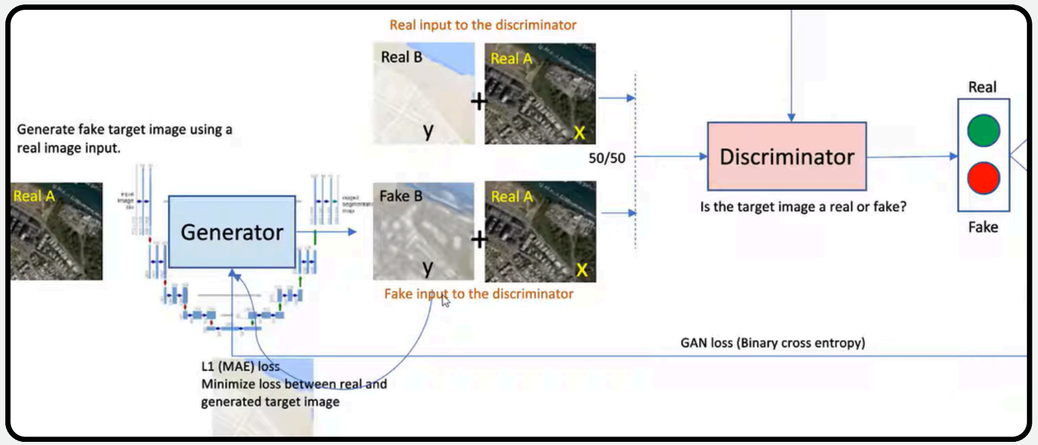


ASSIGNMENT OVERVIEW

In this week we implemented a conditional GAN to generate images of the digit between 0 to 9 that we will provide as input the steps included preprocessing like normalization, defining the cGAN with some initial hyperparameters, hyperparameter tuning and testing. It was trained upon MNIST dataset.

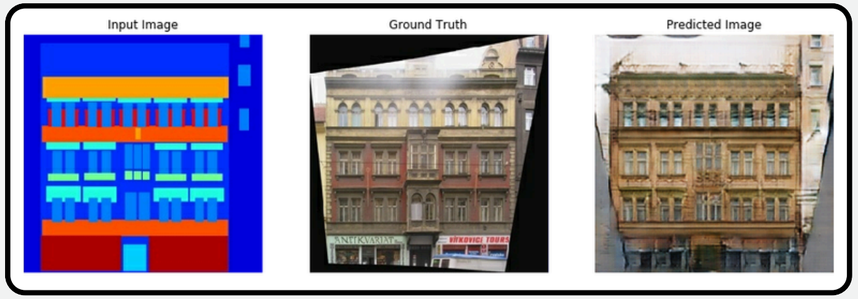
WEEK 7
cGAN - Pix2Pix

In this week we learnt about Pix2Pix model to perform image-to-image translation done using paired examples, we also learnt generator architecture which is U net and discriminator architecture patch GANs and also came across different loss function in generator loss called as L1 (Mean Absolute Error) loss



ASSIGNMENT OVERVIEW

In this week we also implemented this model on the facades dataset.We focused on tasks like converting sketches to colored images. Preprocessing steps included jittering, cropping, and normalization. The model was trained using adversarial loss and L1 loss to ensure high-quality image translations.



