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import os
import glob
import pandas as pd
import torch
import torch.nn as nn
from torch.utils.data import Dataset
import torch.nn.functional as F
from scipy import signal
from scipy.io import wavfile
import matplotlib.pyplot as plt
from imutils.object_detection import non_max_suppression
from torch.utils.data import Dataset, DataLoader
from collections import defaultdict
from torchvision import transforms
import cv2
import imgproc
from PIL import Image
import numpy as np
from tqdm import tqdm
import torch.optim as optim
from torch.nn import CTCLoss
from scipy.special import logsumexp

train_data = pd.read_csv('./Data/train_data_new.csv')
val_data = pd.read_csv('./Data/val_data.csv')
train_img = './Data/Train'
val_img = './Data/Validation'
max_len = 0
for i in train_data['labels']:
    if type(i) != str:
        print(i)
    else:
        if len(i) > max_len:
            max_len = len(i)
print(max_len)

unique = set()
for index, row in train_data.iterrows():
    unique.update(set(row['labels']))
    if '<' in set(row['labels']):
        print(index, row['labels'])
print(unique)

alphabets = list(unique)

17
{'H', 'J', ')', 'M', 'B', '-', 'x', ', ', 'z', 'N', 'd', 't', 'F', 'ú',
's', 'R', 'a', '(', 'n', 'í', 'l', 'G', 'e', 'Q', 'S', 'u', 'á', 'Y',
'0', 'D', ';', 'q', 'y', 'g', 'V', 'A', 'ó', 'P', 'i', 'C', 'r', 'E',

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```
'b', 'ñ', 'c', 'h', 'I', 'v', 'f', 'é', 'o', ':', 'U', 'p', 'j', 'T',  
'L', '.', 'm']
```

```
for i, r in train_data.iterrows():  
    x=r['labels']  
    if "<" in x:  
        print(i, x)
```

```
CHAR=list(alphabets)  
print(len(CHAR))  
CHAR2LABEL = {char: i + 1 for i, char in enumerate(CHAR)}  
LABEL2CHAR = {label: char for char, label in CHAR2LABEL.items()}  
LABEL2CHAR[0] = ""
```

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```
target = [CHAR2LABEL[c] for c in "ync;"]  
target
```

```
[33, 19, 45, 31]
```

```
x=torch.LongTensor([target])  
x = torch.nn.functional.pad(x, (0, 17-len(target)), mode='constant',  
value=0)  
x
```

```
tensor([[33, 19, 45, 31, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,  
0, 0]])
```

```
class OCRDataset(Dataset):  
    def __init__(self, csv_file, class_name=None, transform=None):  
        self.data = pd.read_csv(csv_file)  
        self.transform = transform  
        self.class_name=class_name  
  
    def __len__(self):  
        return len(self.data)  
  
    def __getitem__(self, idx):  
        img_name = self.data.iloc[idx, 0]  
        if self.class_name == "train":  
            img_name = "./Data/Train/"+img_name  
        elif self.class_name == "val":  
            img_name = "./Data/Validation/"+img_name  
        else:  
            print("enter valid class name")  
        image = Image.open(img_name)  
        label = self.data.iloc[idx, 1]  
  
        target= [CHAR2LABEL[c] for c in label]  
        target_length = [len(target)]
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        target = torch.LongTensor(target)
        target = torch.nn.functional.pad(target, (0, max_len-
target_length[0]), mode='constant', value=0)
        target_length = torch.LongTensor(target_length)

        if self.transform:
            image = self.transform(image)

        return image, target, target_length

img_height=64
img_width=160

transform = transforms.Compose([
    transforms.Resize((img_height, img_width)), # Resize image to a
fixed size
    transforms.ToTensor(), # Convert image to tensor
])

train_dataset = OCRDataset(csv_file='./Data/train_data_new.csv',
class_name="train", transform=transform)
val_dataset = OCRDataset(csv_file='./Data/val_data.csv',
class_name="val", transform=transform)
train_loader = DataLoader(train_dataset, batch_size=32, shuffle=True)
val_loader = DataLoader(val_dataset, batch_size=32, shuffle=False)

device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
print(f'device: {device}')

device: cuda

class CRNN(nn.Module):

    def __init__(self, img_channel, img_height, img_width, num_class,
map_to_seq_hidden=64, rnn_hidden=256, leaky_relu=False):
        super(CRNN, self).__init__()

        self.cnn, (output_channel, output_height, output_width) =
self._cnn_backbone(img_channel, img_height, img_width, leaky_relu)

        self.map_to_seq = nn.Linear(output_channel * output_height,
map_to_seq_hidden)

        self.rnn1 = nn.LSTM(map_to_seq_hidden, rnn_hidden,
bidirectional=True)
        self.rnn2 = nn.LSTM(2 * rnn_hidden, rnn_hidden,
bidirectional=True)

        self.dense = nn.Linear(2 * rnn_hidden, num_class)

    def _cnn_backbone(self, img_channel, img_height, img_width,

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leaky_relu):
    assert img_height % 16 == 0
    assert img_width % 4 == 0

    # channels = [img_channel, 64, 128, 256, 256, 512, 512, 512]
    channels = [img_channel, 32, 64, 256, 256, 512, 512, 512]
    kernel_sizes = [3, 3, 3, 3, 3, 3, 2]
    strides = [1, 1, 1, 1, 1, 1, 1]
    paddings = [1, 1, 1, 1, 1, 1, 0]

    cnn = nn.Sequential()

    def conv_relu(i, batch_norm=False):
        # shape of input: (batch, input_channel, height, width)
        input_channel = channels[i]
        output_channel = channels[i+1]

        cnn.add_module(
            f'conv{i}',
            nn.Conv2d(input_channel, output_channel,
kernel_sizes[i], strides[i], paddings[i])
        )

        if batch_norm:
            cnn.add_module(f'batchnorm{i}',
nn.BatchNorm2d(output_channel))

        relu = nn.LeakyReLU(0.2, inplace=True) if leaky_relu else
nn.ReLU(inplace=True)
        cnn.add_module(f'relu{i}', relu)

        # size of image: (channel, height, width) = (img_channel,
img_height, img_width)
        conv_relu(0)
        cnn.add_module('pooling0', nn.MaxPool2d(kernel_size=2,
stride=2))
        # (64, img_height // 2, img_width // 2)

        conv_relu(1)
        cnn.add_module('pooling1', nn.MaxPool2d(kernel_size=2,
stride=2))
        # (128, img_height // 4, img_width // 4)

        conv_relu(2)
        conv_relu(3)
        cnn.add_module(
            'pooling2',
            nn.MaxPool2d(kernel_size=(2, 1))
        ) # (256, img_height // 8, img_width // 4)

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        conv_relu(4, batch_norm=True)
        conv_relu(5, batch_norm=True)
        cnn.add_module(
            'pooling3',
            nn.MaxPool2d(kernel_size=(2, 1))
        ) # (512, img_height // 16, img_width // 4)

        conv_relu(6) # (512, img_height // 16 - 1, img_width // 4 -
1)

        output_channel, output_height, output_width = channels[-1],
img_height // 16 - 1, img_width // 4 - 1

        return cnn, (output_channel, output_height, output_width)

def forward(self, images):
    # shape of images: (batch, channel, height, width)

    conv = self.cnn(images)
    batch, channel, height, width = conv.size()

    conv = conv.view(batch, channel * height, width)
    conv = conv.permute(2, 0, 1) # (width, batch, feature)
    seq = self.map_to_seq(conv)

    recurrent, _ = self.rnn1(seq)
    recurrent, _ = self.rnn2(recurrent)

    output = self.dense(recurrent)
    return output # shape: (seq_len, batch, num_class)

common_config = {
    'data_dir': 'data/mnt/ramdisk/max/90kDICT32px/',
    'img_width': 100,
    'img_height': 32,
    'map_to_seq_hidden': 64,
    'rnn_hidden': 256,
    'leaky_relu': False,
}

num_class = len(LABEL2CHAR) + 1
reload_checkpoint="./torch_checkpoints/22_3_24-14/crnn1_020000_loss0.9
203662287679987.pt"
crnn = CRNN(3, img_height, img_width, num_class,
            map_to_seq_hidden=common_config['map_to_seq_hidden'],
            rnn_hidden=common_config['rnn_hidden'],
            leaky_relu=common_config['leaky_relu'])
# if reload_checkpoint:
#     crnn.load_state_dict(torch.load(reload_checkpoint,

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map_location=device))
crnn.to(device)

CRNN(
  (cnn): Sequential(
    (conv0): Conv2d(3, 32, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1))
    (relu0): ReLU(inplace=True)
    (pooling0): MaxPool2d(kernel_size=2, stride=2, padding=0,
dilation=1, ceil_mode=False)
    (conv1): Conv2d(32, 64, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1))
    (relu1): ReLU(inplace=True)
    (pooling1): MaxPool2d(kernel_size=2, stride=2, padding=0,
dilation=1, ceil_mode=False)
    (conv2): Conv2d(64, 256, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1))
    (relu2): ReLU(inplace=True)
    (conv3): Conv2d(256, 256, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1))
    (relu3): ReLU(inplace=True)
    (pooling2): MaxPool2d(kernel_size=(2, 1), stride=(2, 1),
padding=0, dilation=1, ceil_mode=False)
    (conv4): Conv2d(256, 512, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1))
    (batchnorm4): BatchNorm2d(512, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
    (relu4): ReLU(inplace=True)
    (conv5): Conv2d(512, 512, kernel_size=(3, 3), stride=(1, 1),
padding=(1, 1))
    (batchnorm5): BatchNorm2d(512, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
    (relu5): ReLU(inplace=True)
    (pooling3): MaxPool2d(kernel_size=(2, 1), stride=(2, 1),
padding=0, dilation=1, ceil_mode=False)
    (conv6): Conv2d(512, 512, kernel_size=(2, 2), stride=(1, 1))
    (relu6): ReLU(inplace=True)
  )
  (map_to_seq): Linear(in_features=1536, out_features=64, bias=True)
  (rnn1): LSTM(64, 256, bidirectional=True)
  (rnn2): LSTM(512, 256, bidirectional=True)
  (dense): Linear(in_features=512, out_features=61, bias=True)
)

train_config = {
  'epochs': 200,
  'train_batch_size': 32,
  'eval_batch_size': 512,
  'lr': 0.0005,
  'show_interval': 10,

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        'valid_interval': 500,
        'save_interval': 50,
        'cpu_workers': 4,
        'reload_checkpoint':
"./torch_checkpoints/22_3_24-14/crnn1_020000_loss0.7374361485085437.pt",
        'valid_max_iter': 100,
        'decode_method': 'beam_search',
        'beam_size': 10,
        'checkpoints_dir': './torch_checkpoints/22_3_24-14'
    }

optimizer = optim.RMSprop(crnn.parameters(), lr=train_config['lr'])
criterion = CTCLoss(reduction='sum', zero_infinity=True)
criterion.to(device)

CTCLoss()

NINF = -1 * float('inf')
DEFAULT_EMISSION_THRESHOLD = 0.01

def _reconstruct(labels, blank=0):
    new_labels = []
    # merge same labels
    previous = None
    for l in labels:
        if l != previous:
            new_labels.append(l)
            previous = l
    # delete blank
    new_labels = [l for l in new_labels if l != blank]

    return new_labels

def greedy_decode(emission_log_prob, blank=0, **kwargs):
    labels = np.argmax(emission_log_prob, axis=-1)
    labels = _reconstruct(labels, blank=blank)
    return labels

def beam_search_decode(emission_log_prob, blank=0, **kwargs):
    beam_size = kwargs['beam_size']
    emission_threshold = kwargs.get('emission_threshold',
np.log(DEFAULT_EMISSION_THRESHOLD))

    length, class_count = emission_log_prob.shape

    beams = ([[]], 0) # (prefix, accumulated_log_prob)
    for t in range(length):
        new_beams = []
        for prefix, accumulated_log_prob in beams:

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        for c in range(class_count):
            log_prob = emission_log_prob[t, c]
            if log_prob < emission_threshold:
                continue
            new_prefix = prefix + [c]
            #  $\log(p_1 * p_2) = \log p_1 + \log p_2$ 
            new_accu_log_prob = accumulated_log_prob + log_prob
            new_beams.append((new_prefix, new_accu_log_prob))

        # sorted by accumulated_log_prob
        new_beams.sort(key=lambda x: x[1], reverse=True)
        beams = new_beams[:beam_size]

    # sum up beams to produce labels
    total_accu_log_prob = {}
    for prefix, accu_log_prob in beams:
        labels = tuple(_reconstruct(prefix, blank))
        #  $\log(p_1 + p_2) = \log \sum \exp([\log p_1, \log p_2])$ 
        total_accu_log_prob[labels] = \
            logsumexp([accu_log_prob, total_accu_log_prob.get(labels,
NINF)])

    labels_beams = [(list(labels), accu_log_prob)
                     for labels, accu_log_prob in
total_accu_log_prob.items()]
    labels_beams.sort(key=lambda x: x[1], reverse=True)
    labels = labels_beams[0][0]

    return labels

def prefix_beam_decode(emission_log_prob, blank=0, **kwargs):
    beam_size = kwargs['beam_size']
    emission_threshold = kwargs.get('emission_threshold',
np.log(DEFAULT_EMISSION_THRESHOLD))

    length, class_count = emission_log_prob.shape

    beams = [(tuple(), (0, NINF))] # (prefix, (blank_log_prob,
non_blank_log_prob))
    # initial of beams: (empty_str, (log(1.0), log(0.0)))

    for t in range(length):
        new_beams_dict = defaultdict(lambda: (NINF, NINF)) # log(0.0)
        = NINF

        for prefix, (lp_b, lp_nb) in beams:
            for c in range(class_count):
                log_prob = emission_log_prob[t, c]
                if log_prob < emission_threshold:
                    continue

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        end_t = prefix[-1] if prefix else None

        # if new_prefix == prefix
        new_lp_b, new_lp_nb = new_beams_dict[prefix]

        if c == blank:
            new_beams_dict[prefix] = (
                logsumexp([new_lp_b, lp_b + log_prob, lp_nb +
log_prob]),
                new_lp_nb
            )
            continue
        if c == end_t:
            new_beams_dict[prefix] = (
                new_lp_b,
                logsumexp([new_lp_nb, lp_nb + log_prob])
            )

        # if new_prefix == prefix + (c,)
        new_prefix = prefix + (c,)
        new_lp_b, new_lp_nb = new_beams_dict[new_prefix]

        if c != end_t:
            new_beams_dict[new_prefix] = (
                new_lp_b,
                logsumexp([new_lp_nb, lp_b + log_prob, lp_nb +
log_prob])
            )
        else:
            new_beams_dict[new_prefix] = (
                new_lp_b,
                logsumexp([new_lp_nb, lp_b + log_prob])
            )

        # sorted by log(blank_prob + non_blank_prob)
        beams = sorted(new_beams_dict.items(), key=lambda x:
logsumexp(x[1]), reverse=True)
        beams = beams[:beam_size]

        labels = list(beams[0][0])
        return labels

def ctc_decode(log_probs, label2char=None, blank=0,
method='beam_search', beam_size=10):
    emission_log_probs =
np.transpose(log_probs.detach().cpu().numpy(), (1, 0, 2))
    # size of emission_log_probs: (batch, length, class)

    decoders = {

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        'greedy': greedy_decode,
        'beam_search': beam_search_decode,
        'prefix_beam_search': prefix_beam_decode,
    }
    decoder = decoders[method]

    decoded_list = []
    for emission_log_prob in emission_log_probs:
        decoded = decoder(emission_log_prob, blank=blank,
beam_size=beam_size)
        if label2char:
            decoded = [label2char[l] for l in decoded]
        decoded_list.append(decoded)
    return decoded_list

def train_batch(crnn, data, optimizer, criterion, device):
    crnn.train()
    images, targets, target_lengths = [d.to(device) for d in data]

    logits = crnn(images)
    log_probs = torch.nn.functional.log_softmax(logits, dim=2)

    batch_size = images.size(0)
    input_lengths = torch.LongTensor([logits.size(0)] * batch_size)
    target_lengths = torch.flatten(target_lengths)

    loss = criterion(log_probs, targets, input_lengths,
target_lengths)

    optimizer.zero_grad()
    loss.backward()
    torch.nn.utils.clip_grad_norm_(crnn.parameters(), 5) # gradient
clipping with 5
    optimizer.step()
    return loss.item()

def evaluate(crnn, dataloader, criterion,
            max_iter=None, decode_method='beam_search',
beam_size=10):
    crnn.eval()

    tot_count = 0
    tot_loss = 0
    tot_correct = 0
    wrong_cases = []

    pbar_total = max_iter if max_iter else len(dataloader)
    pbar = tqdm(total=pbar_total, desc="Evaluate")

    with torch.no_grad():

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        for i, data in enumerate(dataloader):
            if max_iter and i >= max_iter:
                break
            device = 'cuda' if next(crnn.parameters()).is_cuda else
'cpu'

            images, targets, target_lengths = [d.to(device) for d in
data]

            logits = crnn(images)
            log_probs = torch.nn.functional.log_softmax(logits, dim=2)

            batch_size = images.size(0)
            input_lengths = torch.LongTensor([logits.size(0)] *
batch_size)

            loss = criterion(log_probs, targets, input_lengths,
target_lengths)

            preds = ctc_decode(log_probs, method=decode_method,
beam_size=beam_size)
            reals = targets.cpu().numpy().tolist()
            target_lengths = target_lengths.cpu().numpy().tolist()

            tot_count += batch_size
            tot_loss += loss.item()
            target_length_counter = 0
            # i=0
            for pred, real, target_length in zip(preds, reals,
target_lengths):
                # print(pred)
                # print(target_length)
                # print(real)
                # print("-----")
                real = real[0:target_length[0]]
                # print(real)
                #
print("!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
")

                # target_length_counter += target_length[0]
                if pred == real:
                    tot_correct += 1
                else:
                    wrong_cases.append((real, pred))
                # i+=1

            pbar.update(1)
            pbar.close()

evaluation = {

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        'loss': tot_loss / tot_count,
        'acc': tot_correct / tot_count,
        'wrong_cases': wrong_cases
    }
    return evaluation

i = 1
for epoch in range(1, train_config['epochs'] + 1):
    print(f'epoch: {epoch}')
    tot_train_loss = 0.
    tot_train_count = 0
    for train_data in train_loader:
        loss = train_batch(crnn, train_data, optimizer, criterion,
device)
        train_size = train_data[0].size(0)

        tot_train_loss += loss
        tot_train_count += train_size
        if i % train_config['show_interval'] == 0:
            print('train_batch_loss[', i, ']: ', loss / train_size)

        if i % train_config['valid_interval'] == 0:
            evaluation = evaluate(crnn, val_loader, criterion,
decode_method=train_config['decode_method'],
beam_size=train_config['beam_size'])
            print('valid_evaluation: loss={loss},
acc={acc}'.format(**evaluation))

            if i % train_config['save_interval'] == 0:
                prefix = 'crnn1'
                loss = evaluation['loss']
                save_model_path =
os.path.join(train_config['checkpoints_dir'],
f'{prefix}_{i:06}_loss{loss}.pt')
                torch.save(crnn.state_dict(), save_model_path)
                print('save model at ', save_model_path)

            i += 1

    print('train_loss: ', tot_train_loss / tot_train_count)

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epoch: 1
train_batch_loss[ 10 ]: 19.372303009033203

train_batch_loss[ 20 ]: 7.483538627624512
train_batch_loss[ 30 ]: 5.671645164489746
train_batch_loss[ 40 ]: 3.922644853591919
train_batch_loss[ 50 ]: 3.880770444869995

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train_batch_loss[ 60 ]: 3.2430238723754883
train_batch_loss[ 70 ]: 2.607043743133545
train_batch_loss[ 80 ]: 2.621840238571167
train_batch_loss[ 90 ]: 2.2539937496185303
train_batch_loss[ 100 ]: 2.0676589012145996
train_loss: 9.238951490999497
epoch: 2
train_batch_loss[ 110 ]: 1.0349032878875732
train_batch_loss[ 120 ]: 1.1241497993469238
train_batch_loss[ 130 ]: 0.48435676097869873
train_batch_loss[ 140 ]: 0.5460381507873535
train_batch_loss[ 150 ]: 0.3112417459487915
train_batch_loss[ 160 ]: 1.5099823474884033
train_batch_loss[ 170 ]: 0.5344560146331787
train_batch_loss[ 180 ]: 0.6993008255958557
train_batch_loss[ 190 ]: 0.3589324951171875
train_batch_loss[ 200 ]: 0.425456702709198
train_loss: 0.6760072655978144
epoch: 3
train_batch_loss[ 210 ]: 0.20357877016067505
train_batch_loss[ 220 ]: 0.20573048293590546
train_batch_loss[ 230 ]: 0.5479603409767151
train_batch_loss[ 240 ]: 0.06727345287799835
train_batch_loss[ 250 ]: 0.03894031047821045
train_batch_loss[ 260 ]: 0.28733325004577637
train_batch_loss[ 270 ]: 0.4901096820831299
train_batch_loss[ 280 ]: 0.02140367031097412
train_batch_loss[ 290 ]: 0.38331887125968933
train_batch_loss[ 300 ]: 0.07707279175519943
train_loss: 0.2715784898780861
epoch: 4
train_batch_loss[ 310 ]: 0.047732945531606674
train_batch_loss[ 320 ]: 0.0364430695772171
train_batch_loss[ 330 ]: 0.29401567578315735
train_batch_loss[ 340 ]: 0.015220015309751034
train_batch_loss[ 350 ]: 0.03525819629430771
train_batch_loss[ 360 ]: 0.08738775551319122
train_batch_loss[ 370 ]: 0.03228221833705902
train_batch_loss[ 380 ]: 0.023368297144770622
train_batch_loss[ 390 ]: 0.05619054287672043
train_batch_loss[ 400 ]: 0.07008052617311478
train_loss: 0.10056971094029939
epoch: 5
train_batch_loss[ 410 ]: 0.13262337446212769
train_batch_loss[ 420 ]: 0.005948426201939583
train_batch_loss[ 430 ]: 0.030007749795913696
train_batch_loss[ 440 ]: 0.0120000708848238
train_batch_loss[ 450 ]: 0.13480237126350403
train_batch_loss[ 460 ]: 0.05024081468582153
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train_batch_loss[ 470 ]: 0.031314171850681305
train_batch_loss[ 480 ]: 0.01593147963285446
train_batch_loss[ 490 ]: 0.1164996474981308
train_batch_loss[ 500 ]: 0.0029667445924133062
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 19.88it/s]
```

```
valid_evaluation: loss=0.6897785509136362, acc=0.8901408450704226
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_000500_loss0.6897785509136362.pt
```

```
train_loss: 0.058696156848586055
```

```
epoch: 6
```

```
train_batch_loss[ 510 ]: 0.0809255987405777
train_batch_loss[ 520 ]: 0.017460910603404045
train_batch_loss[ 530 ]: 0.038562994450330734
train_batch_loss[ 540 ]: 0.001790744485333562
train_batch_loss[ 550 ]: 0.007386916317045689
train_batch_loss[ 560 ]: 0.005571088753640652
train_batch_loss[ 570 ]: 0.37470731139183044
train_batch_loss[ 580 ]: 0.006793775595724583
train_batch_loss[ 590 ]: 0.0015091741224750876
train_batch_loss[ 600 ]: 0.04163285344839096
train_loss: 0.031865212570729336
```

```
epoch: 7
```

```
train_batch_loss[ 610 ]: 0.25154417753219604
train_batch_loss[ 620 ]: 0.0022244970314204693
train_batch_loss[ 630 ]: 0.002843213267624378
train_batch_loss[ 640 ]: 0.0018515628762543201
train_batch_loss[ 650 ]: 0.0002744632656686008
train_batch_loss[ 660 ]: 0.010295633226633072
train_batch_loss[ 670 ]: 0.0021177686285227537
train_batch_loss[ 680 ]: 0.008272813633084297
train_batch_loss[ 690 ]: 0.029299171641469002
train_batch_loss[ 700 ]: 0.0047134291380643845
train_loss: 0.013777599834984292
```

```
epoch: 8
```

```
train_batch_loss[ 710 ]: 0.0008343457011505961
train_batch_loss[ 720 ]: 0.17940367758274078
train_batch_loss[ 730 ]: 0.0017866845009848475
train_batch_loss[ 740 ]: 0.00434489781036973
train_batch_loss[ 750 ]: 0.0041722203604876995
train_batch_loss[ 760 ]: 0.0006400017300620675
train_batch_loss[ 770 ]: 0.0004397871089167893
train_batch_loss[ 780 ]: 0.008351795375347137
train_batch_loss[ 790 ]: 0.012972461991012096
train_batch_loss[ 800 ]: 0.00789592508226633
train_loss: 0.009819868203741259
```

```
epoch: 9
```

```
train_batch_loss[ 810 ]: 0.0018536625429987907
train_batch_loss[ 820 ]: 0.0013186573050916195
```

```
train_batch_loss[ 830 ]: 0.000665524392388761
train_batch_loss[ 840 ]: 0.0002579456486273557
train_batch_loss[ 850 ]: 0.06843160837888718
train_batch_loss[ 860 ]: 0.0009937146678566933
train_batch_loss[ 870 ]: 0.00045309087727218866
train_batch_loss[ 880 ]: 0.01477610133588314
train_batch_loss[ 890 ]: 0.007843228057026863
train_batch_loss[ 900 ]: 0.001246383530087769
train_loss: 0.01516920054583334
```

epoch: 10

```
train_batch_loss[ 910 ]: 0.0020410516299307346
train_batch_loss[ 920 ]: 0.0011538650142028928
train_batch_loss[ 930 ]: 0.0017904335400089622
train_batch_loss[ 940 ]: 0.00044194882502779365
train_batch_loss[ 950 ]: 0.00259743956848979
train_batch_loss[ 960 ]: 0.17456968128681183
train_batch_loss[ 970 ]: 0.005051311105489731
train_batch_loss[ 980 ]: 0.0016960534267127514
train_batch_loss[ 990 ]: 0.026453211903572083
train_batch_loss[ 1000 ]: 0.0011051804758608341
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 17.88it/s]

valid_evaluation: loss=0.6478889861576994, acc=0.9014084507042254

save model at

./torch_checkpoints/22_3_24-14/crnn1_001000_loss0.6478889861576994.pt

```
train_batch_loss[ 1010 ]: 0.0008141401534279188
```

train_loss: 0.017627602046494592

epoch: 11

```
train_batch_loss[ 1020 ]: 0.013790984638035297
train_batch_loss[ 1030 ]: 0.001188145950436592
train_batch_loss[ 1040 ]: 0.000965196406468749
train_batch_loss[ 1050 ]: 0.12969419360160828
train_batch_loss[ 1060 ]: 0.00247611734084785
train_batch_loss[ 1070 ]: 0.0044930726289749146
train_batch_loss[ 1080 ]: 0.0005054682260379195
train_batch_loss[ 1090 ]: 0.004293041303753853
train_batch_loss[ 1100 ]: 0.00270539871416986
train_batch_loss[ 1110 ]: 0.0029227647464722395
train_loss: 0.031067475856647746
```

epoch: 12

```
train_batch_loss[ 1120 ]: 0.00038317733560688794
train_batch_loss[ 1130 ]: 0.0007736668922007084
train_batch_loss[ 1140 ]: 0.0002284058864461258
train_batch_loss[ 1150 ]: 0.0004131175228394568
train_batch_loss[ 1160 ]: 0.0005612801178358495
train_batch_loss[ 1170 ]: 0.002521780552342534
train_batch_loss[ 1180 ]: 0.11001337319612503
train_batch_loss[ 1190 ]: 0.00036660110345110297
train_batch_loss[ 1200 ]: 0.004555473104119301
```

```
train_batch_loss[ 1210 ]: 0.0017323005013167858
train_loss: 0.010638594267975778
epoch: 13
train_batch_loss[ 1220 ]: 0.0006742044351994991
train_batch_loss[ 1230 ]: 0.00035295996349304914
train_batch_loss[ 1240 ]: 0.0003626111429184675
train_batch_loss[ 1250 ]: 0.00034642385435290635
train_batch_loss[ 1260 ]: 0.06513668596744537
train_batch_loss[ 1270 ]: 0.0012085926719009876
train_batch_loss[ 1280 ]: 0.0008057584636844695
train_batch_loss[ 1290 ]: 0.0006547405500896275
train_batch_loss[ 1300 ]: 0.0009600655175745487
train_batch_loss[ 1310 ]: 0.0009795769583433867
train_loss: 0.011147461996960843
```

```
epoch: 14
train_batch_loss[ 1320 ]: 0.00010881051275646314
train_batch_loss[ 1330 ]: 0.0004377130826469511
train_batch_loss[ 1340 ]: 0.000221165333641693
train_batch_loss[ 1350 ]: 0.0005120524438098073
train_batch_loss[ 1360 ]: 0.0002646079519763589
train_batch_loss[ 1370 ]: 0.00036186346551403403
train_batch_loss[ 1380 ]: 0.0003988980024587363
train_batch_loss[ 1390 ]: 0.0005005031707696617
train_batch_loss[ 1400 ]: 0.12344284355640411
train_batch_loss[ 1410 ]: 0.0004724864265881479
train_loss: 0.007462203835363695
```

```
epoch: 15
train_batch_loss[ 1420 ]: 0.0001760228187777102
train_batch_loss[ 1430 ]: 0.00037469883682206273
train_batch_loss[ 1440 ]: 8.353582234121859e-05
train_batch_loss[ 1450 ]: 0.00069779361365363
train_batch_loss[ 1460 ]: 0.0003823389997705817
train_batch_loss[ 1470 ]: 0.00031966142705641687
train_batch_loss[ 1480 ]: 0.0002768495469354093
train_batch_loss[ 1490 ]: 0.00031127792317420244
train_batch_loss[ 1500 ]: 0.004473497159779072
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 25.42it/s]

```
valid_evaluation: loss=0.718074529607531, acc=0.9267605633802817
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_001500_loss0.718074529607531.pt
```

```
train_batch_loss[ 1510 ]: 0.09918373078107834
```

```
train_loss: 0.004547127881623826
```

```
epoch: 16
```

```
train_batch_loss[ 1520 ]: 0.00019838387379422784
train_batch_loss[ 1530 ]: 0.000281885324511677
train_batch_loss[ 1540 ]: 0.0005132326041348279
train_batch_loss[ 1550 ]: 0.00029055826598778367
train_batch_loss[ 1560 ]: 0.0008752649300731719
```



```
train_batch_loss[ 1570 ]: 0.0007927757105790079
train_batch_loss[ 1580 ]: 0.0002200127491960302
train_batch_loss[ 1590 ]: 0.00013318190758582205
train_batch_loss[ 1600 ]: 0.005811022594571114
train_batch_loss[ 1610 ]: 0.000323861138895154
train_loss: 0.008103276984444829
epoch: 17
train_batch_loss[ 1620 ]: 0.00023107223387341946
train_batch_loss[ 1630 ]: 8.623873873148113e-05
train_batch_loss[ 1640 ]: 0.00015012350922916085
train_batch_loss[ 1650 ]: 0.0001240697893081233
train_batch_loss[ 1660 ]: 0.0004153860209044069
train_batch_loss[ 1670 ]: 0.00014071157784201205
train_batch_loss[ 1680 ]: 5.533983130590059e-05
train_batch_loss[ 1690 ]: 0.00011573568190215155
train_batch_loss[ 1700 ]: 0.0026523503474891186
train_batch_loss[ 1710 ]: 0.0004052171134389937
train_loss: 0.011290451762562456
epoch: 18
train_batch_loss[ 1720 ]: 8.773379522608593e-05
train_batch_loss[ 1730 ]: 0.00025838438887149096
train_batch_loss[ 1740 ]: 0.0004781555908266455
train_batch_loss[ 1750 ]: 0.00030306720873340964
train_batch_loss[ 1760 ]: 0.00010513347660889849
train_batch_loss[ 1770 ]: 0.0004062147345393896
train_batch_loss[ 1780 ]: 0.15201550722122192
train_batch_loss[ 1790 ]: 0.0005542442668229342
train_batch_loss[ 1800 ]: 0.00014663168985862285
train_batch_loss[ 1810 ]: 0.0012764716520905495
train_loss: 0.011654567620565064
epoch: 19
train_batch_loss[ 1820 ]: 0.0006617754697799683
train_batch_loss[ 1830 ]: 0.0010042436188086867
train_batch_loss[ 1840 ]: 0.0001308086357312277
train_batch_loss[ 1850 ]: 9.448120545130223e-05
train_batch_loss[ 1860 ]: 0.0009222050430253148
train_batch_loss[ 1870 ]: 8.928417810238898e-05
train_batch_loss[ 1880 ]: 0.00014368815755005926
train_batch_loss[ 1890 ]: 0.0004215527733322233
train_batch_loss[ 1900 ]: 0.00846844632178545
train_batch_loss[ 1910 ]: 0.060027576982975006
train_loss: 0.0040825512764222785
epoch: 20
train_batch_loss[ 1920 ]: 5.756593600381166e-05
train_batch_loss[ 1930 ]: 0.0006541436305269599
train_batch_loss[ 1940 ]: 0.021914096549153328
train_batch_loss[ 1950 ]: 0.012921233661472797
train_batch_loss[ 1960 ]: 7.206759619293734e-05
train_batch_loss[ 1970 ]: 0.01237889751791954
```

```
train_batch_loss[ 1980 ]: 0.06577296555042267
train_batch_loss[ 1990 ]: 0.0002030567266047001
train_batch_loss[ 2000 ]: 0.003936159424483776
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 24.63it/s]
```

```
valid_evaluation: loss=0.6943803461504654, acc=0.9154929577464789
```

```
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_002000_loss0.6943803461504654.pt
```

```
train_batch_loss[ 2010 ]: 0.012968454509973526
```

```
train_batch_loss[ 2020 ]: 1.549719551500554e-06
```

```
train_loss: 0.005468629704539459
```

```
epoch: 21
```

```
train_batch_loss[ 2030 ]: 0.0005490328767336905
```

```
train_batch_loss[ 2040 ]: 5.50177828699816e-05
```

```
train_batch_loss[ 2050 ]: 0.00029034141334705055
```

```
train_batch_loss[ 2060 ]: 5.7743141951505095e-05
```

```
train_batch_loss[ 2070 ]: 0.0001596153888385743
```

```
train_batch_loss[ 2080 ]: 2.623907676024828e-05
```

```
train_batch_loss[ 2090 ]: 0.00030369460000656545
```

```
train_batch_loss[ 2100 ]: 0.0003898900467902422
```

```
train_batch_loss[ 2110 ]: 6.785152072552592e-05
```

```
train_batch_loss[ 2120 ]: 0.00768713653087616
```

```
train_loss: 0.0070651074595520546
```

```
epoch: 22
```

```
train_batch_loss[ 2130 ]: 0.0002657075528986752
```

```
train_batch_loss[ 2140 ]: 7.78252724558115e-05
```

```
train_batch_loss[ 2150 ]: 6.850161298643798e-05
```

```
train_batch_loss[ 2160 ]: 0.00017766846576705575
```

```
train_batch_loss[ 2170 ]: 0.00039131558150984347
```

```
train_batch_loss[ 2180 ]: 0.00015298978541977704
```

```
train_batch_loss[ 2190 ]: 0.0006065190536901355
```

```
train_batch_loss[ 2200 ]: 0.01717989705502987
```

```
train_batch_loss[ 2210 ]: 0.0006696867640130222
```

```
train_batch_loss[ 2220 ]: 0.00036504596937447786
```

```
train_loss: 0.007406343126855907
```

```
epoch: 23
```

```
train_batch_loss[ 2230 ]: 0.0003512697876431048
```

```
train_batch_loss[ 2240 ]: 0.001052643172442913
```

```
train_batch_loss[ 2250 ]: 5.215994315221906e-05
```

```
train_batch_loss[ 2260 ]: 0.00018479512073099613
```

```
train_batch_loss[ 2270 ]: 6.580898480024189e-05
```

```
train_batch_loss[ 2280 ]: 0.0046285539865493774
```

```
train_batch_loss[ 2290 ]: 0.00013366206258069724
```

```
train_batch_loss[ 2300 ]: 0.0008421932579949498
```

```
train_batch_loss[ 2310 ]: 4.480629286263138e-05
```

```
train_batch_loss[ 2320 ]: 7.978064240887761e-05
```

```
train_loss: 0.003868096853170109
```

```
epoch: 24
```

```
train_batch_loss[ 2330 ]: 0.00010981154628098011
```

```
train_batch_loss[ 2340 ]: 0.12387946993112564
train_batch_loss[ 2350 ]: 0.00010515112080611289
train_batch_loss[ 2360 ]: 7.120940426830202e-05
train_batch_loss[ 2370 ]: 2.1406633095466532e-05
train_batch_loss[ 2380 ]: 0.148885115981102
train_batch_loss[ 2390 ]: 0.0023112103808671236
train_batch_loss[ 2400 ]: 0.00011827990238089114
train_batch_loss[ 2410 ]: 8.325827366206795e-05
train_batch_loss[ 2420 ]: 0.03837360814213753
train_loss: 0.00470023136208864
```

epoch: 25

```
train_batch_loss[ 2430 ]: 5.2326529839774594e-05
train_batch_loss[ 2440 ]: 0.021760813891887665
train_batch_loss[ 2450 ]: 1.1962310964008793e-05
train_batch_loss[ 2460 ]: 0.001803300459869206
train_batch_loss[ 2470 ]: 0.0015516811981797218
train_batch_loss[ 2480 ]: 0.0003279408847447485
train_batch_loss[ 2490 ]: 0.0002800058573484421
train_batch_loss[ 2500 ]: 0.00013630534522235394
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 18.32it/s]

valid_evaluation: loss=0.6412615007078144, acc=0.9295774647887324
save model at

./torch_checkpoints/22_3_24-14/crnn1_002500_loss0.6412615007078144.pt

```
train_batch_loss[ 2510 ]: 0.004957736935466528
train_batch_loss[ 2520 ]: 6.543932249769568e-05
train_loss: 0.0020384608265928777
```

epoch: 26

```
train_batch_loss[ 2530 ]: 7.288408232852817e-05
train_batch_loss[ 2540 ]: 0.11480426788330078
train_batch_loss[ 2550 ]: 0.00010704529995564371
train_batch_loss[ 2560 ]: 0.00015306362183764577
train_batch_loss[ 2570 ]: 0.000521920039318502
train_batch_loss[ 2580 ]: 4.467490725801326e-05
train_batch_loss[ 2590 ]: 2.7848122044815682e-05
train_batch_loss[ 2600 ]: 7.188160088844597e-05
train_batch_loss[ 2610 ]: 6.299879896687344e-05
train_batch_loss[ 2620 ]: 0.00012363228597678244
train_loss: 0.004034848863994159
```

epoch: 27

```
train_batch_loss[ 2630 ]: 3.0213755962904543e-05
train_batch_loss[ 2640 ]: 1.371079997625202e-05
train_batch_loss[ 2650 ]: 0.0004354424017947167
train_batch_loss[ 2660 ]: 0.00270151998847723
train_batch_loss[ 2670 ]: 0.00017742844647727907
train_batch_loss[ 2680 ]: 0.00016130993026308715
train_batch_loss[ 2690 ]: 9.05711785890162e-05
train_batch_loss[ 2700 ]: 0.00012575602158904076
train_batch_loss[ 2710 ]: 0.000448672246420756
```

```
train_batch_loss[ 2720 ]: 6.968146044528112e-05
train_loss: 0.002639514623410442
epoch: 28
train_batch_loss[ 2730 ]: 3.827832915703766e-05
train_batch_loss[ 2740 ]: 2.876323924283497e-05
train_batch_loss[ 2750 ]: 3.575992013793439e-05
train_batch_loss[ 2760 ]: 0.00012052319652866572
train_batch_loss[ 2770 ]: 0.0030051793437451124
train_batch_loss[ 2780 ]: 0.002744107972830534
train_batch_loss[ 2790 ]: 0.10324802994728088
train_batch_loss[ 2800 ]: 0.0008117379038594663
train_batch_loss[ 2810 ]: 0.0010048378026112914
train_batch_loss[ 2820 ]: 8.216180140152574e-05
train_loss: 0.022212619216877286
```

```
epoch: 29
train_batch_loss[ 2830 ]: 0.12595339119434357
train_batch_loss[ 2840 ]: 0.0032650430221110582
train_batch_loss[ 2850 ]: 0.0014045056886970997
train_batch_loss[ 2860 ]: 0.010871010832488537
train_batch_loss[ 2870 ]: 0.00015024363528937101
train_batch_loss[ 2880 ]: 0.00010296593245584518
train_batch_loss[ 2890 ]: 0.0001425657537765801
train_batch_loss[ 2900 ]: 0.00012857638648711145
train_batch_loss[ 2910 ]: 0.014583028852939606
train_batch_loss[ 2920 ]: 0.0005083355936221778
train_loss: 0.01717835754557474
```

```
epoch: 30
train_batch_loss[ 2930 ]: 0.06072421371936798
train_batch_loss[ 2940 ]: 0.0029416142497211695
train_batch_loss[ 2950 ]: 7.969045691424981e-05
train_batch_loss[ 2960 ]: 0.000861289503518492
train_batch_loss[ 2970 ]: 9.497387509327382e-05
train_batch_loss[ 2980 ]: 0.0024234135635197163
train_batch_loss[ 2990 ]: 0.0014347422402352095
train_batch_loss[ 3000 ]: 0.004115764982998371
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 25.11it/s]
```

```
valid_evaluation: loss=0.683659216341838, acc=0.9267605633802817
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_003000_loss0.683659216341838.pt
```

```
train_batch_loss[ 3010 ]: 0.00017089824541471899
train_batch_loss[ 3020 ]: 0.029777532443404198
train_batch_loss[ 3030 ]: 7.547981416185697e-07
train_loss: 0.011348774602189351
```

```
epoch: 31
train_batch_loss[ 3040 ]: 9.973016130970791e-05
train_batch_loss[ 3050 ]: 3.735254722414538e-05
train_batch_loss[ 3060 ]: 0.000184153308509849
train_batch_loss[ 3070 ]: 0.0010999921942129731
```

```
train_batch_loss[ 3080 ]: 3.4048251109197736e-05
train_batch_loss[ 3090 ]: 0.0010235634399577975
train_batch_loss[ 3100 ]: 0.00043687084689736366
train_batch_loss[ 3110 ]: 2.8268823371035978e-05
train_batch_loss[ 3120 ]: 0.000148110615555197
train_batch_loss[ 3130 ]: 0.0003900147567037493
train_loss: 0.004181491226019785
epoch: 32
train_batch_loss[ 3140 ]: 0.0004628218594007194
train_batch_loss[ 3150 ]: 0.0009366644662804902
train_batch_loss[ 3160 ]: 1.575479473103769e-05
train_batch_loss[ 3170 ]: 2.3435146431438625e-05
train_batch_loss[ 3180 ]: 0.007656588219106197
train_batch_loss[ 3190 ]: 0.00030760213849134743
train_batch_loss[ 3200 ]: 3.0500994398607872e-05
train_batch_loss[ 3210 ]: 7.838844612706453e-05
train_batch_loss[ 3220 ]: 0.0009529205271974206
train_batch_loss[ 3230 ]: 0.00019945099484175444
train_loss: 0.005187938686696431
epoch: 33
train_batch_loss[ 3240 ]: 6.335706711979583e-05
train_batch_loss[ 3250 ]: 7.085401739459485e-05
train_batch_loss[ 3260 ]: 0.0023773503489792347
train_batch_loss[ 3270 ]: 0.00013800335000269115
train_batch_loss[ 3280 ]: 6.213366577867419e-05
train_batch_loss[ 3290 ]: 1.7769052647054195e-05
train_batch_loss[ 3300 ]: 0.0005510289338417351
train_batch_loss[ 3310 ]: 0.3301568925380707
train_batch_loss[ 3320 ]: 0.00024375205975957215
train_batch_loss[ 3330 ]: 2.9637816624017432e-05
train_loss: 0.008070607438983435
epoch: 34
train_batch_loss[ 3340 ]: 6.585227674804628e-05
train_batch_loss[ 3350 ]: 5.373325984692201e-05
train_batch_loss[ 3360 ]: 0.0006447017658501863
train_batch_loss[ 3370 ]: 0.00021892281074542552
train_batch_loss[ 3380 ]: 0.00035581435076892376
train_batch_loss[ 3390 ]: 2.2774398530600592e-05
train_batch_loss[ 3400 ]: 4.3835548240167554e-06
train_batch_loss[ 3410 ]: 1.6471658454975113e-05
train_batch_loss[ 3420 ]: 0.0023139503318816423
train_batch_loss[ 3430 ]: 3.861795266857371e-05
train_loss: 0.0053999076509189175
epoch: 35
train_batch_loss[ 3440 ]: 3.103381095570512e-05
train_batch_loss[ 3450 ]: 1.835826515161898e-05
train_batch_loss[ 3460 ]: 9.536653124087024e-06
train_batch_loss[ 3470 ]: 4.5379223593045026e-05
train_batch_loss[ 3480 ]: 4.0735729271546006e-05
```

```
train_batch_loss[ 3490 ]: 0.00016892740677576512
train_batch_loss[ 3500 ]: 1.756182246026583e-05
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 27.02it/s]
```

```
valid_evaluation: loss=0.7209868235907084, acc=0.9295774647887324
```

```
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_003500_loss0.7209868235907084.pt
```

```
train_batch_loss[ 3510 ]: 2.5238492526113987e-05
```

```
train_batch_loss[ 3520 ]: 8.2187179941684e-06
```

```
train_batch_loss[ 3530 ]: 4.395045107230544e-05
```

```
train_loss: 0.0010735500225341847
```

```
epoch: 36
```

```
train_batch_loss[ 3540 ]: 8.467659790767357e-05
```

```
train_batch_loss[ 3550 ]: 2.315503661520779e-05
```

```
train_batch_loss[ 3560 ]: 5.352244625100866e-05
```

```
train_batch_loss[ 3570 ]: 0.0002468572638463229
```

```
train_batch_loss[ 3580 ]: 0.00010323063906980678
```

```
train_batch_loss[ 3590 ]: 3.165143425576389e-05
```

```
train_batch_loss[ 3600 ]: 4.051799260196276e-05
```

```
train_batch_loss[ 3610 ]: 2.9768394597340375e-05
```

```
train_batch_loss[ 3620 ]: 0.00023632272495888174
```

```
train_batch_loss[ 3630 ]: 0.00034668491571210325
```

```
train_loss: 0.003315907942977726
```

```
epoch: 37
```

```
train_batch_loss[ 3640 ]: 1.8432845536153764e-05
```

```
train_batch_loss[ 3650 ]: 1.6335743566742167e-05
```

```
train_batch_loss[ 3660 ]: 0.00010365767229814082
```

```
train_batch_loss[ 3670 ]: 0.07771771401166916
```

```
train_batch_loss[ 3680 ]: 6.47495617158711e-05
```

```
train_batch_loss[ 3690 ]: 0.007991407066583633
```

```
train_batch_loss[ 3700 ]: 0.003913576249033213
```

```
train_batch_loss[ 3710 ]: 0.00041148392483592033
```

```
train_batch_loss[ 3720 ]: 3.296594150015153e-05
```

```
train_batch_loss[ 3730 ]: 0.005174156278371811
```

```
train_loss: 0.01780328753274129
```

```
epoch: 38
```

```
train_batch_loss[ 3740 ]: 0.00033260841155424714
```

```
train_batch_loss[ 3750 ]: 0.00014174668467603624
```

```
train_batch_loss[ 3760 ]: 0.00031815338297747076
```

```
train_batch_loss[ 3770 ]: 0.0002296319871675223
```

```
train_batch_loss[ 3780 ]: 0.0035957396030426025
```

```
train_batch_loss[ 3790 ]: 0.020061291754245758
```

```
train_batch_loss[ 3800 ]: 6.480753654614091e-05
```

```
train_batch_loss[ 3810 ]: 8.596322732046247e-05
```

```
train_batch_loss[ 3820 ]: 6.848794873803854e-05
```

```
train_batch_loss[ 3830 ]: 0.00010535708133829758
```

```
train_loss: 0.006687246892307796
```

```
epoch: 39
```

```
train_batch_loss[ 3840 ]: 9.681854135124013e-05
```

```
train_batch_loss[ 3850 ]: 2.6718616936705075e-05
train_batch_loss[ 3860 ]: 0.03813456743955612
train_batch_loss[ 3870 ]: 5.322609649738297e-05
train_batch_loss[ 3880 ]: 4.713309681392275e-05
train_batch_loss[ 3890 ]: 0.00018838686810340732
train_batch_loss[ 3900 ]: 0.002560206688940525
train_batch_loss[ 3910 ]: 7.723439193796366e-05
train_batch_loss[ 3920 ]: 6.908321665832773e-05
train_batch_loss[ 3930 ]: 0.00017573419609107077
train_loss: 0.003318008510632495
```

epoch: 40