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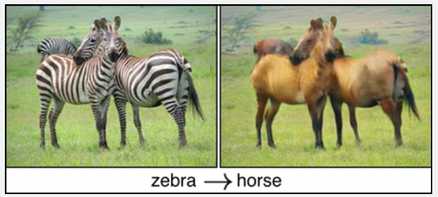
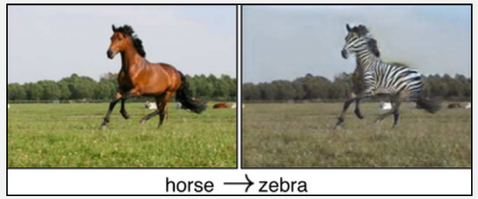
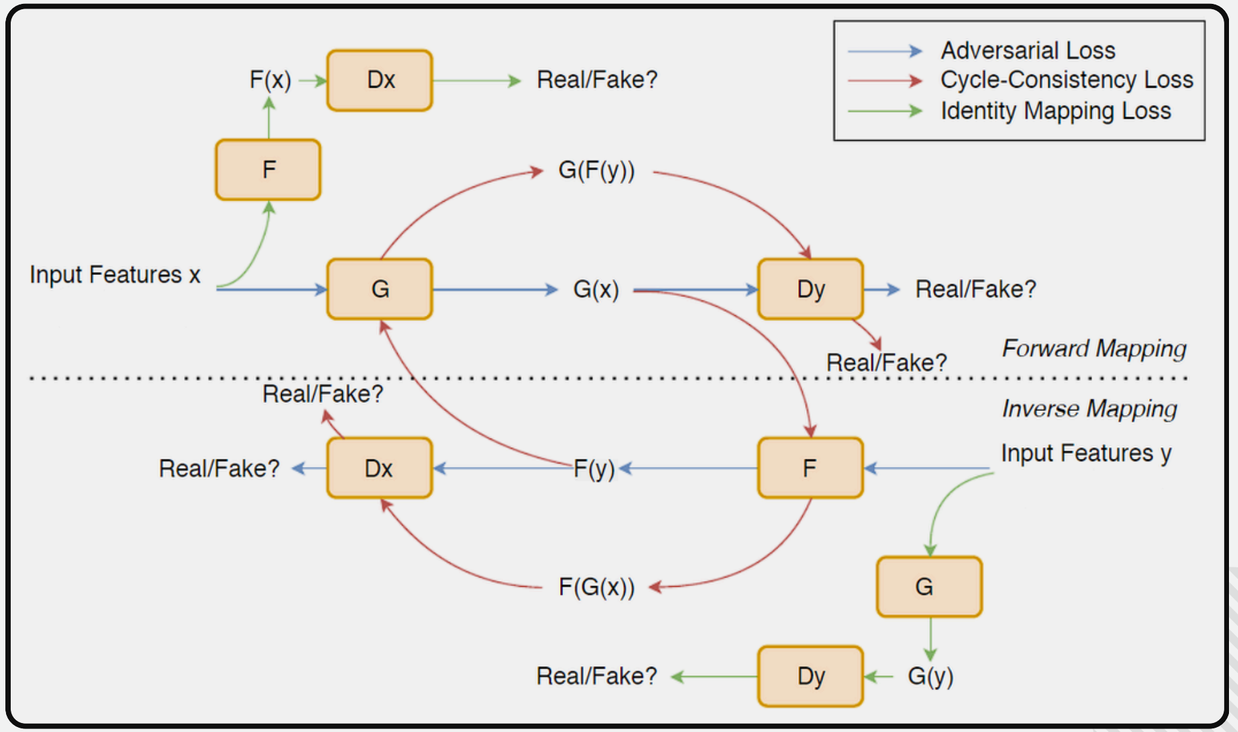
WEEK 8
CycleGANs

In Week 8, we learned about CycleGANs, which is primarily used for image-to-image translation tasks without needing paired examples. We also went through the implementation of CycleGANs and learned about various loss functions namely adversarial loss, cycle consistency loss and identity loss. These loss functions play a crucial role in stabilizing the training process of the two generators and discriminators, thereby resulting in the production of high-quality image-to-image translations.







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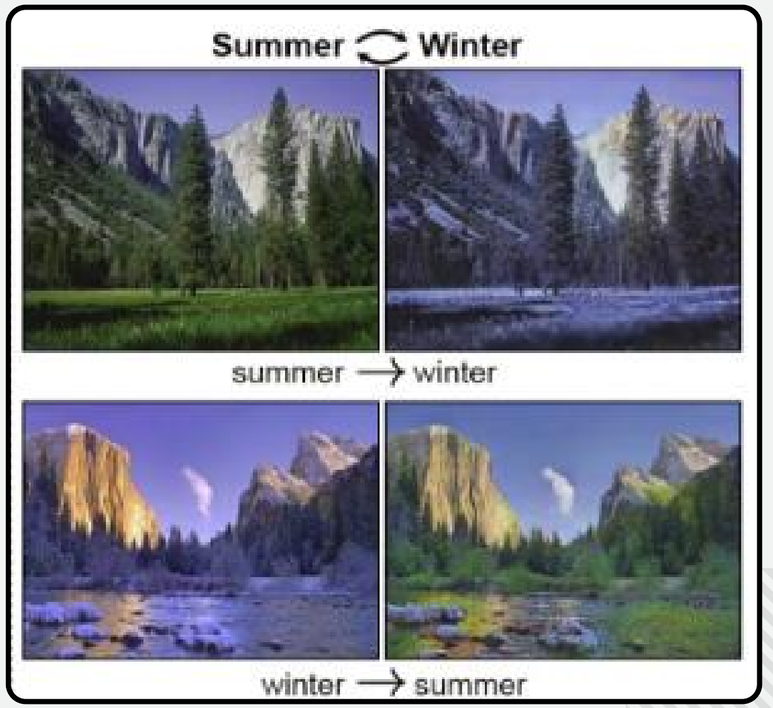
WEEK 8
CycleGANs

ASSIGNMENT OVERVIEW

In this week, we did assignment based on the implementation of CycleGANs for translating the images of summer landscape to winter landscape and vice versa.
We performed various preprocessing tasks on the given images like jittering, cropping, normalization, etc. and then trained our model with the preprocesssed images using loss functions such as adversarial loss, cycle consistency loss and identity loss which were essential for stabilizing the training process and achieving high-quality image translations.



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THANK YOU

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