```
train_batch_loss[ 3940 ]: 1.9764778699027374e-05
train_batch_loss[ 3950 ]: 1.751014315232169e-05
train_batch_loss[ 3960 ]: 9.095878340303898e-05
train_batch_loss[ 3970 ]: 0.14827874302864075
train_batch_loss[ 3980 ]: 8.844379408401437e-06
train_batch_loss[ 3990 ]: 3.0359824449988082e-05
train_batch_loss[ 4000 ]: 1.558698932058178e-05
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 19.85it/s]

valid_evaluation: loss=0.7178690554390491, acc=0.9126760563380282

save model at

./torch_checkpoints/22_3_24-14/crnn1_004000_loss0.7178690554390491.pt

```
train_batch_loss[ 4010 ]: 0.0014821509830653667
train_batch_loss[ 4020 ]: 4.1867308027576655e-05
train_batch_loss[ 4030 ]: 4.555608393275179e-05
train_batch_loss[ 4040 ]: 5.137795445383139e-07
train_loss: 0.005647092387135731
```

epoch: 41

```
train_batch_loss[ 4050 ]: 0.00034158583730459213
train_batch_loss[ 4060 ]: 7.136254862416536e-05
train_batch_loss[ 4070 ]: 4.7075332986423746e-05
train_batch_loss[ 4080 ]: 2.631199822644703e-05
train_batch_loss[ 4090 ]: 6.741979450453073e-05
train_batch_loss[ 4100 ]: 9.929192310664803e-05
train_batch_loss[ 4110 ]: 0.0016076428582891822
train_batch_loss[ 4120 ]: 3.2294716220349073e-05
train_batch_loss[ 4130 ]: 0.00043636883492581546
train_batch_loss[ 4140 ]: 0.0002014019846683368
train_loss: 0.00281958556443078
```

epoch: 42

```
train_batch_loss[ 4150 ]: 6.068207585485652e-05
train_batch_loss[ 4160 ]: 1.703708039713092e-05
train_batch_loss[ 4170 ]: 3.275073686381802e-05
train_batch_loss[ 4180 ]: 0.00033256784081459045
train_batch_loss[ 4190 ]: 0.0006535860011354089
train_batch_loss[ 4200 ]: 2.137598676199559e-05
train_batch_loss[ 4210 ]: 4.4352960685500875e-05
train_batch_loss[ 4220 ]: 0.0002201241150032729
```

```
train_batch_loss[ 4230 ]: 4.067195732204709e-06
train_batch_loss[ 4240 ]: 0.0001383441995130852
train_loss: 0.0021628553143392707
```

epoch: 43

```
train_batch_loss[ 4250 ]: 2.115853931172751e-05
train_batch_loss[ 4260 ]: 1.324013737757923e-05
train_batch_loss[ 4270 ]: 2.573438541730866e-05
train_batch_loss[ 4280 ]: 0.0002804319665301591
train_batch_loss[ 4290 ]: 6.0962396673858166e-05
train_batch_loss[ 4300 ]: 4.5523502194555476e-05
train_batch_loss[ 4310 ]: 0.00044227828038856387
train_batch_loss[ 4320 ]: 2.4041322831180878e-05
train_batch_loss[ 4330 ]: 0.013761581853032112
train_batch_loss[ 4340 ]: 0.0006997054442763329
train_loss: 0.0019184949511983926
```

epoch: 44

```
train_batch_loss[ 4350 ]: 6.19494094280526e-05
train_batch_loss[ 4360 ]: 1.624141077627428e-05
train_batch_loss[ 4370 ]: 0.006306312512606382
train_batch_loss[ 4380 ]: 3.090698373853229e-05
train_batch_loss[ 4390 ]: 0.00016570193110965192
train_batch_loss[ 4400 ]: 0.0010050914715975523
train_batch_loss[ 4410 ]: 0.0002865094575099647
train_batch_loss[ 4420 ]: 7.148388249333948e-05
train_batch_loss[ 4430 ]: 9.033636888489127e-05
train_batch_loss[ 4440 ]: 0.000245125062065199
train_loss: 0.0037709590389665574
```

epoch: 45

```
train_batch_loss[ 4450 ]: 0.0006613783771172166
train_batch_loss[ 4460 ]: 0.0008209016523323953
train_batch_loss[ 4470 ]: 0.0001340644375886768
train_batch_loss[ 4480 ]: 9.462468369747512e-06
train_batch_loss[ 4490 ]: 3.6873487260891125e-05
train_batch_loss[ 4500 ]: 0.029853343963623047
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 19.88it/s]

valid_evaluation: loss=0.8381433268667946, acc=0.9126760563380282
save model at

./torch_checkpoints/22_3_24-14/crnn1_004500_loss0.8381433268667946.pt

```
train_batch_loss[ 4510 ]: 4.602129774866626e-05
train_batch_loss[ 4520 ]: 0.005299774464219809
train_batch_loss[ 4530 ]: 9.22246999834897e-06
train_batch_loss[ 4540 ]: 2.650086025823839e-05
train_loss: 0.0020004526037678337
```

epoch: 46

```
train_batch_loss[ 4550 ]: 2.5160818040603772e-05
train_batch_loss[ 4560 ]: 5.8600994634616654e-06
train_batch_loss[ 4570 ]: 0.0002964237646665424
train_batch_loss[ 4580 ]: 0.00018358082161284983
```



```
train_batch_loss[ 4590 ]: 5.092779974802397e-05
train_batch_loss[ 4600 ]: 7.042850029392866e-06
train_batch_loss[ 4610 ]: 1.2332928235991858e-05
train_batch_loss[ 4620 ]: 1.4633942555519752e-05
train_batch_loss[ 4630 ]: 0.0004209823382552713
train_batch_loss[ 4640 ]: 1.538886863272637e-05
train_loss: 0.00021111697787660298
epoch: 47
train_batch_loss[ 4650 ]: 1.159707608167082e-05
train_batch_loss[ 4660 ]: 3.517588311297004e-06
train_batch_loss[ 4670 ]: 9.646844773669727e-06
train_batch_loss[ 4680 ]: 1.2851101928390563e-05
train_batch_loss[ 4690 ]: 0.025331245735287666
train_batch_loss[ 4700 ]: 6.019945794832893e-05
train_batch_loss[ 4710 ]: 0.00014549115439876914
train_batch_loss[ 4720 ]: 2.9551127227023244e-05
train_batch_loss[ 4730 ]: 1.4216104318620637e-05
train_batch_loss[ 4740 ]: 0.0004236773820593953
train_loss: 0.006354881421071122
epoch: 48
train_batch_loss[ 4750 ]: 8.363454981008545e-06
train_batch_loss[ 4760 ]: 4.68247635581065e-05
train_batch_loss[ 4770 ]: 9.955048153642565e-05
train_batch_loss[ 4780 ]: 0.0005763248191215098
train_batch_loss[ 4790 ]: 0.006469309329986572
train_batch_loss[ 4800 ]: 0.03625361993908882
train_batch_loss[ 4810 ]: 8.147112384904176e-05
train_batch_loss[ 4820 ]: 0.10025350749492645
train_batch_loss[ 4830 ]: 7.181077671702951e-05
train_batch_loss[ 4840 ]: 0.0001803578925319016
train_loss: 0.006887658266874232
epoch: 49
train_batch_loss[ 4850 ]: 0.5063713788986206
train_batch_loss[ 4860 ]: 5.8029283536598086e-05
train_batch_loss[ 4870 ]: 1.413606878486462e-05
train_batch_loss[ 4880 ]: 0.0006498098955489695
train_batch_loss[ 4890 ]: 0.00022653586347587407
train_batch_loss[ 4900 ]: 0.002560000866651535
train_batch_loss[ 4910 ]: 0.0002749628620222211
train_batch_loss[ 4920 ]: 0.0011780178174376488
train_batch_loss[ 4930 ]: 1.6448082533315755e-05
train_batch_loss[ 4940 ]: 0.00017032612231560051
train_loss: 0.007571434366793796
epoch: 50
train_batch_loss[ 4950 ]: 0.00028218983788974583
train_batch_loss[ 4960 ]: 1.574017369421199e-05
train_batch_loss[ 4970 ]: 6.538989691762254e-05
train_batch_loss[ 4980 ]: 0.0002199342125095427
```

```
train_batch_loss[ 4990 ]: 9.857823170023039e-05
train_batch_loss[ 5000 ]: 2.2019550669938326e-05
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 20.51it/s]
```

```
valid_evaluation: loss=0.764096764527576, acc=0.9267605633802817
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_005000_loss0.764096764527576.pt
```

```
train_batch_loss[ 5010 ]: 0.00025668556918390095
train_batch_loss[ 5020 ]: 2.157940252800472e-05
train_batch_loss[ 5030 ]: 4.9661783123156056e-05
train_batch_loss[ 5040 ]: 1.3669387044501491e-05
train_batch_loss[ 5050 ]: 8.145966906643784e-06
train_loss: 0.0027354653134527332
```

```
epoch: 51
```

```
train_batch_loss[ 5060 ]: 0.0028458493761718273
train_batch_loss[ 5070 ]: 2.45578630710952e-05
train_batch_loss[ 5080 ]: 6.501554162241518e-05
train_batch_loss[ 5090 ]: 0.41958948969841003
train_batch_loss[ 5100 ]: 6.825529999332502e-05
train_batch_loss[ 5110 ]: 0.000300051411613822
train_batch_loss[ 5120 ]: 2.6589092158246785e-05
train_batch_loss[ 5130 ]: 0.0042825499549508095
train_batch_loss[ 5140 ]: 0.016611842438578606
train_batch_loss[ 5150 ]: 0.012465937994420528
train_loss: 0.026309478329278792
```

```
epoch: 52
```

```
train_batch_loss[ 5160 ]: 2.0190273062326014e-05
train_batch_loss[ 5170 ]: 3.549647590261884e-05
train_batch_loss[ 5180 ]: 0.00021896290127187967
train_batch_loss[ 5190 ]: 0.0019081546925008297
train_batch_loss[ 5200 ]: 0.0003633047454059124
train_batch_loss[ 5210 ]: 8.213607361540198e-05
train_batch_loss[ 5220 ]: 5.802610394312069e-05
train_batch_loss[ 5230 ]: 0.008417532779276371
train_batch_loss[ 5240 ]: 3.773844946408644e-05
train_batch_loss[ 5250 ]: 2.8142503651906736e-05
train_loss: 0.005520997133525132
```

```
epoch: 53
```

```
train_batch_loss[ 5260 ]: 1.4342652320920024e-05
train_batch_loss[ 5270 ]: 6.672547169728205e-05
train_batch_loss[ 5280 ]: 1.927374250954017e-05
train_batch_loss[ 5290 ]: 2.392355600022711e-05
train_batch_loss[ 5300 ]: 0.00014171269140206277
train_batch_loss[ 5310 ]: 6.460966687882319e-05
train_batch_loss[ 5320 ]: 5.680219146597665e-06
train_batch_loss[ 5330 ]: 8.384795364690945e-06
train_batch_loss[ 5340 ]: 2.2350803192239255e-05
train_batch_loss[ 5350 ]: 8.845703268889338e-05
train_loss: 0.003047265746094393
```

```
epoch: 54
train_batch_loss[ 5360 ]: 1.0338404536014423e-05
train_batch_loss[ 5370 ]: 2.970616696984507e-05
train_batch_loss[ 5380 ]: 0.0024455562233924866
train_batch_loss[ 5390 ]: 1.682384026935324e-05
train_batch_loss[ 5400 ]: 1.3808059520670213e-05
train_batch_loss[ 5410 ]: 4.142343095736578e-05
train_batch_loss[ 5420 ]: 0.0007311787339858711
train_batch_loss[ 5430 ]: 3.464059409452602e-05
train_batch_loss[ 5440 ]: 4.3311672925483435e-05
train_batch_loss[ 5450 ]: 1.9986560801044106e-05
train_loss: 0.004846012253083861
epoch: 55
train_batch_loss[ 5460 ]: 1.3673135072167497e-05
train_batch_loss[ 5470 ]: 2.401740857749246e-05
train_batch_loss[ 5480 ]: 0.007062150631099939
train_batch_loss[ 5490 ]: 0.0004461471689864993
train_batch_loss[ 5500 ]: 2.8432234103092924e-05

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 18.49it/s]

valid_evaluation: loss=0.8211690251256378, acc=0.9098591549295775
save model at
./torch_checkpoints/22_3_24-14/crnn1_005500_loss0.8211690251256378.pt
train_batch_loss[ 5510 ]: 3.416468825889751e-05
train_batch_loss[ 5520 ]: 0.00010055005986941978
train_batch_loss[ 5530 ]: 6.39304198557511e-06
train_batch_loss[ 5540 ]: 8.606079791206867e-05
train_batch_loss[ 5550 ]: 6.541539914906025e-05
train_loss: 0.01235202571569318
epoch: 56
train_batch_loss[ 5560 ]: 0.0004227049648761749
train_batch_loss[ 5570 ]: 4.696428368333727e-05
train_batch_loss[ 5580 ]: 6.072820178815164e-05
train_batch_loss[ 5590 ]: 1.4729171198268887e-05
train_batch_loss[ 5600 ]: 0.00010147241846425459
train_batch_loss[ 5610 ]: 2.9815117159159854e-05
train_batch_loss[ 5620 ]: 0.0023602633737027645
train_batch_loss[ 5630 ]: 1.8096719941240735e-05
train_batch_loss[ 5640 ]: 0.0002512977225705981
train_batch_loss[ 5650 ]: 0.0004461075586732477
train_loss: 0.004257598272250728
epoch: 57
train_batch_loss[ 5660 ]: 0.00011611911031650379
train_batch_loss[ 5670 ]: 3.266343264840543e-05
train_batch_loss[ 5680 ]: 1.8837083189282566e-05
train_batch_loss[ 5690 ]: 4.015639569843188e-05
train_batch_loss[ 5700 ]: 0.00012999586760997772
train_batch_loss[ 5710 ]: 3.142665445921011e-05
train_batch_loss[ 5720 ]: 4.8553272790741175e-05
```

```
train_batch_loss[ 5730 ]: 0.0001483792148064822
train_batch_loss[ 5740 ]: 8.724189683562145e-06
train_batch_loss[ 5750 ]: 0.0035850373096764088
train_loss: 0.003827129562942451
```

epoch: 58

```
train_batch_loss[ 5760 ]: 0.00033341985545121133
train_batch_loss[ 5770 ]: 0.00042323264642618597
train_batch_loss[ 5780 ]: 0.00012448235065676272
train_batch_loss[ 5790 ]: 8.281219379568938e-06
train_batch_loss[ 5800 ]: 2.6370595151092857e-05
train_batch_loss[ 5810 ]: 3.3331562008243054e-06
train_batch_loss[ 5820 ]: 1.3225781003711745e-05
train_batch_loss[ 5830 ]: 7.10654467184213e-06
train_batch_loss[ 5840 ]: 3.8937185308896005e-05
train_batch_loss[ 5850 ]: 1.4513733731291723e-05
train_loss: 0.0007057045853775343
```

epoch: 59

```
train_batch_loss[ 5860 ]: 0.00022809862275607884
train_batch_loss[ 5870 ]: 2.545101597206667e-05
train_batch_loss[ 5880 ]: 1.495973629062064e-05
train_batch_loss[ 5890 ]: 2.7962272724835202e-05
train_batch_loss[ 5900 ]: 1.2238839190104045e-05
train_batch_loss[ 5910 ]: 0.015545619651675224
train_batch_loss[ 5920 ]: 0.0001808632368920371
train_batch_loss[ 5930 ]: 0.00044030853314325213
train_batch_loss[ 5940 ]: 0.002790228696539998
train_batch_loss[ 5950 ]: 0.0003803979780059308
train_loss: 0.010828657599936092
```

epoch: 60

```
train_batch_loss[ 5960 ]: 5.2672276069642976e-05
train_batch_loss[ 5970 ]: 3.9865553844720125e-05
train_batch_loss[ 5980 ]: 2.5233694032067433e-05
train_batch_loss[ 5990 ]: 4.827422526432201e-05
train_batch_loss[ 6000 ]: 0.00025378819555044174
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 25.90it/s]

valid_evaluation: loss=0.8983227865796694, acc=0.9267605633802817
save model at

./torch_checkpoints/22_3_24-14/crnn1_006000_loss0.8983227865796694.pt

```
train_batch_loss[ 6010 ]: 5.351381332729943e-05
train_batch_loss[ 6020 ]: 0.0005322423530742526
train_batch_loss[ 6030 ]: 0.00849976483732462
train_batch_loss[ 6040 ]: 0.0005446557188406587
train_batch_loss[ 6050 ]: 0.060986824333667755
train_batch_loss[ 6060 ]: 8.241324879539509e-05
train_loss: 0.004362269864693877
```

epoch: 61

```
train_batch_loss[ 6070 ]: 4.015843296656385e-05
train_batch_loss[ 6080 ]: 4.409857865539379e-06
```

```
train_batch_loss[ 6090 ]: 0.22652235627174377
train_batch_loss[ 6100 ]: 2.164703982998617e-05
train_batch_loss[ 6110 ]: 7.331887900363654e-05
train_batch_loss[ 6120 ]: 0.037866637110710144
train_batch_loss[ 6130 ]: 2.58517793554347e-05
train_batch_loss[ 6140 ]: 0.0013961098156869411
train_batch_loss[ 6150 ]: 0.0008791005820967257
train_batch_loss[ 6160 ]: 0.00119775568600744
train_loss: 0.004181913995600563
epoch: 62
train_batch_loss[ 6170 ]: 0.008759947493672371
train_batch_loss[ 6180 ]: 2.0490768292802386e-05
train_batch_loss[ 6190 ]: 0.0007633878849446774
train_batch_loss[ 6200 ]: 8.071339834714308e-05
train_batch_loss[ 6210 ]: 3.569172622519545e-05
train_batch_loss[ 6220 ]: 0.0007965029217302799
train_batch_loss[ 6230 ]: 0.0007486007525585592
train_batch_loss[ 6240 ]: 8.832350431475788e-06
train_batch_loss[ 6250 ]: 0.00030139769660308957
train_batch_loss[ 6260 ]: 0.0006227444391697645
train_loss: 0.0013843301400376742
epoch: 63
train_batch_loss[ 6270 ]: 1.2950429663760588e-05
train_batch_loss[ 6280 ]: 8.169943612301722e-06
train_batch_loss[ 6290 ]: 7.470985292457044e-05
train_batch_loss[ 6300 ]: 4.711637302534655e-06
train_batch_loss[ 6310 ]: 1.3934740309196059e-05
train_batch_loss[ 6320 ]: 0.0001546400599181652
train_batch_loss[ 6330 ]: 7.777076461934485e-06
train_batch_loss[ 6340 ]: 9.447961929254234e-06
train_batch_loss[ 6350 ]: 0.0005087632453069091
train_batch_loss[ 6360 ]: 2.966339343402069e-05
train_loss: 0.0028915075555569813
epoch: 64
train_batch_loss[ 6370 ]: 0.0019198366208001971
train_batch_loss[ 6380 ]: 3.553545684553683e-05
train_batch_loss[ 6390 ]: 1.5393157809739932e-05
train_batch_loss[ 6400 ]: 0.00013158244837541133
train_batch_loss[ 6410 ]: 2.1613164790323935e-05
train_batch_loss[ 6420 ]: 5.501788109540939e-06
train_batch_loss[ 6430 ]: 6.856444088043645e-05
train_batch_loss[ 6440 ]: 3.246465712436475e-05
train_batch_loss[ 6450 ]: 5.8035639085574076e-05
train_batch_loss[ 6460 ]: 2.0708050215034746e-05
train_loss: 0.0055197622281180974
epoch: 65
train_batch_loss[ 6470 ]: 9.587328531779349e-05
train_batch_loss[ 6480 ]: 8.631170203443617e-05
```

```
train_batch_loss[ 6490 ]: 3.3046457247110084e-05
train_batch_loss[ 6500 ]: 2.4993947590701282e-05
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 27.76it/s]
```

```
valid_evaluation: loss=0.8693566358399013, acc=0.9323943661971831
```

```
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_006500_loss0.8693566358399013.pt
```

```
train_batch_loss[ 6510 ]: 0.0001247043692274019
train_batch_loss[ 6520 ]: 1.478259036957752e-05
train_batch_loss[ 6530 ]: 0.029433345422148705
train_batch_loss[ 6540 ]: 5.408913057181053e-05
train_batch_loss[ 6550 ]: 1.6795060219010338e-05
train_batch_loss[ 6560 ]: 0.0014456898206844926
train_loss: 0.005585915542362782
```

```
epoch: 66
```

```
train_batch_loss[ 6570 ]: 1.2414384400472045e-05
train_batch_loss[ 6580 ]: 3.7716331462434027e-06
train_batch_loss[ 6590 ]: 1.1944444850087166e-05
train_batch_loss[ 6600 ]: 0.0010830428218469024
train_batch_loss[ 6610 ]: 1.308568607782945e-05
train_batch_loss[ 6620 ]: 9.122649498749524e-05
train_batch_loss[ 6630 ]: 5.6762028179946356e-06
train_batch_loss[ 6640 ]: 0.00011580949649214745
train_batch_loss[ 6650 ]: 2.050408284048899e-06
train_batch_loss[ 6660 ]: 2.5267461751354858e-05
train_loss: 0.0011306238825260278
```

```
epoch: 67
```

```
train_batch_loss[ 6670 ]: 2.4444623704766855e-05
train_batch_loss[ 6680 ]: 2.501067501725629e-05
train_batch_loss[ 6690 ]: 7.19322451914195e-06
train_batch_loss[ 6700 ]: 1.2224915735714603e-05
train_batch_loss[ 6710 ]: 1.2831103049393278e-05
train_batch_loss[ 6720 ]: 1.0230988664261531e-05
train_batch_loss[ 6730 ]: 0.03639426454901695
train_batch_loss[ 6740 ]: 1.7602360458113253e-05
train_batch_loss[ 6750 ]: 0.002632806310430169
train_batch_loss[ 6760 ]: 7.37316076993011e-05
train_loss: 0.004042969766867301
```

```
epoch: 68
```

```
train_batch_loss[ 6770 ]: 9.734831110108644e-06
train_batch_loss[ 6780 ]: 0.00019357017299626023
train_batch_loss[ 6790 ]: 5.748664079874288e-06
train_batch_loss[ 6800 ]: 4.945560067426413e-05
train_batch_loss[ 6810 ]: 0.00017924277926795185
train_batch_loss[ 6820 ]: 1.0536969057284296e-06
train_batch_loss[ 6830 ]: 2.5738652766449377e-05
train_batch_loss[ 6840 ]: 1.9798048015218228e-05
train_batch_loss[ 6850 ]: 1.2908152712043375e-05
train_batch_loss[ 6860 ]: 0.0509403795003891
```

```
train_loss: 0.00113984680129087
epoch: 69
train_batch_loss[ 6870 ]: 0.0005739837069995701
train_batch_loss[ 6880 ]: 9.547795343678445e-06
train_batch_loss[ 6890 ]: 4.7909885324770585e-05
train_batch_loss[ 6900 ]: 0.0008647278882563114
train_batch_loss[ 6910 ]: 1.1334190276102163e-05
train_batch_loss[ 6920 ]: 1.0369220035499893e-05
train_batch_loss[ 6930 ]: 0.0022581350058317184
train_batch_loss[ 6940 ]: 1.3023527571931481e-06
train_batch_loss[ 6950 ]: 4.04448619519826e-05
train_batch_loss[ 6960 ]: 0.004863315261900425
train_loss: 0.0029203564653537562
epoch: 70
train_batch_loss[ 6970 ]: 7.850196197978221e-06
train_batch_loss[ 6980 ]: 1.0422279956401326e-05
train_batch_loss[ 6990 ]: 1.293874538532691e-05
train_batch_loss[ 7000 ]: 1.2574046195368282e-05
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 28.03it/s]

```
valid_evaluation: loss=0.7739426169636279, acc=0.9352112676056338
save model at
./torch_checkpoints/22_3_24-14/crnn1_007000_loss0.7739426169636279.pt
train_batch_loss[ 7010 ]: 0.00011232237739022821
train_batch_loss[ 7020 ]: 2.363772364333272e-05
train_batch_loss[ 7030 ]: 7.746295977995032e-07
train_batch_loss[ 7040 ]: 7.061703854560619e-06
train_batch_loss[ 7050 ]: 1.5480383808608167e-05
train_batch_loss[ 7060 ]: 0.00015149323735386133
train_batch_loss[ 7070 ]: 2.8641273578008017e-06
train_loss: 0.003908679035507034
epoch: 71
train_batch_loss[ 7080 ]: 7.352758257184178e-05
train_batch_loss[ 7090 ]: 2.197710819018539e-05
train_batch_loss[ 7100 ]: 0.007283364422619343
train_batch_loss[ 7110 ]: 0.0005659842281602323
train_batch_loss[ 7120 ]: 0.012915357016026974
train_batch_loss[ 7130 ]: 7.966579869389534e-05
train_batch_loss[ 7140 ]: 0.0006993443239480257
train_batch_loss[ 7150 ]: 1.39644125738414e-05
train_batch_loss[ 7160 ]: 0.0008061790140345693
train_batch_loss[ 7170 ]: 9.001203579828143e-06
train_loss: 0.009763199723993667
epoch: 72
train_batch_loss[ 7180 ]: 0.0086432583630085
train_batch_loss[ 7190 ]: 5.5131049521151e-06
train_batch_loss[ 7200 ]: 0.0019379607401788235
train_batch_loss[ 7210 ]: 5.380035872804001e-06
train_batch_loss[ 7220 ]: 3.133356221951544e-05
```

```
train_batch_loss[ 7230 ]: 5.5374148359987885e-05
train_batch_loss[ 7240 ]: 0.00026840384816750884
train_batch_loss[ 7250 ]: 7.064945384627208e-05
train_batch_loss[ 7260 ]: 2.5161378289340064e-05
train_batch_loss[ 7270 ]: 0.00010307034972356632
train_loss: 0.006448483845273298
```

epoch: 73

```
train_batch_loss[ 7280 ]: 4.261713183950633e-05
train_batch_loss[ 7290 ]: 0.00025859009474515915
train_batch_loss[ 7300 ]: 6.353370554279536e-05
train_batch_loss[ 7310 ]: 2.126499111909652e-06
train_batch_loss[ 7320 ]: 3.1154970201896504e-05
train_batch_loss[ 7330 ]: 1.1417914720368572e-06
train_batch_loss[ 7340 ]: 1.2693045391642954e-05
train_batch_loss[ 7350 ]: 5.898848394281231e-05
train_batch_loss[ 7360 ]: 1.419307227479294e-05
train_batch_loss[ 7370 ]: 8.14936647657305e-05
train_loss: 0.001994885857357999
```

epoch: 74

```
train_batch_loss[ 7380 ]: 0.0006738328374922276
train_batch_loss[ 7390 ]: 1.0184870689045056e-06
train_batch_loss[ 7400 ]: 0.00016744137974455953
train_batch_loss[ 7410 ]: 1.4653769540018402e-05
train_batch_loss[ 7420 ]: 1.574138514115475e-05
train_batch_loss[ 7430 ]: 1.324348704656586e-05
train_batch_loss[ 7440 ]: 9.967462574422825e-06
train_batch_loss[ 7450 ]: 3.2822168577695265e-05
train_batch_loss[ 7460 ]: 1.0922281944658607e-05
train_batch_loss[ 7470 ]: 6.957556593079062e-07
train_loss: 0.00027488801719762954
```

epoch: 75

```
train_batch_loss[ 7480 ]: 3.6172300497128163e-06
train_batch_loss[ 7490 ]: 6.5647068367979955e-06
train_batch_loss[ 7500 ]: 3.5086866319034016e-06
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 27.67it/s]

valid_evaluation: loss=0.7833182011061991, acc=0.9267605633802817
save model at

./torch_checkpoints/22_3_24-14/crnn1_007500_loss0.7833182011061991.pt

```
train_batch_loss[ 7510 ]: 7.72074236010667e-06
train_batch_loss[ 7520 ]: 1.0190406101173721e-05
train_batch_loss[ 7530 ]: 3.187953552696854e-06
train_batch_loss[ 7540 ]: 1.1756806998164393e-05
train_batch_loss[ 7550 ]: 8.404139407502953e-06
train_batch_loss[ 7560 ]: 2.6933612389257178e-05
train_batch_loss[ 7570 ]: 7.504680525016738e-06
train_loss: 0.00018741372987687627
```

epoch: 76

```
train_batch_loss[ 7580 ]: 7.735798135399818e-06
```



```
train_batch_loss[ 7590 ]: 0.00048727961257100105
train_batch_loss[ 7600 ]: 0.00013124351971782744
train_batch_loss[ 7610 ]: 0.005059405695647001
train_batch_loss[ 7620 ]: 0.010244093835353851
train_batch_loss[ 7630 ]: 0.0025057271122932434
train_batch_loss[ 7640 ]: 0.0058651091530919075
train_batch_loss[ 7650 ]: 0.0011971211060881615
train_batch_loss[ 7660 ]: 0.0001267811458092183
train_batch_loss[ 7670 ]: 0.008107936009764671
train_loss: 0.021495958162653303
epoch: 77
train_batch_loss[ 7680 ]: 0.00013481850328389555
train_batch_loss[ 7690 ]: 3.214371463400312e-05
train_batch_loss[ 7700 ]: 0.0004684281302616
train_batch_loss[ 7710 ]: 7.621063105034409e-06
train_batch_loss[ 7720 ]: 3.482908505247906e-05
train_batch_loss[ 7730 ]: 2.167208367609419e-05
train_batch_loss[ 7740 ]: 2.3588847852806794e-06
train_batch_loss[ 7750 ]: 7.754896068945527e-05
train_batch_loss[ 7760 ]: 0.01790449023246765
train_batch_loss[ 7770 ]: 1.4370220014825463e-05
train_loss: 0.01285422816275482
epoch: 78
train_batch_loss[ 7780 ]: 1.2682590750046074e-05
train_batch_loss[ 7790 ]: 3.791743438341655e-05
train_batch_loss[ 7800 ]: 1.802770930225961e-05
train_batch_loss[ 7810 ]: 6.921580643393099e-05
train_batch_loss[ 7820 ]: 7.324644684558734e-05
train_batch_loss[ 7830 ]: 2.8214624762767926e-05
train_batch_loss[ 7840 ]: 4.609459574567154e-05
train_batch_loss[ 7850 ]: 5.660072929458693e-06
train_batch_loss[ 7860 ]: 9.457395208301023e-06
train_batch_loss[ 7870 ]: 3.1687915907241404e-05
train_loss: 0.0014392690322854698
epoch: 79
train_batch_loss[ 7880 ]: 2.184111508540809e-05
train_batch_loss[ 7890 ]: 3.5656910313264234e-06
train_batch_loss[ 7900 ]: 5.6675553423701786e-06
train_batch_loss[ 7910 ]: 0.07505621761083603
train_batch_loss[ 7920 ]: 3.810735961451428e-06
train_batch_loss[ 7930 ]: 8.116983735817485e-06
train_batch_loss[ 7940 ]: 2.5324028683826327e-05
train_batch_loss[ 7950 ]: 3.0349920052685775e-05
train_batch_loss[ 7960 ]: 3.739743260666728e-05
train_batch_loss[ 7970 ]: 8.578845881856978e-05
train_loss: 0.002229727101307556
epoch: 80
train_batch_loss[ 7980 ]: 2.0225801563356072e-05
```

```
train_batch_loss[ 7990 ]: 9.025407052831724e-06
train_batch_loss[ 8000 ]: 4.214801447233185e-05
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 22.05it/s]
```

```
valid_evaluation: loss=0.9303785775748776, acc=0.9295774647887324
```

```
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_008000_loss0.9303785775748776.pt
```

```
train_batch_loss[ 8010 ]: 0.00041692188824526966
train_batch_loss[ 8020 ]: 1.5043516214063857e-05
train_batch_loss[ 8030 ]: 1.5488417375308927e-06
train_batch_loss[ 8040 ]: 2.2873448415339226e-06
train_batch_loss[ 8050 ]: 0.00018937613640446216
train_batch_loss[ 8060 ]: 1.273948419111548e-05
train_batch_loss[ 8070 ]: 2.1587945866485825e-06
train_batch_loss[ 8080 ]: 2.0461777846018474e-05
train_loss: 6.326534886507677e-05
```

```
epoch: 81
```

```
train_batch_loss[ 8090 ]: 4.687526597990654e-06
train_batch_loss[ 8100 ]: 1.3015019248996396e-05
train_batch_loss[ 8110 ]: 4.313579211157048e-06
train_batch_loss[ 8120 ]: 5.826522283314262e-06
train_batch_loss[ 8130 ]: 1.715277903713286e-06
train_batch_loss[ 8140 ]: 3.914386070391629e-06
train_batch_loss[ 8150 ]: 2.920023007391137e-06
train_batch_loss[ 8160 ]: 1.7435115751140984e-06
train_batch_loss[ 8170 ]: 1.2674454410444014e-06
train_batch_loss[ 8180 ]: 2.824117473210208e-06
train_loss: 7.226129247500718e-06
```

```
epoch: 82
```

```
train_batch_loss[ 8190 ]: 6.001665042276727e-06
train_batch_loss[ 8200 ]: 2.9168497803766513e-06
train_batch_loss[ 8210 ]: 2.975861889353837e-06
train_batch_loss[ 8220 ]: 2.1569487671513343e-06
train_batch_loss[ 8230 ]: 1.6644578408886446e-06
train_batch_loss[ 8240 ]: 1.7897672250910546e-06
train_batch_loss[ 8250 ]: 4.906500180368312e-06
train_batch_loss[ 8260 ]: 3.229664343962213e-06
train_batch_loss[ 8270 ]: 2.1613523131236434e-06
train_batch_loss[ 8280 ]: 2.551232910263934e-06
train_loss: 2.941062144237548e-06
```

```
epoch: 83
```

```
train_batch_loss[ 8290 ]: 1.4083240102991113e-06
train_batch_loss[ 8300 ]: 7.800360322107736e-07
train_batch_loss[ 8310 ]: 1.3861954357707873e-06
train_batch_loss[ 8320 ]: 8.655040346638998e-07
train_batch_loss[ 8330 ]: 7.967382771312259e-07
train_batch_loss[ 8340 ]: 1.1529148196132155e-06
train_batch_loss[ 8350 ]: 6.245663826121017e-07
train_batch_loss[ 8360 ]: 2.0955958461854607e-06
```

```
train_batch_loss[ 8370 ]: 1.321572426604689e-06
train_batch_loss[ 8380 ]: 2.886523134293384e-06
train_loss: 2.0017100327523446e-06
```

epoch: 84

```
train_batch_loss[ 8390 ]: 2.021574118771241e-06
train_batch_loss[ 8400 ]: 1.9223666640755255e-06
train_batch_loss[ 8410 ]: 1.0922374258370837e-06
train_batch_loss[ 8420 ]: 1.0497249149921117e-06
train_batch_loss[ 8430 ]: 1.5904545307421358e-06
train_batch_loss[ 8440 ]: 1.744067162690044e-06
train_batch_loss[ 8450 ]: 1.9568838069972117e-06
train_batch_loss[ 8460 ]: 2.147451596101746e-06
train_batch_loss[ 8470 ]: 4.98834197060205e-07
train_batch_loss[ 8480 ]: 1.7077103393603466e-06
train_loss: 1.389858561268728e-06
```

epoch: 85

```
train_batch_loss[ 8490 ]: 8.016467631932755e-07
train_batch_loss[ 8500 ]: 1.6215776668104809e-06
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 28.23it/s]

valid_evaluation: loss=0.8109778052169673, acc=0.9352112676056338

save model at

./torch_checkpoints/22_3_24-14/crnn1_008500_loss0.8109778052169673.pt

```
train_batch_loss[ 8510 ]: 1.8029844568445696e-06
train_batch_loss[ 8520 ]: 7.530534276156686e-07
train_batch_loss[ 8530 ]: 7.006170790191391e-07
train_batch_loss[ 8540 ]: 6.831614882685244e-07
train_batch_loss[ 8550 ]: 4.4490661821328104e-07
train_batch_loss[ 8560 ]: 7.225152103274013e-07
train_batch_loss[ 8570 ]: 1.3726202041652869e-06
train_batch_loss[ 8580 ]: 9.493314792052843e-07
train_loss: 9.565721058040102e-07
```

epoch: 86

```
train_batch_loss[ 8590 ]: 9.837991683525615e-07
train_batch_loss[ 8600 ]: 7.268509421010094e-07
train_batch_loss[ 8610 ]: 6.850760883025941e-07
train_batch_loss[ 8620 ]: 3.8710766148142284e-07
train_batch_loss[ 8630 ]: 2.3134619198117434e-07
train_batch_loss[ 8640 ]: 6.253617357288022e-07
train_batch_loss[ 8650 ]: 4.429273303685477e-07
train_batch_loss[ 8660 ]: 6.153526896923722e-07
train_batch_loss[ 8670 ]: 9.773398232937325e-07
train_batch_loss[ 8680 ]: 3.4613168509167735e-07
train_loss: 6.632278980994563e-07
```

epoch: 87

```
train_batch_loss[ 8690 ]: 7.456335993083485e-07
train_batch_loss[ 8700 ]: 5.421588298304414e-07
train_batch_loss[ 8710 ]: 4.7615881726414955e-07
train_batch_loss[ 8720 ]: 1.7785350792109966e-07
```

```
train_batch_loss[ 8730 ]: 2.570304786786437e-07
train_batch_loss[ 8740 ]: 6.221160901986877e-07
train_batch_loss[ 8750 ]: 3.5122440067425487e-07
train_batch_loss[ 8760 ]: 2.8402422458384535e-07
train_batch_loss[ 8770 ]: 3.623422912824026e-07
train_batch_loss[ 8780 ]: 3.797758836299181e-07
train_loss: 4.5328285273122095e-07
```

epoch: 88

```
train_batch_loss[ 8790 ]: 3.110034754172375e-07
train_batch_loss[ 8800 ]: 4.038155907437613e-07
train_batch_loss[ 8810 ]: 2.249721262614912e-07
train_batch_loss[ 8820 ]: 1.257285475730896e-07
train_batch_loss[ 8830 ]: 1.3526369002647698e-07
train_batch_loss[ 8840 ]: 2.0896538899251027e-07
train_batch_loss[ 8850 ]: 3.6424637528398307e-07
train_batch_loss[ 8860 ]: 1.548323780298233e-07
train_batch_loss[ 8870 ]: 4.781612119586498e-07
train_batch_loss[ 8880 ]: 3.01752010045675e-07
train_loss: 3.134777225843974e-07
```

epoch: 89

```
train_batch_loss[ 8890 ]: 1.251457888429286e-07
train_batch_loss[ 8900 ]: 2.0278072554447135e-07
train_batch_loss[ 8910 ]: 2.5513773493912595e-07
train_batch_loss[ 8920 ]: 1.489350012207069e-07
train_batch_loss[ 8930 ]: 1.0436633601784706e-07
train_batch_loss[ 8940 ]: 1.8184073269367218e-07
train_batch_loss[ 8950 ]: 1.561046332199112e-07
train_batch_loss[ 8960 ]: 1.1233953500777716e-07
train_batch_loss[ 8970 ]: 6.127766027930193e-07
train_batch_loss[ 8980 ]: 1.0663643479347229e-07
train_loss: 2.034425992972794e-07
```

epoch: 90

```
train_batch_loss[ 8990 ]: 1.6435880922927026e-07
train_batch_loss[ 9000 ]: 6.239861249923706e-08
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 28.94it/s]

valid_evaluation: loss=0.8187679250160573, acc=0.9380281690140845
save model at

./torch_checkpoints/22_3_24-14/crnn1_009000_loss0.8187679250160573.pt

```
train_batch_loss[ 9010 ]: 7.86958409548788e-08
train_batch_loss[ 9020 ]: 1.685573209897484e-07
train_batch_loss[ 9030 ]: 1.6798730939626694e-07
train_batch_loss[ 9040 ]: 1.0587973520159721e-07
train_batch_loss[ 9050 ]: 8.42846930027008e-08
train_batch_loss[ 9060 ]: 8.313509169965982e-08
train_batch_loss[ 9070 ]: 1.0709391062846407e-07
train_batch_loss[ 9080 ]: 5.069887265563011e-08
train_batch_loss[ 9090 ]: 0.0
train_loss: 1.3298579289458705e-07
```

```
epoch: 91
train_batch_loss[ 9100 ]: 8.1476173363626e-08
train_batch_loss[ 9110 ]: 1.4202650788774918e-07
train_batch_loss[ 9120 ]: 2.689175744308159e-07
train_batch_loss[ 9130 ]: 6.50179572403431e-08
train_batch_loss[ 9140 ]: 7.729226325636773e-08
train_batch_loss[ 9150 ]: 7.252673839275303e-08
train_batch_loss[ 9160 ]: 5.989568307995796e-08
train_batch_loss[ 9170 ]: 1.0702206054702401e-07
train_batch_loss[ 9180 ]: 4.46889316663146e-08
train_batch_loss[ 9190 ]: 7.487684428042485e-08
train_loss: 8.239778578499943e-08
epoch: 92
train_batch_loss[ 9200 ]: 4.684989107772708e-08
train_batch_loss[ 9210 ]: 1.5598196512200957e-07
train_batch_loss[ 9220 ]: 6.728032531100325e-08
train_batch_loss[ 9230 ]: 3.584864316508174e-08
train_batch_loss[ 9240 ]: 7.991548045538366e-08
train_batch_loss[ 9250 ]: 6.979097832982006e-08
train_batch_loss[ 9260 ]: 5.576021067099646e-08
train_batch_loss[ 9270 ]: 5.261972191306086e-08
train_batch_loss[ 9280 ]: 4.09772802356656e-08
train_batch_loss[ 9290 ]: 1.9092105674189952e-08
train_loss: 5.265783021113697e-08
epoch: 93
train_batch_loss[ 9300 ]: 1.4319084584712982e-08
train_batch_loss[ 9310 ]: 3.1180661608232185e-08
train_batch_loss[ 9320 ]: 2.3283057259959605e-08
train_batch_loss[ 9330 ]: 1.1175863789958385e-08
train_batch_loss[ 9340 ]: 7.450580596923828e-09
train_batch_loss[ 9350 ]: 3.3527612686157227e-08
train_batch_loss[ 9360 ]: 4.793037078343332e-08
train_batch_loss[ 9370 ]: 4.842877388000488e-08
train_batch_loss[ 9380 ]: 1.768785296007991e-08
train_batch_loss[ 9390 ]: 1.862644971595273e-08
train_loss: 2.6628115194701394e-08
epoch: 94
train_batch_loss[ 9400 ]: 1.1408701539039612e-08
train_batch_loss[ 9410 ]: 3.3178356062535386e-08
train_batch_loss[ 9420 ]: 6.51925802230835e-09
train_batch_loss[ 9430 ]: 1.676289684837684e-08
train_batch_loss[ 9440 ]: 8.381903171539307e-09
train_batch_loss[ 9450 ]: 8.38183566997941e-09
train_batch_loss[ 9460 ]: 1.0710209608078003e-08
train_batch_loss[ 9470 ]: 1.3329554349184036e-08
train_batch_loss[ 9480 ]: 2.223532646894455e-08
train_batch_loss[ 9490 ]: 1.1176325642736629e-08
train_loss: 1.4920778546721102e-08
```

```
epoch: 95
train_batch_loss[ 9500 ]: -3.725290298461914e-09

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 22.26it/s]

valid_evaluation: loss=0.8376243386942316, acc=0.9380281690140845
save model at
./torch_checkpoints/22_3_24-14/crnn1_009500_loss0.8376243386942316.pt
train_batch_loss[ 9510 ]: 8.381903171539307e-09
train_batch_loss[ 9520 ]: 7.450580596923828e-09
train_batch_loss[ 9530 ]: 1.862645149230957e-09
train_batch_loss[ 9540 ]: 7.450580596923828e-09
train_batch_loss[ 9550 ]: -9.458744898438454e-10
train_batch_loss[ 9560 ]: 1.1059455573558807e-08
train_batch_loss[ 9570 ]: 2.2104359231889248e-08
train_batch_loss[ 9580 ]: 2.2444022818035592e-07
train_batch_loss[ 9590 ]: 2.484066953911679e-06
train_loss: 0.005468533727700691
epoch: 96
train_batch_loss[ 9600 ]: 0.00046265212586149573
train_batch_loss[ 9610 ]: 0.013121054507791996
train_batch_loss[ 9620 ]: 2.1140496755833738e-05
train_batch_loss[ 9630 ]: 0.0025573824532330036
train_batch_loss[ 9640 ]: 0.0028057629242539406
train_batch_loss[ 9650 ]: 1.1440990419941954e-05
train_batch_loss[ 9660 ]: 0.0011978760594502091
train_batch_loss[ 9670 ]: 0.00017371622379869223
train_batch_loss[ 9680 ]: 1.872380153145059e-06
train_batch_loss[ 9690 ]: 0.00024666014360263944
train_loss: 0.02792095945435671
epoch: 97
train_batch_loss[ 9700 ]: 6.7246191974845715e-06
train_batch_loss[ 9710 ]: 3.577097231755033e-05
train_batch_loss[ 9720 ]: 5.185013833397534e-06
train_batch_loss[ 9730 ]: 4.8751928261481225e-05
train_batch_loss[ 9740 ]: 0.0004429953405633569
train_batch_loss[ 9750 ]: 6.511226820293814e-05
train_batch_loss[ 9760 ]: 0.0002076836972264573
train_batch_loss[ 9770 ]: 3.0125179364404175e-06
train_batch_loss[ 9780 ]: 1.1026983884221409e-05
train_batch_loss[ 9790 ]: 1.682871334196534e-05
train_loss: 0.013473506362187943
epoch: 98
train_batch_loss[ 9800 ]: 1.893947774078697e-05
train_batch_loss[ 9810 ]: 2.2796750272391364e-05
train_batch_loss[ 9820 ]: 8.057183003984392e-05
train_batch_loss[ 9830 ]: 3.732066397788003e-05
train_batch_loss[ 9840 ]: 1.2635999837584677e-06
train_batch_loss[ 9850 ]: 5.478056846186519e-05
train_batch_loss[ 9860 ]: 2.284617949044332e-06
```

```
train_batch_loss[ 9870 ]: 9.324211305283825e-07
train_batch_loss[ 9880 ]: 2.116481846314855e-05
train_batch_loss[ 9890 ]: 3.8127127481857315e-06
train_loss: 0.0031545653973657434
```

epoch: 99

```
train_batch_loss[ 9900 ]: 2.5573849598004017e-06
train_batch_loss[ 9910 ]: 3.697453939821571e-05
train_batch_loss[ 9920 ]: 6.370955816237256e-05
train_batch_loss[ 9930 ]: 2.8060121621820144e-05
train_batch_loss[ 9940 ]: 0.0005522086867131293
train_batch_loss[ 9950 ]: 5.033512934460305e-06
train_batch_loss[ 9960 ]: 2.3049069568514824e-06
train_batch_loss[ 9970 ]: 2.3089514797902666e-06
train_batch_loss[ 9980 ]: 1.6163394320756197e-06
train_batch_loss[ 9990 ]: 6.756955554010347e-05
train_loss: 0.0002643386913239438
```

epoch: 100

```
train_batch_loss[ 10000 ]: 1.837393756431993e-05
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 23.57it/s]

valid_evaluation: loss=0.8941356577084099, acc=0.923943661971831

save model at

./torch_checkpoints/22_3_24-14/crnn1_010000_loss0.8941356577084099.pt

```
train_batch_loss[ 10010 ]: 4.601524051395245e-05
train_batch_loss[ 10020 ]: 5.114635860081762e-05
train_batch_loss[ 10030 ]: 6.005743216519477e-06
train_batch_loss[ 10040 ]: 2.6580396479403134e-06
train_batch_loss[ 10050 ]: 0.010339667089283466
train_batch_loss[ 10060 ]: 7.989204459590837e-05
train_batch_loss[ 10070 ]: 5.964422598481178e-06
train_batch_loss[ 10080 ]: 5.6525303079979494e-05
train_batch_loss[ 10090 ]: 0.00016924327064771205
train_batch_loss[ 10100 ]: 1.2268622716267903e-06
train_loss: 0.0003760852314510868
```

epoch: 101

```
train_batch_loss[ 10110 ]: 4.003211870440282e-06
train_batch_loss[ 10120 ]: 4.650890696211718e-05
train_batch_loss[ 10130 ]: 7.652139174751937e-06
train_batch_loss[ 10140 ]: 8.19782871985808e-06
train_batch_loss[ 10150 ]: 9.291510650655255e-06
train_batch_loss[ 10160 ]: 3.3196861295436975e-06
train_batch_loss[ 10170 ]: 1.8601584088173695e-05
train_batch_loss[ 10180 ]: 4.849461038247682e-05
train_batch_loss[ 10190 ]: 1.0977632882713806e-05
train_batch_loss[ 10200 ]: 7.6141441240906715e-06
train_loss: 0.003554390840081115
```

epoch: 102

```
train_batch_loss[ 10210 ]: 9.154082363238558e-05
train_batch_loss[ 10220 ]: 0.0007138874498195946
```

```
train_batch_loss[ 10230 ]: 1.3089359526929911e-05
train_batch_loss[ 10240 ]: 8.66859991219826e-05
train_batch_loss[ 10250 ]: 0.004640054423362017
train_batch_loss[ 10260 ]: 3.2297677535098046e-05
train_batch_loss[ 10270 ]: 0.0006507504731416702
train_batch_loss[ 10280 ]: 0.00015581022307742387
train_batch_loss[ 10290 ]: 7.037808245513588e-06
train_batch_loss[ 10300 ]: 0.0001471904688514769
train_loss: 0.00660469958125683
```

epoch: 103

```
train_batch_loss[ 10310 ]: 1.590657848282717e-05
train_batch_loss[ 10320 ]: 6.576864961971296e-06
train_batch_loss[ 10330 ]: 1.1727240689651808e-06
train_batch_loss[ 10340 ]: 8.311740202771034e-06
train_batch_loss[ 10350 ]: 1.9086473912466317e-06
train_batch_loss[ 10360 ]: 0.00015005472232587636
train_batch_loss[ 10370 ]: 1.5495819752686657e-05
train_batch_loss[ 10380 ]: 9.973451597034e-06
train_batch_loss[ 10390 ]: 3.815875516011147e-06
train_batch_loss[ 10400 ]: 1.1711373417711002e-06
train_loss: 0.0025486637003014844
```

epoch: 104

```
train_batch_loss[ 10410 ]: 0.001809676643460989
train_batch_loss[ 10420 ]: 0.0054458435624837875
train_batch_loss[ 10430 ]: 1.0719068086473271e-05
train_batch_loss[ 10440 ]: 7.981964154168963e-05
train_batch_loss[ 10450 ]: 9.643182238505688e-06
train_batch_loss[ 10460 ]: 7.88217585068196e-06
train_batch_loss[ 10470 ]: 2.916898438343196e-06
train_batch_loss[ 10480 ]: 0.0001873869332484901
train_batch_loss[ 10490 ]: 6.246480188565329e-05
train_batch_loss[ 10500 ]: 1.3241513443063013e-05
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 26.78it/s]

valid_evaluation: loss=0.9254451086613494, acc=0.9267605633802817

save model at

./torch_checkpoints/22_3_24-14/crnn1_010500_loss0.9254451086613494.pt

train_loss: 0.00019220726575925484

epoch: 105

```
train_batch_loss[ 10510 ]: 5.543367933569243e-07
train_batch_loss[ 10520 ]: 4.826008535019355e-06
train_batch_loss[ 10530 ]: 2.057684014289407e-06
train_batch_loss[ 10540 ]: 2.5258868845412508e-05
train_batch_loss[ 10550 ]: 6.821631359343883e-06
train_batch_loss[ 10560 ]: 2.5795989131438546e-06
train_batch_loss[ 10570 ]: 1.1601252481341362e-05
train_batch_loss[ 10580 ]: 9.114115755437524e-07
train_batch_loss[ 10590 ]: 6.528514404635644e-07
train_batch_loss[ 10600 ]: 2.7742330530600157e-06
```



```
train_loss: 0.00031015897675070234
epoch: 106
train_batch_loss[ 10610 ]: 2.5738179374457104e-06
train_batch_loss[ 10620 ]: 5.054712801211281e-06
train_batch_loss[ 10630 ]: 1.3829977660861914e-06
train_batch_loss[ 10640 ]: 9.160088666249067e-06
train_batch_loss[ 10650 ]: 1.3586464774562046e-05
train_batch_loss[ 10660 ]: 0.0001614960638107732
train_batch_loss[ 10670 ]: 1.288047997149988e-06
train_batch_loss[ 10680 ]: 1.7951932704818319e-06
train_batch_loss[ 10690 ]: 1.4609890058636665e-05
train_batch_loss[ 10700 ]: 7.82005736255087e-06
train_loss: 0.00017838687493325404
epoch: 107
train_batch_loss[ 10710 ]: 0.009532161988317966
train_batch_loss[ 10720 ]: 5.601437806035392e-06
train_batch_loss[ 10730 ]: 5.572751251747832e-05
train_batch_loss[ 10740 ]: 0.00015167419041972607
train_batch_loss[ 10750 ]: 1.5215994153550128e-06
train_batch_loss[ 10760 ]: 0.015904169529676437
train_batch_loss[ 10770 ]: 0.009318196214735508
train_batch_loss[ 10780 ]: 8.713721399544738e-06
train_batch_loss[ 10790 ]: 5.6856752053136006e-05
train_batch_loss[ 10800 ]: 5.970028723822907e-06
train_loss: 0.012401064042411952
epoch: 108
train_batch_loss[ 10810 ]: 6.196903541422216e-06
train_batch_loss[ 10820 ]: 1.4232549801818095e-05
train_batch_loss[ 10830 ]: 4.411486224853434e-05
train_batch_loss[ 10840 ]: 1.9365102161827963e-06
train_batch_loss[ 10850 ]: 0.00026390189304947853
train_batch_loss[ 10860 ]: 0.19203776121139526
train_batch_loss[ 10870 ]: 0.011476515792310238
train_batch_loss[ 10880 ]: 2.4120819944073446e-05
train_batch_loss[ 10890 ]: 0.00017591292271390557
train_batch_loss[ 10900 ]: 0.05207306146621704
train_loss: 0.00401602348254203
epoch: 109
train_batch_loss[ 10910 ]: 0.41935527324676514
train_batch_loss[ 10920 ]: 2.496881461411249e-05
train_batch_loss[ 10930 ]: 1.2439427337085363e-05
train_batch_loss[ 10940 ]: 0.0812392458319664
train_batch_loss[ 10950 ]: 2.8662121621891856e-05
train_batch_loss[ 10960 ]: 3.938551162718795e-05
train_batch_loss[ 10970 ]: 5.310845381245599e-07
train_batch_loss[ 10980 ]: 1.968590368051082e-06
train_batch_loss[ 10990 ]: 0.00014780942001380026
train_batch_loss[ 11000 ]: 1.9101094039797317e-06
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 20.43it/s]
```

```
valid_evaluation: loss=0.9612252683706687, acc=0.9098591549295775
save model at
./torch_checkpoints/22_3_24-14/crnn1_011000_loss0.9612252683706687.pt
train_loss: 0.011188795905461403
epoch: 110
train_batch_loss[ 11010 ]: 4.004579386673868e-05
train_batch_loss[ 11020 ]: 2.461971052980516e-05
train_batch_loss[ 11030 ]: 4.788463684235467e-06
train_batch_loss[ 11040 ]: 1.3804017726215534e-05
train_batch_loss[ 11050 ]: 1.8339524103794247e-06
train_batch_loss[ 11060 ]: 2.653883711900562e-06
train_batch_loss[ 11070 ]: 3.562984784366563e-05
train_batch_loss[ 11080 ]: 0.012061161920428276
train_batch_loss[ 11090 ]: 8.301793423015624e-05
train_batch_loss[ 11100 ]: 2.0645853510359302e-05
train_batch_loss[ 11110 ]: 1.3150274753570557e-06
train_loss: 0.0002355813462587276
epoch: 111
train_batch_loss[ 11120 ]: 2.9987606467329897e-05
train_batch_loss[ 11130 ]: 2.881373802665621e-06
train_batch_loss[ 11140 ]: 0.0009182142093777657
train_batch_loss[ 11150 ]: 0.0002870371681638062
train_batch_loss[ 11160 ]: 5.69389812881127e-05
train_batch_loss[ 11170 ]: 9.062619028554764e-07
train_batch_loss[ 11180 ]: 0.00013955104805063456
train_batch_loss[ 11190 ]: 8.083598368102685e-05
train_batch_loss[ 11200 ]: 1.0375249075877946e-05
train_batch_loss[ 11210 ]: 2.324914476048434e-06
train_loss: 0.00011229602680439443
epoch: 112
train_batch_loss[ 11220 ]: 6.320629836409353e-06
train_batch_loss[ 11230 ]: 2.8507131446531275e-06
train_batch_loss[ 11240 ]: 0.00021051712974440306
train_batch_loss[ 11250 ]: 7.286802429007366e-06
train_batch_loss[ 11260 ]: 1.470157144467521e-06
train_batch_loss[ 11270 ]: 9.491074706602376e-06
train_batch_loss[ 11280 ]: 2.7576912543736398e-05
train_batch_loss[ 11290 ]: 1.3311345128386165e-06
train_batch_loss[ 11300 ]: 4.432612695381977e-05
train_batch_loss[ 11310 ]: 2.6397145120427012e-05
train_loss: 0.00010767881308789646
epoch: 113
train_batch_loss[ 11320 ]: 1.6106278053484857e-06
train_batch_loss[ 11330 ]: 5.852198228240013e-06
train_batch_loss[ 11340 ]: 8.740314569877228e-07
train_batch_loss[ 11350 ]: 1.4905761418049224e-05
train_batch_loss[ 11360 ]: 6.337666036415612e-07
train_batch_loss[ 11370 ]: 6.147770363895688e-06
train_batch_loss[ 11380 ]: 1.357372411803226e-06
train_batch_loss[ 11390 ]: 3.420645953156054e-06
```

```
train_batch_loss[ 11400 ]: 2.8801732696592808e-06
train_batch_loss[ 11410 ]: 3.349145345055149e-06
train_loss: 0.00027994928094819606
epoch: 114
train_batch_loss[ 11420 ]: 1.2665195754379965e-05
train_batch_loss[ 11430 ]: 3.0403753044083714e-05
train_batch_loss[ 11440 ]: 1.0242220014333725e-06
train_batch_loss[ 11450 ]: 3.501848186715506e-05
train_batch_loss[ 11460 ]: 1.4298504538601264e-05
train_batch_loss[ 11470 ]: 5.723016784031643e-06
train_batch_loss[ 11480 ]: 2.7333435355103575e-05
train_batch_loss[ 11490 ]: 3.9342554373433813e-05
train_batch_loss[ 11500 ]: 1.7411755834473297e-05
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 21.89it/s]
```

```
valid_evaluation: loss=1.0146929046532638, acc=0.923943661971831
```

```
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_011500_loss1.0146929046532638.pt
```

```
train_batch_loss[ 11510 ]: 0.0004186595615465194
```

```
train_loss: 0.010686640054029854
```

```
epoch: 115
```

```
train_batch_loss[ 11520 ]: 0.0001634654909139499
train_batch_loss[ 11530 ]: 4.994612027076073e-06
train_batch_loss[ 11540 ]: 1.4456327335210517e-06
train_batch_loss[ 11550 ]: 1.5904455722193234e-05
train_batch_loss[ 11560 ]: 3.2185341751755914e-06
train_batch_loss[ 11570 ]: 0.00011022407852578908
train_batch_loss[ 11580 ]: 8.27226831461303e-05
train_batch_loss[ 11590 ]: 1.4664019545307383e-06
train_batch_loss[ 11600 ]: 2.5777100745472126e-05
train_batch_loss[ 11610 ]: 8.747432730160654e-06
train_loss: 0.006854641455559014
```

```
epoch: 116
```

```
train_batch_loss[ 11620 ]: 2.842047933881986e-06
train_batch_loss[ 11630 ]: 3.275755034337635e-06
train_batch_loss[ 11640 ]: 0.00029480698867700994
train_batch_loss[ 11650 ]: 7.682619616389275e-05
train_batch_loss[ 11660 ]: 0.0001254002272617072
train_batch_loss[ 11670 ]: 0.0005357905756682158
train_batch_loss[ 11680 ]: 7.889222615631297e-06
train_batch_loss[ 11690 ]: 1.646444434300065e-05
train_batch_loss[ 11700 ]: 0.0002747380349319428
train_batch_loss[ 11710 ]: 1.482182960899081e-05
train_loss: 0.009415694558229836
```

```
epoch: 117
```

```
train_batch_loss[ 11720 ]: 3.9419683162122965e-07
train_batch_loss[ 11730 ]: 4.3638683564495295e-06
train_batch_loss[ 11740 ]: 1.009586685540853e-05
train_batch_loss[ 11750 ]: 2.4565088097006083e-06
```

```
train_batch_loss[ 11760 ]: 2.4921546355471946e-06
train_batch_loss[ 11770 ]: 6.122110062278807e-05
train_batch_loss[ 11780 ]: 1.0641102562658489e-05
train_batch_loss[ 11790 ]: 4.738918050861685e-06
train_batch_loss[ 11800 ]: 0.04140188544988632
train_batch_loss[ 11810 ]: 5.38998210686259e-06
train_loss: 0.003401525789590351
```

epoch: 118

```
train_batch_loss[ 11820 ]: 1.2880801477876958e-05
train_batch_loss[ 11830 ]: 7.011937213974306e-06
train_batch_loss[ 11840 ]: 1.0390644092694856e-05
train_batch_loss[ 11850 ]: 0.0002492503263056278
train_batch_loss[ 11860 ]: 0.0035981819964945316
train_batch_loss[ 11870 ]: 9.007355401990935e-06
train_batch_loss[ 11880 ]: 3.877675680996617e-06
train_batch_loss[ 11890 ]: 2.6475114282220602e-05
train_batch_loss[ 11900 ]: 2.7344905902282335e-05
train_batch_loss[ 11910 ]: 7.87255703471601e-05
train_loss: 0.005148430134181586
```

epoch: 119

```
train_batch_loss[ 11920 ]: 9.04506232473068e-05
train_batch_loss[ 11930 ]: 8.673443517182022e-06
train_batch_loss[ 11940 ]: 9.262058483727742e-06
train_batch_loss[ 11950 ]: 3.33827301801648e-05
train_batch_loss[ 11960 ]: 7.413726416416466e-05
train_batch_loss[ 11970 ]: 0.0009406295721419156
train_batch_loss[ 11980 ]: 0.07884340733289719
train_batch_loss[ 11990 ]: 1.3886266970075667e-05
train_batch_loss[ 12000 ]: 9.934301488101482e-07
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 20.93it/s]

valid_evaluation: loss=0.8495553951238243, acc=0.9436619718309859

save model at

./torch_checkpoints/22_3_24-14/crnn1_012000_loss0.8495553951238243.pt

```
train_batch_loss[ 12010 ]: 9.695399057818577e-06
```

```
train_loss: 0.0016170739275279179
```

epoch: 120

```
train_batch_loss[ 12020 ]: 2.9774375434499234e-05
train_batch_loss[ 12030 ]: 1.3290858987602405e-05
train_batch_loss[ 12040 ]: 9.960014722310007e-06
train_batch_loss[ 12050 ]: 4.364995675132377e-06
train_batch_loss[ 12060 ]: 3.283836576883914e-06
train_batch_loss[ 12070 ]: 1.6145873814821243e-05
train_batch_loss[ 12080 ]: 3.6483143048826605e-05
train_batch_loss[ 12090 ]: 2.330918869120069e-05
train_batch_loss[ 12100 ]: 4.075103788636625e-05
train_batch_loss[ 12110 ]: 1.491536750108935e-05
train_batch_loss[ 12120 ]: 0.0
```

```
train_loss: 0.002874374530573832
```

```
epoch: 121
train_batch_loss[ 12130 ]: 0.011149058118462563
train_batch_loss[ 12140 ]: 8.172491652658209e-05
train_batch_loss[ 12150 ]: 2.9865504984627478e-05
train_batch_loss[ 12160 ]: 7.010384592831542e-07
train_batch_loss[ 12170 ]: 1.2245776815689169e-05
train_batch_loss[ 12180 ]: 7.063865268719383e-06
train_batch_loss[ 12190 ]: 1.4262168406276032e-05
train_batch_loss[ 12200 ]: 1.1211780474695843e-05
train_batch_loss[ 12210 ]: 4.4790331230615266e-06
train_batch_loss[ 12220 ]: 4.268578322808025e-06
train_loss: 0.002936577064098881
```

```
epoch: 122
train_batch_loss[ 12230 ]: 1.3783719623461366e-06
train_batch_loss[ 12240 ]: 9.792960554477759e-06
train_batch_loss[ 12250 ]: 3.6299825296737254e-06
train_batch_loss[ 12260 ]: 7.046559039736167e-05
train_batch_loss[ 12270 ]: 4.5917739043943584e-05
train_batch_loss[ 12280 ]: 3.316807851660997e-05
train_batch_loss[ 12290 ]: 3.578375617507845e-05
train_batch_loss[ 12300 ]: 4.554303814074956e-06
train_batch_loss[ 12310 ]: 4.011153578176163e-06
train_batch_loss[ 12320 ]: 9.211894393956754e-06
train_loss: 0.004402628805378616
```

```
epoch: 123
train_batch_loss[ 12330 ]: 0.00021711816953029484
train_batch_loss[ 12340 ]: 3.2468651625094935e-05
train_batch_loss[ 12350 ]: 1.1829283721453976e-05
train_batch_loss[ 12360 ]: 1.6939455235842615e-05
train_batch_loss[ 12370 ]: 0.00035728176590055227
train_batch_loss[ 12380 ]: 0.03327133506536484
train_batch_loss[ 12390 ]: 3.030657535418868e-05
train_batch_loss[ 12400 ]: 1.989525480894372e-05
train_batch_loss[ 12410 ]: 3.1057486921781674e-05
train_batch_loss[ 12420 ]: 7.003763312241063e-05
train_loss: 0.003961693143174954
```

```
epoch: 124
train_batch_loss[ 12430 ]: 1.1772468496928923e-05
train_batch_loss[ 12440 ]: 0.0002890012401621789
train_batch_loss[ 12450 ]: 2.5812681997194886e-05
train_batch_loss[ 12460 ]: 2.296838465554174e-05
train_batch_loss[ 12470 ]: 1.674517761784955e-06
train_batch_loss[ 12480 ]: 8.747082347326796e-07
train_batch_loss[ 12490 ]: 2.430254426144529e-06
train_batch_loss[ 12500 ]: 5.273737770039588e-06
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 21.47it/s]
```

```
valid_evaluation: loss=0.9378341748172164, acc=0.9211267605633803
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_012500_loss0.9378341748172164.pt
train_batch_loss[ 12510 ]: 0.003979692701250315
train_batch_loss[ 12520 ]: 5.647776106343372e-06
train_loss: 0.005389199905227252
epoch: 125
train_batch_loss[ 12530 ]: 8.497706858179299e-07
train_batch_loss[ 12540 ]: 3.656569606391713e-05
train_batch_loss[ 12550 ]: 0.0026607608888298273
train_batch_loss[ 12560 ]: 8.082772183115594e-06
train_batch_loss[ 12570 ]: 3.049292899959255e-06
train_batch_loss[ 12580 ]: 1.656505673963693e-06
train_batch_loss[ 12590 ]: 9.077607683138922e-05
train_batch_loss[ 12600 ]: 0.0014369639102369547
train_batch_loss[ 12610 ]: 6.647949703619815e-06
train_batch_loss[ 12620 ]: 2.564271562732756e-05
train_loss: 0.0013048869045538059
epoch: 126
train_batch_loss[ 12630 ]: 1.521216381661361e-05
train_batch_loss[ 12640 ]: 7.162897873058682e-06
train_batch_loss[ 12650 ]: 1.4538600225932896e-06
train_batch_loss[ 12660 ]: 1.8740577161224792e-06
train_batch_loss[ 12670 ]: 1.3814315025229007e-06
train_batch_loss[ 12680 ]: 5.857821633981075e-06
train_batch_loss[ 12690 ]: 4.7612134949304163e-05
train_batch_loss[ 12700 ]: 5.240856353339041e-06
train_batch_loss[ 12710 ]: 1.4156139513943344e-05
train_batch_loss[ 12720 ]: 2.901867219406995e-06
train_loss: 0.002803370645063796
epoch: 127
train_batch_loss[ 12730 ]: 6.029405085428152e-06
train_batch_loss[ 12740 ]: 3.293707550255931e-06
train_batch_loss[ 12750 ]: 7.930053698146367e-07
train_batch_loss[ 12760 ]: 5.558175871556159e-06
train_batch_loss[ 12770 ]: 3.889248182531446e-05
train_batch_loss[ 12780 ]: 0.0002846185234375298
train_batch_loss[ 12790 ]: 2.752886757662054e-06
train_batch_loss[ 12800 ]: 7.455365903297206e-06
train_batch_loss[ 12810 ]: 0.008037456311285496
train_batch_loss[ 12820 ]: 0.004312196280807257
train_loss: 0.009866502569970096
epoch: 128
train_batch_loss[ 12830 ]: 2.9325062769203214e-06
train_batch_loss[ 12840 ]: 2.67125760728959e-05
train_batch_loss[ 12850 ]: 7.648140467608755e-07
train_batch_loss[ 12860 ]: 5.821137165185064e-06
train_batch_loss[ 12870 ]: 0.02065463177859783
train_batch_loss[ 12880 ]: 3.2776875741546974e-05
train_batch_loss[ 12890 ]: 0.0006944767665117979
train_batch_loss[ 12900 ]: 3.434692553128116e-05
```

```
train_batch_loss[ 12910 ]: 9.445188879908528e-06
train_batch_loss[ 12920 ]: 1.9716142560355365e-05
train_loss: 0.011275677147195632
epoch: 129
train_batch_loss[ 12930 ]: 6.707113789161667e-05
train_batch_loss[ 12940 ]: 2.0898092770949006e-05
train_batch_loss[ 12950 ]: 7.528629794251174e-06
train_batch_loss[ 12960 ]: 3.523296300045331e-06
train_batch_loss[ 12970 ]: 2.022445733018685e-05
train_batch_loss[ 12980 ]: 1.0852845662157051e-05
train_batch_loss[ 12990 ]: 4.3610566535789985e-07
train_batch_loss[ 13000 ]: 1.0053918231278658e-06
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 20.32it/s]
```

```
valid_evaluation: loss=0.9196159016498378, acc=0.9211267605633803
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_013000_loss0.9196159016498378.pt
```

```
train_batch_loss[ 13010 ]: 1.2588247955136467e-06
train_batch_loss[ 13020 ]: 0.00019201490795239806
train_loss: 0.00022736805950000435
```

```
epoch: 130
```

```
train_batch_loss[ 13030 ]: 2.0109753677388653e-05
train_batch_loss[ 13040 ]: 3.8884958485141397e-05
train_batch_loss[ 13050 ]: 2.2188123693922535e-05
train_batch_loss[ 13060 ]: 7.255844138853718e-06
train_batch_loss[ 13070 ]: 1.092451475415146e-05
train_batch_loss[ 13080 ]: 1.2902225989819271e-06
train_batch_loss[ 13090 ]: 3.75290255760774e-07
train_batch_loss[ 13100 ]: 4.9493173719383776e-05
train_batch_loss[ 13110 ]: 2.18536879401654e-05
train_batch_loss[ 13120 ]: 0.000394953356590122
train_batch_loss[ 13130 ]: 1.5894571940104166e-07
train_loss: 0.0013753170565511624
```

```
epoch: 131
```

```
train_batch_loss[ 13140 ]: 7.833432391635142e-06
train_batch_loss[ 13150 ]: 0.008713486604392529
train_batch_loss[ 13160 ]: 1.119360877055442e-05
train_batch_loss[ 13170 ]: 1.622038666937442e-06
train_batch_loss[ 13180 ]: 1.9065863625655766e-06
train_batch_loss[ 13190 ]: 5.8492769312579185e-06
train_batch_loss[ 13200 ]: 0.00019493410945869982
train_batch_loss[ 13210 ]: 7.825376087566838e-06
train_batch_loss[ 13220 ]: 6.045345799066126e-06
train_batch_loss[ 13230 ]: 1.0587536053208169e-05
train_loss: 0.0002199224280018398
```

```
epoch: 132
```

```
train_batch_loss[ 13240 ]: 3.3621834063524147e-06
train_batch_loss[ 13250 ]: 3.482924967102008e-06
train_batch_loss[ 13260 ]: 6.010857759974897e-05
```

```
train_batch_loss[ 13270 ]: 7.519411155954003e-07
train_batch_loss[ 13280 ]: 2.4743344511080068e-06
train_batch_loss[ 13290 ]: 8.767615327087697e-06
train_batch_loss[ 13300 ]: 4.0685405110707507e-05
train_batch_loss[ 13310 ]: 8.85503595782211e-07
train_batch_loss[ 13320 ]: 3.8037169360904954e-06
train_batch_loss[ 13330 ]: 3.6553688005369622e-06
train_loss: 1.333080482659643e-05
```

epoch: 133

```
train_batch_loss[ 13340 ]: 1.288879502681084e-06
train_batch_loss[ 13350 ]: 1.1378974704712164e-06
train_batch_loss[ 13360 ]: 5.755571237386903e-07
train_batch_loss[ 13370 ]: 1.932712393681868e-06
train_batch_loss[ 13380 ]: 1.2681302905548364e-05
train_batch_loss[ 13390 ]: 6.138599928817712e-06
train_batch_loss[ 13400 ]: 6.626353865613055e-07
train_batch_loss[ 13410 ]: 1.3300050341058522e-06
train_batch_loss[ 13420 ]: 1.509091816842556e-06
train_batch_loss[ 13430 ]: 8.58888597576879e-07
train_loss: 4.282704510324524e-06
```

epoch: 134

```
train_batch_loss[ 13440 ]: 2.4690370992175303e-06
train_batch_loss[ 13450 ]: 2.119937335010036e-06
train_batch_loss[ 13460 ]: 1.2738746590912342e-06
train_batch_loss[ 13470 ]: 1.092268348656944e-06
train_batch_loss[ 13480 ]: 8.543224225832091e-07
train_batch_loss[ 13490 ]: 5.589918146142736e-07
train_batch_loss[ 13500 ]: 2.1223513613222167e-06
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 22.03it/s]

valid_evaluation: loss=0.8456282740655604, acc=0.9323943661971831

save model at

./torch_checkpoints/22_3_24-14/crnn1_013500_loss0.8456282740655604.pt

```
train_batch_loss[ 13510 ]: 5.602267947324435e-07
train_batch_loss[ 13520 ]: 6.819583404649165e-07
train_batch_loss[ 13530 ]: 1.9669516859721625e-06
train_loss: 1.5503043688510074e-06
```

epoch: 135

```
train_batch_loss[ 13540 ]: 4.0105078369379044e-07
train_batch_loss[ 13550 ]: 6.756725383638695e-07
train_batch_loss[ 13560 ]: 1.8024902601609938e-05
train_batch_loss[ 13570 ]: 2.1487157937372103e-06
train_batch_loss[ 13580 ]: 7.058015398797579e-07
train_batch_loss[ 13590 ]: 5.548194508264714e-07
train_batch_loss[ 13600 ]: 9.706734545034124e-07
train_batch_loss[ 13610 ]: 6.258484290810884e-07
train_batch_loss[ 13620 ]: 1.664564251768752e-06
train_batch_loss[ 13630 ]: 1.3643521015183069e-06
train_loss: 1.3117393081456182e-06
```



```
epoch: 136
train_batch_loss[ 13640 ]: 7.876277550167288e-07
train_batch_loss[ 13650 ]: 5.85596865221305e-07
train_batch_loss[ 13660 ]: 1.1235388228669763e-06
train_batch_loss[ 13670 ]: 6.345504743876518e-07
train_batch_loss[ 13680 ]: 3.4906406654044986e-07
train_batch_loss[ 13690 ]: 9.299071734858444e-07
train_batch_loss[ 13700 ]: 5.451124707178678e-07
train_batch_loss[ 13710 ]: 4.691532922151964e-07
train_batch_loss[ 13720 ]: 7.720979624536994e-07
train_batch_loss[ 13730 ]: 6.851571470178897e-07
train_loss: 6.925449259812145e-07
```

```
epoch: 137
train_batch_loss[ 13740 ]: 4.357557372713927e-07
train_batch_loss[ 13750 ]: 1.05873857592087e-06
train_batch_loss[ 13760 ]: 2.6749319204100175e-07
train_batch_loss[ 13770 ]: 4.6720370505681785e-07
train_batch_loss[ 13780 ]: 3.7390873330878094e-07
train_batch_loss[ 13790 ]: 2.931028575403616e-07
train_batch_loss[ 13800 ]: 2.5145283188976464e-07
train_batch_loss[ 13810 ]: 2.5234930944861844e-07
train_batch_loss[ 13820 ]: 4.307493099986459e-07
train_batch_loss[ 13830 ]: 7.513734772146563e-07
train_loss: 4.839865231986575e-07
```

```
epoch: 138
train_batch_loss[ 13840 ]: 3.380700945854187e-07
train_batch_loss[ 13850 ]: 3.292076087291207e-07
train_batch_loss[ 13860 ]: 3.964828465541359e-07
train_batch_loss[ 13870 ]: 1.6346160691682599e-07
train_batch_loss[ 13880 ]: 2.952701265712676e-07
train_batch_loss[ 13890 ]: 2.8163046295048844e-07
train_batch_loss[ 13900 ]: 1.8666284518076282e-07
train_batch_loss[ 13910 ]: 4.4519754283101065e-07
train_batch_loss[ 13920 ]: 1.8346584340633854e-07
train_batch_loss[ 13930 ]: 7.303448796847078e-07
train_loss: 3.4600956095494696e-07
```

```
epoch: 139
train_batch_loss[ 13940 ]: 1.6641752154100686e-07
train_batch_loss[ 13950 ]: 2.5890034294207e-07
train_batch_loss[ 13960 ]: 1.3073433535737422e-07
train_batch_loss[ 13970 ]: 1.369025994790718e-07
train_batch_loss[ 13980 ]: 1.745634108374361e-07
train_batch_loss[ 13990 ]: 1.930018243001541e-07
train_batch_loss[ 14000 ]: 9.877840057015419e-08
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 21.67it/s]
```

```
valid_evaluation: loss=0.8379797920686337, acc=0.9352112676056338
```

```
save model at
```

```
./torch_checkpoints/22_3_24-14/crnn1_014000_loss0.8379797920686337.pt
```

```
train_batch_loss[ 14010 ]: 2.1978439690428786e-07
train_batch_loss[ 14020 ]: 4.517621619015699e-07
train_batch_loss[ 14030 ]: 2.8777856186934514e-07
train_loss: 2.3671513305990012e-07
epoch: 140
train_batch_loss[ 14040 ]: 1.4893521438352764e-07
train_batch_loss[ 14050 ]: 1.1909287422895432e-07
train_batch_loss[ 14060 ]: 2.2548181277670665e-07
train_batch_loss[ 14070 ]: 3.059358277823776e-07
train_batch_loss[ 14080 ]: 1.416765371686779e-07
train_batch_loss[ 14090 ]: 2.521554733903031e-07
train_batch_loss[ 14100 ]: 2.0477409634622745e-07
train_batch_loss[ 14110 ]: 9.092036634683609e-08
train_batch_loss[ 14120 ]: 1.1443623293416749e-07
train_batch_loss[ 14130 ]: 1.3969838619232178e-07
train_batch_loss[ 14140 ]: 0.0
train_loss: 1.6091775508087918e-07
epoch: 141
train_batch_loss[ 14150 ]: 7.584253580716904e-08
train_batch_loss[ 14160 ]: 1.0331859812140465e-07
train_batch_loss[ 14170 ]: 1.4295073924586177e-07
train_batch_loss[ 14180 ]: 5.5399141274392605e-08
train_batch_loss[ 14190 ]: 1.5753886373204296e-07
train_batch_loss[ 14200 ]: 9.493305697105825e-08
train_batch_loss[ 14210 ]: 6.425807441701181e-08
train_batch_loss[ 14220 ]: 4.6566128730773926e-08
train_batch_loss[ 14230 ]: 5.820765380804005e-08
train_batch_loss[ 14240 ]: 3.6903657019138336e-08
train_loss: 1.0371717327784121e-07
epoch: 142
train_batch_loss[ 14250 ]: 4.417961463332176e-08
train_batch_loss[ 14260 ]: 9.493669494986534e-08
train_batch_loss[ 14270 ]: 1.0717553777794819e-07
train_batch_loss[ 14280 ]: 6.262723672989523e-08
train_batch_loss[ 14290 ]: 6.752087244876748e-08
train_batch_loss[ 14300 ]: 6.332629709504545e-08
train_batch_loss[ 14310 ]: 4.383036866784096e-08
train_batch_loss[ 14320 ]: 8.171627996489406e-08
train_batch_loss[ 14330 ]: 8.274167839772417e-08
train_batch_loss[ 14340 ]: 3.311788532300852e-08
train_loss: 6.770901821553825e-08
epoch: 143
train_batch_loss[ 14350 ]: 4.0046757021627855e-08
train_batch_loss[ 14360 ]: 1.3969838619232178e-08
train_batch_loss[ 14370 ]: 4.1913150283789946e-08
train_batch_loss[ 14380 ]: 3.189779818058014e-08
train_batch_loss[ 14390 ]: 2.163869794458151e-08
train_batch_loss[ 14400 ]: 6.926711648702621e-08
train_batch_loss[ 14410 ]: 3.905734047293663e-08
```

```
train_batch_loss[ 14420 ]: 3.3498054108349606e-08
train_batch_loss[ 14430 ]: 3.53898030880373e-08
train_batch_loss[ 14440 ]: 3.258537617512047e-08
train_loss: 3.9707128508296875e-08
```

epoch: 144

```
train_batch_loss[ 14450 ]: 1.30385160446167e-08
train_batch_loss[ 14460 ]: 3.6961864680051804e-08
train_batch_loss[ 14470 ]: 2.7488567866384983e-08
train_batch_loss[ 14480 ]: 3.7252896323280993e-09
train_batch_loss[ 14490 ]: 2.0692823454737663e-08
train_batch_loss[ 14500 ]: 1.5831574273761362e-08
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 29.60it/s]

valid_evaluation: loss=0.8475994608515848, acc=0.9352112676056338
save model at

./torch_checkpoints/22_3_24-14/crnn1_014500_loss0.8475994608515848.pt

```
train_batch_loss[ 14510 ]: 1.8044374883174896e-08
train_batch_loss[ 14520 ]: 1.8088030628859997e-08
train_batch_loss[ 14530 ]: 3.2071966415969655e-08
train_batch_loss[ 14540 ]: 2.654268982382746e-08
train_loss: 2.3645128311076078e-08
```

epoch: 145

```
train_batch_loss[ 14550 ]: 3.213062882423401e-08
train_batch_loss[ 14560 ]: 7.436028681695461e-09
train_batch_loss[ 14570 ]: 3.3760443329811096e-09
train_batch_loss[ 14580 ]: -6.984919309616089e-09
train_batch_loss[ 14590 ]: 1.1634224250656189e-08
train_batch_loss[ 14600 ]: 3.725290298461914e-09
train_batch_loss[ 14610 ]: 5.587935447692871e-09
train_batch_loss[ 14620 ]: 7.450580596923828e-09
train_batch_loss[ 14630 ]: 1.302305108197288e-08
train_batch_loss[ 14640 ]: 2.194065018557012e-08
train_loss: 1.3110345705994686e-08
```

epoch: 146

```
train_batch_loss[ 14650 ]: 1.4551915228366852e-11
train_batch_loss[ 14660 ]: 6.51925802230835e-09
train_batch_loss[ 14670 ]: 4.1763996705412865e-09
train_batch_loss[ 14680 ]: 2.7939677238464355e-09
train_batch_loss[ 14690 ]: -4.547473508864641e-13
train_batch_loss[ 14700 ]: -3.259629011154175e-09
train_batch_loss[ 14710 ]: 7.446885774697876e-09
train_batch_loss[ 14720 ]: 1.5832483768463135e-08
train_batch_loss[ 14730 ]: -2.7939677238464355e-09
train_batch_loss[ 14740 ]: 0.0
train_loss: 5.5280494307093995e-09
```

epoch: 147

```
train_batch_loss[ 14750 ]: 0.0
train_batch_loss[ 14760 ]: 3.259629011154175e-09
train_batch_loss[ 14770 ]: 0.0
```

```
train_batch_loss[ 14780 ]: 1.862645149230957e-09
train_batch_loss[ 14790 ]: 9.313225746154785e-10
train_batch_loss[ 14800 ]: 4.190950697591234e-09
train_batch_loss[ 14810 ]: 9.313225746154785e-10
train_batch_loss[ 14820 ]: 0.0
train_batch_loss[ 14830 ]: 1.0943040251731873e-08
train_batch_loss[ 14840 ]: 0.0
train_loss: 4.611922641057975e-09
```

epoch: 148

```
train_batch_loss[ 14850 ]: 5.215224518906325e-08
train_batch_loss[ 14860 ]: 4.190951585769653e-09
train_batch_loss[ 14870 ]: 1.0244491477351403e-08
train_batch_loss[ 14880 ]: 4.749017179506154e-08
train_batch_loss[ 14890 ]: 7.450580596923828e-09
train_batch_loss[ 14900 ]: 3.725290298461914e-09
train_batch_loss[ 14910 ]: 0.702092707157135
train_batch_loss[ 14920 ]: 0.3209880590438843
train_batch_loss[ 14930 ]: 0.15951049327850342
train_batch_loss[ 14940 ]: 9.804096771404147e-05
train_loss: 0.0486237592729579
```

epoch: 149

```
train_batch_loss[ 14950 ]: 0.0007715562824159861
train_batch_loss[ 14960 ]: 0.00034085812512785196
train_batch_loss[ 14970 ]: 4.1359242459293455e-05
train_batch_loss[ 14980 ]: 0.0006052699754945934
train_batch_loss[ 14990 ]: 1.5331082977354527e-05
train_batch_loss[ 15000 ]: 0.03426346555352211
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 28.18it/s]

valid_evaluation: loss=0.8071828311282984, acc=0.9380281690140845
save model at

./torch_checkpoints/22_3_24-14/crnn1_015000_loss0.8071828311282984.pt

```
train_batch_loss[ 15010 ]: 2.1458636183524504e-05
train_batch_loss[ 15020 ]: 9.095905625144951e-06
train_batch_loss[ 15030 ]: 5.390524165704846e-06
train_batch_loss[ 15040 ]: 8.320579945575446e-05
train_loss: 0.00956311374701052
```

epoch: 150

```
train_batch_loss[ 15050 ]: 0.00012425820750650018
train_batch_loss[ 15060 ]: 0.00016856459842529148
train_batch_loss[ 15070 ]: 1.3970306099508889e-05
train_batch_loss[ 15080 ]: 1.4950191143725533e-05
train_batch_loss[ 15090 ]: 2.816316964526777e-06
train_batch_loss[ 15100 ]: 3.7094464460096788e-06
train_batch_loss[ 15110 ]: 1.104342118196655e-05
train_batch_loss[ 15120 ]: 8.347647963091731e-06
train_batch_loss[ 15130 ]: 2.4809851311147213e-06
train_batch_loss[ 15140 ]: 1.4863885553495493e-06
train_batch_loss[ 15150 ]: 1.986821113556895e-07
```

train_loss: 0.009873137370342394

epoch: 151

train_batch_loss[15160]: 2.29008037422318e-06
train_batch_loss[15170]: 1.4005041521159e-05
train_batch_loss[15180]: 3.3378957596141845e-05
train_batch_loss[15190]: 4.37732960563153e-05
train_batch_loss[15200]: 1.0554532309470233e-05
train_batch_loss[15210]: 3.837993062916212e-06
train_batch_loss[15220]: 1.1567026376724243e-06
train_batch_loss[15230]: 5.061556294094771e-07
train_batch_loss[15240]: 2.3325032998400275e-06
train_batch_loss[15250]: 2.098508775816299e-05

train_loss: 0.00176774811180629

epoch: 152

train_batch_loss[15260]: 2.3034383048070595e-05
train_batch_loss[15270]: 8.366312249563634e-05
train_batch_loss[15280]: 7.88751549407607e-06
train_batch_loss[15290]: 3.0179044188116677e-06
train_batch_loss[15300]: 2.031095164056751e-06
train_batch_loss[15310]: 7.129247023840435e-07
train_batch_loss[15320]: 0.00011867538705701008
train_batch_loss[15330]: 1.0759395081549883e-06
train_batch_loss[15340]: 6.1224395722092595e-06
train_batch_loss[15350]: 5.121226422488689e-06

train_loss: 0.00089311361166598

epoch: 153

train_batch_loss[15360]: 1.5859478708080132e-06
train_batch_loss[15370]: 6.046364433132112e-06
train_batch_loss[15380]: 3.414330421946943e-06
train_batch_loss[15390]: 2.190517079725396e-06
train_batch_loss[15400]: 1.345295345345221e-06
train_batch_loss[15410]: 1.4421398191188928e-06
train_batch_loss[15420]: 0.00040612430893816054
train_batch_loss[15430]: 2.561973815318197e-06
train_batch_loss[15440]: 8.380336566915503e-07
train_batch_loss[15450]: 3.0497872103296686e-06

train_loss: 7.76471757446627e-06

epoch: 154

train_batch_loss[15460]: 1.7578931874595582e-06
train_batch_loss[15470]: 8.289982815767871e-07
train_batch_loss[15480]: 7.492256486330007e-07
train_batch_loss[15490]: 5.350448191165924e-07
train_batch_loss[15500]: 6.888707275720662e-07

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 27.29it/s]

valid_evaluation: loss=0.8353943915899948, acc=0.9380281690140845

save model at

./torch_checkpoints/22_3_24-14/crnn1_015500_loss0.8353943915899948.pt

train_batch_loss[15510]: 4.5517654712057265e-07

```
train_batch_loss[ 15520 ]: 7.126931791390234e-07
train_batch_loss[ 15530 ]: 1.5810933291504625e-06
train_batch_loss[ 15540 ]: 2.2194581106305122e-06
train_batch_loss[ 15550 ]: 0.0001377458102069795
train_loss: 1.8308966975199214e-05
epoch: 155
train_batch_loss[ 15560 ]: 1.0925355127255898e-05
train_batch_loss[ 15570 ]: 1.343563781119883e-06
train_batch_loss[ 15580 ]: 0.00018623955838847905
train_batch_loss[ 15590 ]: 0.00030796206556260586
train_batch_loss[ 15600 ]: 4.969584915670566e-05
train_batch_loss[ 15610 ]: 1.985332346521318e-06
train_batch_loss[ 15620 ]: 5.300538759911433e-06
train_batch_loss[ 15630 ]: 0.013287543319165707
train_batch_loss[ 15640 ]: 2.5128572815447114e-05
train_batch_loss[ 15650 ]: 0.0035085580311715603
train_loss: 0.011647338782019451
epoch: 156
train_batch_loss[ 15660 ]: 6.1747773543174844e-06
train_batch_loss[ 15670 ]: 0.003966913558542728
train_batch_loss[ 15680 ]: 0.012920837849378586
train_batch_loss[ 15690 ]: 4.558946784527507e-06
train_batch_loss[ 15700 ]: 7.752339115540963e-06
train_batch_loss[ 15710 ]: 1.1346679684720584e-06
train_batch_loss[ 15720 ]: 4.223529117552971e-07
train_batch_loss[ 15730 ]: 3.0859580874675885e-05
train_batch_loss[ 15740 ]: 1.9477129171718843e-06
train_batch_loss[ 15750 ]: 1.8487428405933315e-06
train_loss: 0.010546300602546363
epoch: 157
train_batch_loss[ 15760 ]: 1.2789964785042685e-06
train_batch_loss[ 15770 ]: 0.002364842686802149
train_batch_loss[ 15780 ]: 9.204013622365892e-06
train_batch_loss[ 15790 ]: 5.822485945827793e-06
train_batch_loss[ 15800 ]: 5.665343906002818e-06
train_batch_loss[ 15810 ]: 6.727541403961368e-06
train_batch_loss[ 15820 ]: 0.0004660924314521253
train_batch_loss[ 15830 ]: 1.0427234883536585e-05
train_batch_loss[ 15840 ]: 3.79456491828023e-06
train_batch_loss[ 15850 ]: 1.3835149729857221e-05
train_loss: 0.0015468236025102343
epoch: 158
train_batch_loss[ 15860 ]: 8.773286390351132e-05
train_batch_loss[ 15870 ]: 4.968936536897672e-06
train_batch_loss[ 15880 ]: 5.508488811756251e-06
train_batch_loss[ 15890 ]: 3.7312643144105095e-06
train_batch_loss[ 15900 ]: 3.891900632879697e-05
train_batch_loss[ 15910 ]: 2.658032144609024e-06
train_batch_loss[ 15920 ]: 4.2382735045976005e-06
```

```
train_batch_loss[ 15930 ]: 3.2291347906721057e-06
train_batch_loss[ 15940 ]: 3.7915503980912035e-07
train_batch_loss[ 15950 ]: 1.7678967196843587e-05
train_loss: 3.801339300754051e-05
```

epoch: 159

```
train_batch_loss[ 15960 ]: 5.176521517569199e-05
train_batch_loss[ 15970 ]: 6.514252163469791e-06
train_batch_loss[ 15980 ]: 8.04652227088809e-05
train_batch_loss[ 15990 ]: 1.711449272079335e-06
train_batch_loss[ 16000 ]: 1.0000658221542835e-06
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 20.99it/s]

valid_evaluation: loss=0.9126050940832832, acc=0.9352112676056338

save model at

./torch_checkpoints/22_3_24-14/crnn1_016000_loss0.9126050940832832.pt

```
train_batch_loss[ 16010 ]: 2.9265216653584503e-05
train_batch_loss[ 16020 ]: 4.772691113430483e-07
train_batch_loss[ 16030 ]: 0.0001223977596964687
train_batch_loss[ 16040 ]: 1.7101942830777261e-06
train_batch_loss[ 16050 ]: 7.564120096503757e-06
train_loss: 2.3806492671659737e-05
```

epoch: 160

```
train_batch_loss[ 16060 ]: 1.797870936570689e-06
train_batch_loss[ 16070 ]: 5.289803084451705e-07
train_batch_loss[ 16080 ]: 4.711545625468716e-05
train_batch_loss[ 16090 ]: 3.3252290450036526e-06
train_batch_loss[ 16100 ]: 1.1220397936995141e-05
train_batch_loss[ 16110 ]: 5.064159995527007e-05
train_batch_loss[ 16120 ]: 1.6127407889143797e-06
train_batch_loss[ 16130 ]: 9.023274287756067e-07
train_batch_loss[ 16140 ]: 3.565137092209625e-07
train_batch_loss[ 16150 ]: 6.8781550908170175e-06
train_batch_loss[ 16160 ]: 3.625946798517058e-06
train_loss: 3.5706685916902375e-06
```

epoch: 161

```
train_batch_loss[ 16170 ]: 2.7170972316525877e-07
train_batch_loss[ 16180 ]: 4.384427029435756e-06
train_batch_loss[ 16190 ]: 7.573689799755812e-07
train_batch_loss[ 16200 ]: 2.668239176273346e-07
train_batch_loss[ 16210 ]: 9.12718974177551e-07
train_batch_loss[ 16220 ]: 9.194117183142225e-07
train_batch_loss[ 16230 ]: 8.520091796526685e-07
train_batch_loss[ 16240 ]: 6.167609853946487e-07
train_batch_loss[ 16250 ]: 1.4646734598500188e-06
train_batch_loss[ 16260 ]: 3.145093785406061e-07
train_loss: 1.1059139472328904e-06
```

epoch: 162

```
train_batch_loss[ 16270 ]: 3.7085987969476264e-07
train_batch_loss[ 16280 ]: 1.0430976544739679e-06
```

```
train_batch_loss[ 16290 ]: 5.24974723248306e-07
train_batch_loss[ 16300 ]: 9.908004585668095e-07
train_batch_loss[ 16310 ]: 6.952201374588185e-07
train_batch_loss[ 16320 ]: 3.8032885640859604e-07
train_batch_loss[ 16330 ]: 2.0675361156463623e-07
train_batch_loss[ 16340 ]: 7.561684469692409e-07
train_batch_loss[ 16350 ]: 5.243300620350055e-07
train_batch_loss[ 16360 ]: 4.123063717997866e-06
train_loss: 7.348977230066067e-07
```

epoch: 163

```
train_batch_loss[ 16370 ]: 6.070546874070715e-07
train_batch_loss[ 16380 ]: 3.087318134475936e-07
train_batch_loss[ 16390 ]: 6.011686650708725e-07
train_batch_loss[ 16400 ]: 7.951091447466752e-07
train_batch_loss[ 16410 ]: 6.756445145583712e-07
train_batch_loss[ 16420 ]: 8.19035847143823e-07
train_batch_loss[ 16430 ]: 1.9790604710578918e-07
train_batch_loss[ 16440 ]: 5.344477926882973e-07
train_batch_loss[ 16450 ]: 1.0238544234653091e-07
train_batch_loss[ 16460 ]: 3.59062823918066e-07
train_loss: 5.161396450684416e-07
```

epoch: 164

```
train_batch_loss[ 16470 ]: 4.434783136275655e-07
train_batch_loss[ 16480 ]: 4.773027626470139e-07
train_batch_loss[ 16490 ]: 1.0238724712507974e-07
train_batch_loss[ 16500 ]: 4.876334287473583e-07
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 28.36it/s]

valid_evaluation: loss=0.8776617940246377, acc=0.9408450704225352

save model at

./torch_checkpoints/22_3_24-14/crnn1_016500_loss0.8776617940246377.pt

```
train_batch_loss[ 16510 ]: 4.806206561625004e-07
train_batch_loss[ 16520 ]: 6.79820288951305e-07
train_batch_loss[ 16530 ]: 2.5634653866291046e-07
train_batch_loss[ 16540 ]: 5.355103098736436e-07
train_batch_loss[ 16550 ]: 5.491262982104672e-07
train_batch_loss[ 16560 ]: 4.2623418039511307e-07
train_loss: 3.6877658901544746e-07
```

epoch: 165

```
train_batch_loss[ 16570 ]: 6.050177034921944e-07
train_batch_loss[ 16580 ]: 2.2895966367286746e-07
train_batch_loss[ 16590 ]: 3.506373786876793e-07
train_batch_loss[ 16600 ]: 4.7350465592899127e-07
train_batch_loss[ 16610 ]: 3.735621589839866e-07
train_batch_loss[ 16620 ]: 2.2631138563156128e-07
train_batch_loss[ 16630 ]: 1.219886911485446e-07
train_batch_loss[ 16640 ]: 2.022133571699669e-07
train_batch_loss[ 16650 ]: 3.4594268072396517e-07
train_batch_loss[ 16660 ]: 2.3218743194775016e-07
```



```
train_loss: 2.6671931764403034e-07
epoch: 166
train_batch_loss[ 16670 ]: 1.6185728668460797e-07
train_batch_loss[ 16680 ]: 3.1972010106073867e-07
train_batch_loss[ 16690 ]: 9.515491683487198e-08
train_batch_loss[ 16700 ]: 4.227763952258101e-07
train_batch_loss[ 16710 ]: 8.086497871317988e-08
train_batch_loss[ 16720 ]: 2.9802322387695312e-08
train_batch_loss[ 16730 ]: 2.1624146029353142e-07
train_batch_loss[ 16740 ]: 8.900678949430585e-08
train_batch_loss[ 16750 ]: 1.0058185750949633e-07
train_batch_loss[ 16760 ]: 7.493424050153408e-07
train_loss: 1.8579021233581143e-07
epoch: 167
train_batch_loss[ 16770 ]: 3.010461568919709e-07
train_batch_loss[ 16780 ]: 8.799543138593435e-08
train_batch_loss[ 16790 ]: 1.0424987806345598e-07
train_batch_loss[ 16800 ]: 1.8597347661852837e-07
train_batch_loss[ 16810 ]: 1.5459575308796047e-07
train_batch_loss[ 16820 ]: 1.423177167225731e-07
train_batch_loss[ 16830 ]: 1.6015836479255086e-07
train_batch_loss[ 16840 ]: 1.0291113738958302e-07
train_batch_loss[ 16850 ]: 1.6333052599293296e-07
train_batch_loss[ 16860 ]: 4.470324910244017e-08
train_loss: 1.257342629721043e-07
epoch: 168
train_batch_loss[ 16870 ]: 2.801095888571581e-07
train_batch_loss[ 16880 ]: 1.2275245353521314e-07
train_batch_loss[ 16890 ]: 1.2363302914764063e-07
train_batch_loss[ 16900 ]: 8.934853212849703e-08
train_batch_loss[ 16910 ]: 7.916241884231567e-08
train_batch_loss[ 16920 ]: 7.05440470483154e-08
train_batch_loss[ 16930 ]: 8.987236554958145e-08
train_batch_loss[ 16940 ]: 2.601882265196309e-08
train_batch_loss[ 16950 ]: 7.741243734926684e-08
train_batch_loss[ 16960 ]: 1.0398741778772091e-07
train_loss: 8.848284212239812e-08
epoch: 169
train_batch_loss[ 16970 ]: 6.877235136926174e-08
train_batch_loss[ 16980 ]: 5.110629786031495e-08
train_batch_loss[ 16990 ]: 2.444721758365631e-08
train_batch_loss[ 17000 ]: 1.2175416941317962e-07

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 23.73it/s]

valid_evaluation: loss=0.8854518726648448, acc=0.9436619718309859
save model at
./torch_checkpoints/22_3_24-14/crnn1_017000_loss0.8854518726648448.pt
train_batch_loss[ 17010 ]: 5.6461374242644524e-08
train_batch_loss[ 17020 ]: 3.445802576607093e-08
```

```
train_batch_loss[ 17030 ]: 1.7695128917694092e-08
train_batch_loss[ 17040 ]: 4.316098056733608e-08
train_batch_loss[ 17050 ]: 5.77274477109313e-08
train_batch_loss[ 17060 ]: 5.21540641784668e-08
train_loss: 6.064630293720562e-08
epoch: 170
train_batch_loss[ 17070 ]: 6.565824151039124e-08
train_batch_loss[ 17080 ]: 2.4905602913349867e-08
train_batch_loss[ 17090 ]: 8.087954483926296e-08
train_batch_loss[ 17100 ]: 4.6332615966093726e-08
train_batch_loss[ 17110 ]: 5.588661622368818e-08
train_batch_loss[ 17120 ]: 2.5596818886697292e-08
train_batch_loss[ 17130 ]: 1.0244548320770264e-08
train_batch_loss[ 17140 ]: 3.5388268315728055e-08
train_batch_loss[ 17150 ]: 6.120535545051098e-08
train_batch_loss[ 17160 ]: 1.1201336747035384e-08
train_batch_loss[ 17170 ]: 0.0
train_loss: 4.166147839270611e-08
epoch: 171
train_batch_loss[ 17180 ]: 1.7113052308559418e-08
train_batch_loss[ 17190 ]: 1.4904799172654748e-08
train_batch_loss[ 17200 ]: 7.508731414418435e-09
train_batch_loss[ 17210 ]: 6.51925802230835e-09
train_batch_loss[ 17220 ]: 1.7636921256780624e-08
train_batch_loss[ 17230 ]: 1.9528556549630594e-08
train_batch_loss[ 17240 ]: 1.0652001947164536e-08
train_batch_loss[ 17250 ]: 7.392372936010361e-09
train_batch_loss[ 17260 ]: 3.664172254502773e-08
train_batch_loss[ 17270 ]: 4.831235145275059e-08
train_loss: 2.2475675306942464e-08
epoch: 172
train_batch_loss[ 17280 ]: 1.1175870895385742e-08
train_batch_loss[ 17290 ]: 0.0
train_batch_loss[ 17300 ]: 7.450580596923828e-09
train_batch_loss[ 17310 ]: 7.450580596923828e-09
train_batch_loss[ 17320 ]: 7.450580596923828e-09
train_batch_loss[ 17330 ]: -3.259629011154175e-09
train_batch_loss[ 17340 ]: 7.887138053774834e-09
train_batch_loss[ 17350 ]: 0.0
train_batch_loss[ 17360 ]: 2.1420419216156006e-08
train_batch_loss[ 17370 ]: -9.313225746154785e-10
train_loss: 1.0360466209441375e-08
epoch: 173
train_batch_loss[ 17380 ]: 3.6961864680051804e-09
train_batch_loss[ 17390 ]: 1.4900926714744855e-08
train_batch_loss[ 17400 ]: -9.349037100037094e-10
train_batch_loss[ 17410 ]: 1.862645149230957e-09
train_batch_loss[ 17420 ]: 7.436028681695461e-09
train_batch_loss[ 17430 ]: 3.725290298461914e-09
```

```
train_batch_loss[ 17440 ]: 4.190923164060223e-09
train_batch_loss[ 17450 ]: 3.4924594327634395e-09
train_batch_loss[ 17460 ]: 3.7180143408477306e-09
train_batch_loss[ 17470 ]: 1.2318082553974818e-08
train_loss: 1.0874516466411057e-08
```

epoch: 174

```
train_batch_loss[ 17480 ]: 3.725290298461914e-09
train_batch_loss[ 17490 ]: -9.313225746154785e-10
train_batch_loss[ 17500 ]: 4.097817196679898e-08
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 29.39it/s]

valid_evaluation: loss=0.8938975241651732, acc=0.9408450704225352
save model at

./torch_checkpoints/22_3_24-14/crnn1_017500_loss0.8938975241651732.pt

```
train_batch_loss[ 17510 ]: -3.7216523196548223e-09
train_batch_loss[ 17520 ]: 0.0
train_batch_loss[ 17530 ]: 7.392372936010361e-09
train_batch_loss[ 17540 ]: 2.3283064365386963e-10
train_batch_loss[ 17550 ]: 1.4639226719737053e-08
train_batch_loss[ 17560 ]: 7.450580596923828e-09
train_batch_loss[ 17570 ]: 0.0
train_loss: 3.4470590353385107e-09
```

epoch: 175

```
train_batch_loss[ 17580 ]: -2.7939677238464355e-09
train_batch_loss[ 17590 ]: 7.450580596923828e-09
train_batch_loss[ 17600 ]: 0.0
train_batch_loss[ 17610 ]: 9.313225746154785e-09
train_batch_loss[ 17620 ]: 4.6566128730773926e-09
train_batch_loss[ 17630 ]: 0.0
train_batch_loss[ 17640 ]: 4.6566128730773926e-09
train_batch_loss[ 17650 ]: 4.656612873077393e-10
train_batch_loss[ 17660 ]: -3.6088749766349792e-09
train_batch_loss[ 17670 ]: 2.3283064365386963e-10
train_loss: 2.9552206659518066e-09
```

epoch: 176

```
train_batch_loss[ 17680 ]: 3.725290298461914e-09
train_batch_loss[ 17690 ]: -9.313223525708736e-10
train_batch_loss[ 17700 ]: 2.7939675018018306e-09
train_batch_loss[ 17710 ]: -7.105427357601002e-15
train_batch_loss[ 17720 ]: -8.381903171539307e-09
train_batch_loss[ 17730 ]: 0.0
train_batch_loss[ 17740 ]: -3.725290298461914e-09
train_batch_loss[ 17750 ]: 3.259629011154175e-09
train_batch_loss[ 17760 ]: 1.5532129964412889e-06
train_batch_loss[ 17770 ]: 0.11103792488574982
train_loss: 0.016888276647886936
```

epoch: 177

```
train_batch_loss[ 17780 ]: 0.00017281710461247712
train_batch_loss[ 17790 ]: 0.01854357123374939
```

```
train_batch_loss[ 17800 ]: 6.601055065402761e-05
train_batch_loss[ 17810 ]: 0.01194697991013527
train_batch_loss[ 17820 ]: 1.7577207245267346e-06
train_batch_loss[ 17830 ]: 0.05464202165603638
train_batch_loss[ 17840 ]: 0.0665765255689621
train_batch_loss[ 17850 ]: 0.0106043154373765
train_batch_loss[ 17860 ]: 0.0018645953387022018
train_batch_loss[ 17870 ]: 0.0024535278789699078
train_loss: 0.018485701377350672
```

epoch: 178

```
train_batch_loss[ 17880 ]: 2.1660589482053183e-06
train_batch_loss[ 17890 ]: 0.0005294470465742052
train_batch_loss[ 17900 ]: 3.9206966903293505e-05
train_batch_loss[ 17910 ]: 2.575601456555887e-06
train_batch_loss[ 17920 ]: 1.1890470887010451e-05
train_batch_loss[ 17930 ]: 1.8420715832689893e-06
train_batch_loss[ 17940 ]: 9.116316732615815e-07
train_batch_loss[ 17950 ]: 1.8777351442622603e-06
train_batch_loss[ 17960 ]: 4.2744351958390325e-05
train_batch_loss[ 17970 ]: 0.10765081644058228
train_loss: 0.006756477644488038
```

epoch: 179

```
train_batch_loss[ 17980 ]: 3.41398526870762e-06
train_batch_loss[ 17990 ]: 5.61485649086535e-07
train_batch_loss[ 18000 ]: 1.372603128402261e-05
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 27.37it/s]

valid_evaluation: loss=1.0402359507033523, acc=0.923943661971831
save model at

./torch_checkpoints/22_3_24-14/crnn1_018000_loss1.0402359507033523.pt

```
train_batch_loss[ 18010 ]: 4.2670080802054144e-06
train_batch_loss[ 18020 ]: 1.990685996133834e-05
train_batch_loss[ 18030 ]: 4.493849701248109e-06
train_batch_loss[ 18040 ]: 1.723848981782794e-06
train_batch_loss[ 18050 ]: 7.774891855660826e-06
train_batch_loss[ 18060 ]: 6.512225922961079e-07
train_batch_loss[ 18070 ]: 0.0032516932114958763
train_loss: 0.004885577283369602
```

epoch: 180

```
train_batch_loss[ 18080 ]: 1.0387739166617393e-06
train_batch_loss[ 18090 ]: 2.8604890758288093e-05
train_batch_loss[ 18100 ]: 1.5371394965768559e-06
train_batch_loss[ 18110 ]: 3.970228135585785e-06
train_batch_loss[ 18120 ]: 1.042084363689355e-06
train_batch_loss[ 18130 ]: 7.560388439742383e-06
train_batch_loss[ 18140 ]: 4.579574579111068e-06
train_batch_loss[ 18150 ]: 1.774908469087677e-06
train_batch_loss[ 18160 ]: 9.917202987708151e-07
train_batch_loss[ 18170 ]: 5.887121915293392e-06
```

```
train_batch_loss[ 18180 ]: 0.0
train_loss: 1.206868472172559e-05
epoch: 181
train_batch_loss[ 18190 ]: 2.898155798902735e-06
train_batch_loss[ 18200 ]: 2.093111106660217e-07
train_batch_loss[ 18210 ]: 6.714834626109223e-07
train_batch_loss[ 18220 ]: 1.5940750017762184e-06
train_batch_loss[ 18230 ]: 9.945933925337158e-07
train_batch_loss[ 18240 ]: 2.740171112236567e-06
train_batch_loss[ 18250 ]: 2.1127850686752936e-06
train_batch_loss[ 18260 ]: 2.988756932609249e-06
train_batch_loss[ 18270 ]: 1.1664232033581357e-06
train_batch_loss[ 18280 ]: 1.4262980130297365e-06
train_loss: 1.5607149113128867e-06
epoch: 182
train_batch_loss[ 18290 ]: 3.5131233744323254e-07
train_batch_loss[ 18300 ]: 1.1175814051966881e-06
train_batch_loss[ 18310 ]: 5.721219622500939e-07
train_batch_loss[ 18320 ]: 2.8147042030468583e-06
train_batch_loss[ 18330 ]: 1.545540726510808e-07
train_batch_loss[ 18340 ]: 9.679206414148211e-08
train_batch_loss[ 18350 ]: 6.310722824309778e-07
train_batch_loss[ 18360 ]: 3.683335307869129e-07
train_batch_loss[ 18370 ]: 1.5561204236291815e-06
train_batch_loss[ 18380 ]: 6.39589416095987e-07
train_loss: 9.615340921003785e-07
epoch: 183
train_batch_loss[ 18390 ]: 5.015170927435975e-07
train_batch_loss[ 18400 ]: 6.705137138851569e-07
train_batch_loss[ 18410 ]: 4.14718670072034e-07
train_batch_loss[ 18420 ]: 7.176997769420268e-07
train_batch_loss[ 18430 ]: 2.0977311976366764e-07
train_batch_loss[ 18440 ]: 4.565627023112029e-07
train_batch_loss[ 18450 ]: 1.380685716867447e-07
train_batch_loss[ 18460 ]: 1.1098775303253205e-06
train_batch_loss[ 18470 ]: 8.082712952273141e-07
train_batch_loss[ 18480 ]: 2.7654243694996694e-07
train_loss: 6.407686929291085e-07
epoch: 184
train_batch_loss[ 18490 ]: 3.7788183249176654e-07
train_batch_loss[ 18500 ]: 2.667288754309993e-07

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 24.4lit/s]

valid_evaluation: loss=1.0222434142381478, acc=0.923943661971831
save model at
./torch_checkpoints/22_3_24-14/crnn1_018500_loss1.0222434142381478.pt
train_batch_loss[ 18510 ]: 2.7471105568110943e-07
train_batch_loss[ 18520 ]: 1.9068829715251923e-07
train_batch_loss[ 18530 ]: 1.0521398507989943e-06
```

```
train_batch_loss[ 18540 ]: 3.420282155275345e-07
train_batch_loss[ 18550 ]: 1.2267264537513256e-07
train_batch_loss[ 18560 ]: 1.3655517250299454e-07
train_batch_loss[ 18570 ]: 2.7425994630903006e-07
train_batch_loss[ 18580 ]: 3.909206043317681e-07
train_loss: 4.6146532807054907e-07
epoch: 185
train_batch_loss[ 18590 ]: 1.490041796614605e-07
train_batch_loss[ 18600 ]: 2.2075619199313223e-07
train_batch_loss[ 18610 ]: 3.1804614764041617e-07
train_batch_loss[ 18620 ]: 3.8616866504526115e-07
train_batch_loss[ 18630 ]: 3.142630475849728e-07
train_batch_loss[ 18640 ]: 3.961604306823574e-07
train_batch_loss[ 18650 ]: 4.5308792095966055e-07
train_batch_loss[ 18660 ]: 1.5832480926292192e-07
train_batch_loss[ 18670 ]: 2.3395111270474445e-07
train_batch_loss[ 18680 ]: 2.8148997444077395e-07
train_loss: 3.4435059246608715e-07
epoch: 186
train_batch_loss[ 18690 ]: 8.207007340388373e-08
train_batch_loss[ 18700 ]: 1.6350520581909223e-07
train_batch_loss[ 18710 ]: 4.1896572611221927e-07
train_batch_loss[ 18720 ]: 3.7928106166873476e-07
train_batch_loss[ 18730 ]: 3.158493200317025e-07
train_batch_loss[ 18740 ]: 4.5122558844923333e-07
train_batch_loss[ 18750 ]: 3.685705962652719e-07
train_batch_loss[ 18760 ]: 3.785707463066501e-07
train_batch_loss[ 18770 ]: 2.60770320892334e-08
train_batch_loss[ 18780 ]: 2.009328454732895e-07
train_loss: 2.7771228590365185e-07
epoch: 187
train_batch_loss[ 18790 ]: 2.743254299275577e-07
train_batch_loss[ 18800 ]: 2.1692176233045757e-07
train_batch_loss[ 18810 ]: 7.802657364663901e-08
train_batch_loss[ 18820 ]: 5.587935447692871e-08
train_batch_loss[ 18830 ]: 2.1603945299375482e-07
train_batch_loss[ 18840 ]: 1.7512863337287854e-07
train_batch_loss[ 18850 ]: 1.420157786924392e-07
train_batch_loss[ 18860 ]: 6.565801413671579e-08
train_batch_loss[ 18870 ]: 3.361928975209594e-07
train_batch_loss[ 18880 ]: 2.8812792152166367e-08
train_loss: 1.8521552742977262e-07
epoch: 188
train_batch_loss[ 18890 ]: 2.1327286958694458e-07
train_batch_loss[ 18900 ]: 1.4473289411398582e-07
train_batch_loss[ 18910 ]: 1.284934114664793e-07
train_batch_loss[ 18920 ]: 7.613562047481537e-08
train_batch_loss[ 18930 ]: 5.7159923017024994e-08
train_batch_loss[ 18940 ]: 3.958120942115784e-08
```

```
train_batch_loss[ 18950 ]: 5.725269147660583e-08
train_batch_loss[ 18960 ]: 1.0523943672069436e-07
train_batch_loss[ 18970 ]: 1.33176754957276e-07
train_batch_loss[ 18980 ]: 1.5832483768463135e-07
train_loss: 1.4207434981049232e-07
epoch: 189
train_batch_loss[ 18990 ]: 2.840351953636855e-08
train_batch_loss[ 19000 ]: 5.952892223604067e-08
```

```
Evaluate: 100%|██████████| 12/12 [00:00<00:00, 29.49it/s]
```

```
valid_evaluation: loss=1.0294830283701, acc=0.9295774647887324
save model at
./torch_checkpoints/22_3_24-14/crnn1_019000_loss1.0294830283701.pt
```

```
train_batch_loss[ 19010 ]: 9.53982635110151e-08
train_batch_loss[ 19020 ]: 8.148344221581283e-08
train_batch_loss[ 19030 ]: 3.5841367207467556e-08
train_batch_loss[ 19040 ]: 4.5605702325701714e-08
train_batch_loss[ 19050 ]: 5.497712862734261e-08
train_batch_loss[ 19060 ]: 6.43777653408506e-08
train_batch_loss[ 19070 ]: 2.8882556080134236e-07
train_batch_loss[ 19080 ]: 8.486671276841662e-08
train_loss: 8.392465385091485e-08
```

```
epoch: 190
```

```
train_batch_loss[ 19090 ]: 6.740447133779526e-08
train_batch_loss[ 19100 ]: 3.4226104617118835e-08
train_batch_loss[ 19110 ]: 4.831235855817795e-08
train_batch_loss[ 19120 ]: 4.4235999752118005e-08
train_batch_loss[ 19130 ]: 8.032269960267513e-08
train_batch_loss[ 19140 ]: 1.452881406294182e-07
train_batch_loss[ 19150 ]: 7.497146015111866e-08
train_batch_loss[ 19160 ]: 2.0489096641540527e-08
train_batch_loss[ 19170 ]: 7.869675044958058e-08
train_batch_loss[ 19180 ]: 5.2619725465774536e-08
train_batch_loss[ 19190 ]: 0.0
train_loss: 5.996845284283799e-08
```

```
epoch: 191
```

```
train_batch_loss[ 19200 ]: 2.514570951461792e-08
train_batch_loss[ 19210 ]: 2.421438694000244e-08
train_batch_loss[ 19220 ]: 4.3568430641016676e-08
train_batch_loss[ 19230 ]: 3.14321368932724e-08
train_batch_loss[ 19240 ]: 4.423782229423523e-08
train_batch_loss[ 19250 ]: 3.350396582391113e-08
train_batch_loss[ 19260 ]: 3.535751602612436e-08
train_batch_loss[ 19270 ]: 3.314869445603108e-08
train_batch_loss[ 19280 ]: 3.0731825972907245e-08
train_batch_loss[ 19290 ]: 1.257285475730896e-08
train_loss: 3.723922988852292e-08
```

```
epoch: 192
```

```
train_batch_loss[ 19300 ]: 2.130400389432907e-08
```

```
train_batch_loss[ 19310 ]: 4.307366907596588e-08
train_batch_loss[ 19320 ]: 3.096647560596466e-08
train_batch_loss[ 19330 ]: 2.059823600575328e-08
train_batch_loss[ 19340 ]: 1.4901161193847656e-08
train_batch_loss[ 19350 ]: 9.255018085241318e-09
train_batch_loss[ 19360 ]: 1.0942585504380986e-08
train_batch_loss[ 19370 ]: 1.488660927861929e-08
train_batch_loss[ 19380 ]: 8.19563723553074e-08
train_batch_loss[ 19390 ]: 9.778887033462524e-09
train_loss: 2.4834458507549834e-08
```

epoch: 193

```
train_batch_loss[ 19400 ]: 1.1176098269061185e-08
train_batch_loss[ 19410 ]: 1.862645149230957e-08
train_batch_loss[ 19420 ]: 5.587935447692871e-09
train_batch_loss[ 19430 ]: 2.0489096641540527e-08
train_batch_loss[ 19440 ]: 2.8867361834272742e-08
train_batch_loss[ 19450 ]: 1.4901161193847656e-08
train_batch_loss[ 19460 ]: 1.1161318980157375e-08
train_batch_loss[ 19470 ]: 2.1420419216156006e-08
train_batch_loss[ 19480 ]: 1.4901160305669237e-08
train_batch_loss[ 19490 ]: 7.82310962677002e-08
train_loss: 1.5716967182261268e-08
```

epoch: 194

```
train_batch_loss[ 19500 ]: 2.514570951461792e-08
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 29.63it/s]

valid_evaluation: loss=1.0585174336839258, acc=0.9295774647887324
save model at

./torch_checkpoints/22_3_24-14/crnn1_019500_loss1.0585174336839258.pt

```
train_batch_loss[ 19510 ]: 1.8626449271863521e-09
train_batch_loss[ 19520 ]: 0.0
train_batch_loss[ 19530 ]: 7.4505797087454084e-09
train_batch_loss[ 19540 ]: 5.587935447692871e-09
train_batch_loss[ 19550 ]: 5.587935447692871e-09
train_batch_loss[ 19560 ]: 1.862645149230957e-09
train_batch_loss[ 19570 ]: -1.862645149230957e-09
train_batch_loss[ 19580 ]: 7.916241884231567e-09
train_batch_loss[ 19590 ]: 3.4924596548080444e-09
train_loss: 1.2238056623526646e-08
```

epoch: 195

```
train_batch_loss[ 19600 ]: 3.725290298461914e-09
train_batch_loss[ 19610 ]: 3.941750037483871e-09
train_batch_loss[ 19620 ]: -1.3445969671010971e-08
train_batch_loss[ 19630 ]: -1.862645149230957e-09
train_batch_loss[ 19640 ]: 3.725290298461914e-09
train_batch_loss[ 19650 ]: 7.450580596923828e-09
train_batch_loss[ 19660 ]: 5.580659490078688e-09
train_batch_loss[ 19670 ]: 4.540197551250458e-09
train_batch_loss[ 19680 ]: 0.0
```



```
train_batch_loss[ 19690 ]: 3.725290298461914e-09
train_loss: 3.859880473800585e-09
epoch: 196
train_batch_loss[ 19700 ]: -7.105427357601002e-15
train_batch_loss[ 19710 ]: 0.0
train_batch_loss[ 19720 ]: 0.0
train_batch_loss[ 19730 ]: 6.526533979922533e-09
train_batch_loss[ 19740 ]: 6.984919309616089e-09
train_batch_loss[ 19750 ]: 0.0
train_batch_loss[ 19760 ]: 9.313225746154785e-10
train_batch_loss[ 19770 ]: 3.725290298461914e-09
train_batch_loss[ 19780 ]: 3.725290298461914e-09
train_batch_loss[ 19790 ]: 3.725290076417309e-09
train_loss: 2.2736341771731836e-09
epoch: 197
train_batch_loss[ 19800 ]: 0.0
train_batch_loss[ 19810 ]: -7.450580596923828e-09
train_batch_loss[ 19820 ]: -5.587907025983441e-09
train_batch_loss[ 19830 ]: 3.725290076417309e-09
train_batch_loss[ 19840 ]: 2.7939677238464355e-09
train_batch_loss[ 19850 ]: -3.7252618767524837e-09
train_batch_loss[ 19860 ]: 7.449671102222055e-09
train_batch_loss[ 19870 ]: 2.7939677238464355e-09
train_batch_loss[ 19880 ]: 7.334165275096893e-09
train_batch_loss[ 19890 ]: 7.448761607520282e-09
train_loss: 3.0303932190475596e-09
epoch: 198
train_batch_loss[ 19900 ]: 0.0
train_batch_loss[ 19910 ]: 0.6556535363197327
train_batch_loss[ 19920 ]: 0.064222551882267
train_batch_loss[ 19930 ]: 0.00019918008183594793
train_batch_loss[ 19940 ]: 7.878074370637478e-07
train_batch_loss[ 19950 ]: 5.0201371777802706e-05
train_batch_loss[ 19960 ]: 2.630028120620409e-06
train_batch_loss[ 19970 ]: 0.11489763855934143
train_batch_loss[ 19980 ]: 1.0894391380134039e-05
train_batch_loss[ 19990 ]: 3.2280866435030475e-05
train_loss: 0.031189153823747272
epoch: 199
train_batch_loss[ 20000 ]: 9.187788236886263e-06
```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 29.13it/s]

valid_evaluation: loss=0.8126347316271613, acc=0.9267605633802817
save model at

```
./torch_checkpoints/22_3_24-14/crnn1_020000_loss0.8126347316271613.pt
train_batch_loss[ 20010 ]: 3.5929806472267956e-05
train_batch_loss[ 20020 ]: 3.14805620291736e-05
train_batch_loss[ 20030 ]: 6.970235517655965e-06
train_batch_loss[ 20040 ]: 1.526988489786163e-05
```

```

train_batch_loss[ 20050 ]: 0.0007948977872729301
train_batch_loss[ 20060 ]: 8.602276466262992e-06
train_batch_loss[ 20070 ]: 1.2916279956698418e-06
train_batch_loss[ 20080 ]: 3.175800884491764e-07
train_batch_loss[ 20090 ]: 6.372115421982016e-07
train_loss: 0.0005404033536069789
epoch: 200
train_batch_loss[ 20100 ]: 6.920588475622935e-07
train_batch_loss[ 20110 ]: 2.4302935344167054e-06
train_batch_loss[ 20120 ]: 9.352204415336018e-07
train_batch_loss[ 20130 ]: 6.4428531914018095e-06
train_batch_loss[ 20140 ]: 8.885342595021939e-07
train_batch_loss[ 20150 ]: 1.8404535921945353e-06
train_batch_loss[ 20160 ]: 0.0006335830548778176
train_batch_loss[ 20170 ]: 7.037150498945266e-05
train_batch_loss[ 20180 ]: 7.73041756474413e-05
train_batch_loss[ 20190 ]: 3.9301428955695883e-07
train_batch_loss[ 20200 ]: 2.0464261372884116e-06
train_loss: 0.000979545088030889

```

```

evaluation = evaluate(crnn, val_loader, criterion,

```

```

decode_method=train_config['decode_method'],

```

```

beam_size=train_config['beam_size'])

```

```

loss = evaluation['loss']

```

```

acc = evaluation['acc']

```

```

print(f'valid_evaluation: loss={loss}, acc={acc*100} %')

```

```

Evaluate: 100%|██████████| 12/12 [00:00<00:00, 19.46it/s]

```

```

valid_evaluation: loss=0.7536714319507001, acc=94.64788732394366 %

```

```

# torch.save(crnn.state_dict(), 'torchmodel_weights_1.pt')

```

```

num_class = len(LABEL2CHAR) + 1

```

```

crnn1 = CRNN(3, img_height, img_width, num_class,
              map_to_seq_hidden=common_config['map_to_seq_hidden'],
              rnn_hidden=common_config['rnn_hidden'],
              leaky_relu=common_config['leaky_relu'])

```

```

crnn1.load_state_dict(torch.load("./torch_checkpoints/22_3_24-14/crnn1_020000_loss1.125697967997739.pt"))

```

```

crnn1.to(device)

```

```

def decode(labels):

```

```

    chars=""

```

```

    for i in labels:

```

```

        chars=chars+LABEL2CHAR[i]

```

```

    return chars

```

```

with torch.no_grad():
    for i, data in enumerate(val_loader):
        if i == 5:
            break
        device = 'cuda' if next(crnn.parameters()).is_cuda else
'cpu'

        images, targets, target_lengths = [d.to(device) for d in
data]

        logits = crnn(images)
        log_probs = torch.nn.functional.log_softmax(logits, dim=2)

        batch_size = images.size(0)

        preds = ctc_decode(log_probs, method="beam_search",
beam_size=10)
        reals = targets.cpu().numpy().tolist()
        target_lengths = target_lengths.cpu().numpy().tolist()
        print(f"-----
{len(preds)}-----")
        _, ax = plt.subplots(8, 4, figsize=(25, 10))
        for k, (image, pred, real, target_length) in
enumerate(zip(images, preds, reals, target_lengths)):
            img = (image*255).cpu().numpy().astype(np.uint8)
            real = real[0:target_length[0]]
            real=decode(real)
            pred=decode(pred)
            # print(f"prediction:{pred} , real:{real}")
            title = f"Prediction: {pred} , Real: {real}"
            img_tr = np.transpose(img, (1,2,0))
            ax[k // 4, k % 4].imshow(img_tr)
            ax[k // 4, k % 4].set_title(title)
            ax[k // 4, k % 4].axis("off")
        plt.show()

```

Prediction: puesto , Real: puesto

puesto

Prediction: mano , Real: mano

mano

Prediction: monedas , Real: monedas

monedas

Prediction: años , Real: años

años

Prediction: se , Real: se

se

Prediction: ornato , Real: ornato

ornato

Prediction: o , Real: o

o

Prediction: principal , Real: principal

principal

Prediction: a , Real: a

a

Prediction: al , Real: al

al

Prediction: de , Real: de

de

Prediction: cumplieredes , Real: cumplieredes,

cumplieredes,

Prediction: gas- , Real: gas-

gas-

Prediction: de , Real: de

de

Prediction: limos- , Real: limos-

limos-

Prediction: devocion , Real: devocion

devocion

Prediction: besar , Real: besar

besar

Prediction: Sacerdote) , Real: Sacerdote)

Sacerdote)

Prediction: oro , Real: oro,

oro ,

Prediction: para , Real: para

para

Prediction: ten , Real: ten

ten

Prediction: la , Real: la

la

Prediction: nás , Real: nas.

nas.

Prediction: em- , Real: em-

em-

Prediction: la , Real: la

la

Prediction: tantas , Real: tantas

tantas

Prediction: quantos , Real: quantos

quantos

Prediction: que , Real: que

que

Prediction: en , Real: en

en

Prediction: Iglesia , Real: Iglesia,

Iglesia ,

Prediction: Vuestra , Real: Vuestra

Vuestra

Prediction: plead , Real: plead

plead

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Prediction: en , Real: en

en

Prediction: del , Real: del

del

Prediction: no , Real: no

no

Prediction: mo- , Real: mo-

mo-

Prediction: interes , Real: interes,

interes,

Prediction: ms- , Real: mi-

mi-

Prediction: ha , Real: ha

ha

Prediction: este , Real: este

este

Prediction: el , Real: el

el

Prediction: Altar , Real: Altar,

Altar,

Prediction: os , Real: os

os

Prediction: tivar , Real: tivar

tivar

Prediction: sino , Real: sino

sino

Prediction: zad , Real: rad

rad

Prediction: engrandezido , Real: engrandezido

engrandezido

Prediction: camino , Real: camino

camino

Prediction: Santissimo , Real: Santissimo

Santissimo

Prediction: y , Real: y

y

Prediction: ha , Real: ha

ha

Prediction: a , Real: a

a

Prediction: el , Real: el

el

Prediction: lo , Real: lo

lo

Prediction: Dios , Real: Dios

Dios

Prediction: sobre , Real: sobre

sobre

Prediction: Sacramento , Real: Sacramento

Sacramento

Prediction: aunque , Real: aunque

aunque

Prediction: de , Real: de

de

Prediction: ello , Real: ello

ello

Prediction: amor , Real: amor,

amor,

Prediction: que , Real: que

que

Prediction: por , Real: por

por

Prediction: todas , Real: todas

todas

-32-

Prediction: las , Real: las
las
Prediction: mundo , Real: mundo,
mundo,
Prediction: de , Real: de
de
Prediction: actos , Real: actos
actos
Prediction: que , Real: que
que
Prediction: con , Real: con
con
Prediction: Deyno , Real: Deuno
Devno
Prediction: de , Real: de
de

Prediction: fa- , Real: fa-
fa-
Prediction: la , Real: la
la
Prediction: Autria , Real: Austria,
Austria ,
Prediction: de , Real: de
de
Prediction: muchos , Real: muchos
muchos
Prediction: este , Real: este
este
Prediction: de , Real: de
de
Prediction: Ituala , Real: Italia
Italia

Prediction: milias , Real: milias
milias
Prediction: Imperial , Real: imperial
Imperial
Prediction: imitad , Real: imitad
imitad
Prediction: Fe , Real: Fe
Fè
Prediction: han , Real: han
han
Prediction: divino , Real: divino
divino
Prediction: los , Real: los
los
Prediction: de , Real: de
de

Prediction: del , Real: del
del
Prediction: Casa , Real: Casa
Casa
Prediction: los , Real: los
los
Prediction: viva , Real: visa
viva
Prediction: hecho , Real: hecho
hecho
Prediction: Misterio , Real: Misterio.
Misterio.
Prediction: potentados , Real: Potentados
Potentados
Prediction: nuestros , Real: nuestros
nuestros

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Prediction: tiempos , Real: tiempos,
tiempos,
Prediction: de , Real: de
de
Prediction: hora , Real: hora
hora
Prediction: el , Real: el
el
Prediction: cubrir , Real: cubrir
cubrir
Prediction: perfumar , Real: perfumar
perfumar
Prediction: de , Real: de
de
Prediction: todo , Real: todo
todo

Prediction: oi , Real: oi,
oi,
Prediction: traerle , Real: traerle
traerle
Prediction: de , Real: de
de
Prediction: Viatico , Real: Viatico
Viatico
Prediction: de , Real: de
de
Prediction: su , Real: su
su
Prediction: lumi- , Real: lumi-
lumi-
Prediction: genero , Real: genero
genero

Prediction: que , Real: que
que
Prediction: a , Real: a
a
Prediction: su , Real: su
su
Prediction: hizo , Real: hizo
hizo
Prediction: ahombras , Real: ahombras,
ahombras ,
Prediction: casa , Real: casa,
casa ,
Prediction: narias , Real: narias,
narias ,
Prediction: de , Real: de
de

Prediction: aviendo , Real: aviendo
aviendo
Prediction: la , Real: la
la
Prediction: muerte , Real: muerte
muerte
Prediction: colgar , Real: colgar,
colgar ,
Prediction: y , Real: y
y
Prediction: inchirla , Real: inchirla
inchirla
Prediction: y , Real: y
y
Prediction: rico , Real: rico
rico

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Prediction: ador- , Real: ador-

ador-

Prediction: y , Real: y

y

Prediction: este , Real: este

este

Prediction: por , Real: por

por

Prediction: dispa- , Real: dispa-

dispa-

Prediction: del , Real: del

del

Prediction: hizo , Real: hizo

hizo

Prediction: A , Real: A

A

Prediction: no, , Real: no,

no,

Prediction: que , Real: que

que

Prediction: Su- , Real: Su-

Su-

Prediction: sus , Real: sus

sus

Prediction: rase , Real: rase

rase

Prediction: Castillo, , Real: Castillo,

Castillo,

Prediction: una , Real: una

una

Prediction: este , Real: este

este

Prediction: y , Real: y

y

Prediction: al , Real: al

al

Prediction: premo , Real: premo

premo

Prediction: puertas, , Real: puertas,

puertas,

Prediction: la , Real: la

la

Prediction: que , Real: que

que

Prediction: gran , Real: gran

gran

Prediction: exemplo , Real: exemplo

exemplo

Prediction: musica, , Real: musica,

musica,

Prediction: entrar , Real: entrar

entrar

Prediction: Rey , Real: Rey

Rey

Prediction: se , Real: se

se

Prediction: artilleria , Real: artilleria

artilleria

Prediction: le , Real: le

le

Prediction: salva- , Real: salva.

salva.

Prediction: añadir , Real: añadir

añadir

Text Detection

```
import torch.nn.init as init
from collections import namedtuple
from torchvision import models
import time
from torch.autograd import Variable
# from torchvision.models.vgg import model_urls

import cv2
import numpy
import pytesseract
from pytesseract import image_to_string

def predict_boxes(img_path):
    img = cv2.imread(img_path)
    H,W=img.shape[0], img.shape[1]
    img = cv2.resize(img,(320, 512))
    rW=W/256
    rH=H/512
    b,g,r = cv2.split(img)
    # text detection network
    net = cv2.dnn.readNet('./frozen_east_text_detection.pb')
    blob = cv2.dnn.blobFromImage(img, 1.0,
    (img.shape[1],img.shape[0]), (b.mean(), g.mean(), r.mean()),
    swapRB=False, crop=False)
    outputLayers = []
    outputLayers.append("feature_fusion/Conv_7/Sigmoid")
    outputLayers.append("feature_fusion/concat_3")
    net.setInput(blob)
    output = net.forward(outputLayers)
```

```

scores = output[0]
geometry = output[1]

(numRows, numCols) = scores.shape[2:4]
rects = []
confidences = []

for y in range(0, numRows):
    scoresData = scores[0, 0, y]
    xData0 = geometry[0, 0, y]
    xData1 = geometry[0, 1, y]
    xData2 = geometry[0, 2, y]
    xData3 = geometry[0, 3, y]
    anglesData = geometry[0, 4, y]

    for x in range(0, numCols):
        # if our score does not have sufficient probability,
        ignore it    if scoresData[x] < 0.1:
                        continue

        # compute the offset factor as our resulting feature maps
        will          # be 4x smaller than the input image
                    (offsetX, offsetY) = (x * 4.0, y * 4.0)

        # extract the rotation angle for the prediction and then
        # compute the sin and cosine
                    angle = anglesData[x]
                    cos = np.cos(angle)
                    sin = np.sin(angle)

        # use the geometry volume to derive the width and height
        of            # the bounding box
                    h = xData0[x] + xData2[x]
                    w = xData1[x] + xData3[x]

        # compute both the starting and ending (x, y)-coordinates
        for          # the text prediction bounding box
                    endX = int(offsetX + (cos * xData1[x]) + (sin *
xData2[x]))
                    endY = int(offsetY - (sin * xData1[x]) + (cos *
xData2[x]))
                    startX = int(endX - w)
                    startY = int(endY - h)

        # add the bounding box coordinates and probability score
        to

```



```

        # our respective lists
        rects.append((startX, startY, endX, endY))
        confidences.append(scoresData[x])
    boxes = non_max_suppression(np.array(rects), probs=confidences,
overlapThresh=0.4)
    # print(len(boxes))
    # print(img.shape)
    orig = img.copy()

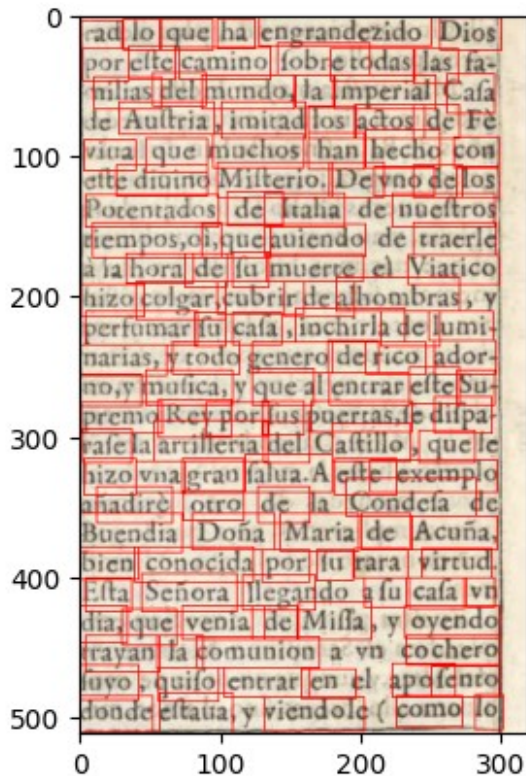
    # orig = cv2.resize(orig,(320, 512))
    for i, (startX, startY, endX, endY) in enumerate(boxes):
        # scale the bounding box coordinates based on the respective
        # ratios
        startX = int(startX )
        startY = int(startY )
        endX = int(endX )
        endY = int(endY ) + 5
        # draw the bounding box on the image
        cv2.rectangle(orig, (startX, startY), (endX, endY), (0, 0,
255), 1)

    # show the output image
    image = cv2.cvtColor(orig, cv2.COLOR_BGR2RGB)
    plt.imshow(image)
    plt.show()

    return boxes

boxes = predict_boxes("./Data/p12_1.png")
print(len(boxes))

```

130

```
# sorting the boxes detected as we read the text from left to right
min_height=100
for box in boxes:
    height=box[3]-box[1]
    if height<min_height:
        min_height=height
# sort the text bixes based on the height
height_sort = sorted(boxes, key = lambda x: x[1])
rows=[]
check=0
row_no=0
for i, box in enumerate(height_sort):
    if i==0:
        check = box[1]
        row_no+=1
        rows.append([row_no,box])
        continue
    if box[1]>=check+min_height:
        row_no+=1
        check=box[1]
        rows.append([row_no, box])
        continue
    rows.append([row_no, box])
```

```

# cluster the text boxes belonging to a row
final_sort={}
idx=0
for i in rows:
    if i[0]>idx:
        idx=i[0]
        final_sort[idx]=[]
        final_sort[idx].append(i[1])
# keeping the text bixes detected as we read from left to right and
top to bottom
final=[]
for index in final_sort.keys():
    l=final_sort[index]
    l=sorted(l, key = lambda x: x[0])
    for box in l:
        final.append(box)

def recognize_text(img_path, boxes, file_name: None):
    img = cv2.imread(img_path)
    img = cv2.resize(img, (320,512))
    for i, (startX, startY, endX, endY) in enumerate(boxes):
        # print(startX, startY, endX, endY)
        if startX<0:
            startX=0
        if startY<0:
            startY=0
        cropped_img = img[startY:endY+5, startX:endX]
        cropped_img = cv2.cvtColor(cropped_img, cv2.COLOR_BGR2RGB)
        img_height = 64
        img_width = 160
        transform = transforms.Compose([
            transforms.ToPILImage(),
            transforms.Resize((img_height, img_width)), # Resize
image to a fixed size
            transforms.ToTensor(), # Convert image to tensor
        ])
        image = transform(cropped_img)
        image = image.to(device)
        image = image.unsqueeze(0)
        logits = crnn(image)
        log_probs = torch.nn.functional.log_softmax(logits, dim=2)
        pred = ctc_decode(log_probs, method='beam_search',
beam_size=10)
        # pred = pred.squeeze(0)
        # print(pred)
        pred = decode(pred[0])
        print(pred)
        # plt.imshow(cropped_img)
        # plt.show()

```

```
# if i==10:  
#     break  
  
recognize_text("./Data/p12_1.png", boxes=final, file_name=None)  
  
ad  
lo  
que  
ha  
engrandeido  
Dios  
oor  
este  
camino  
sobretr  
etodas  
las  
niliias  
del  
mundo,  
la  
mperial  
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Austria  
imitad  
los  
actos  
de  
ziua  
que  
muéhos  
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Misterio.  
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ode  
los  
Potentados  
de  
ltuala  
nuestros  
iempos,oi  
ique  
aviendo  
traerle  
hora
```

de
su
muerte
Viatico
hizo
colgar,
cubrir
rdea)
atombras
verfumar
su
casa
jnchirla.
adel
lumi-
narias,
rtodo
genero
de,
rico
ador-
noy
nusica,
quea
entrar
este
Su-
premo
Reyp
Apor
sus
vuertass
dispa
rase
avissa
del
antillo
que
vizo
una
gran
salvaz
este
exemplo
ñadire-
otro
de
cd,
nuendia
poña

Maria
de
Acuña
bien
conocida
por
su
rara
virtud
sta
Señora
llegan
asu
casa
ynr
dia,
que
venia
de
Missa
oendo
rayan
lae
comunion
tochero
suyo
quiso
entrar
en
apose
sento
donde
estava
iendole
como
lo