In [1]:
```
import torch
import numpy as np
import torchvision
from torchvision import datasets
import torchvision.transforms as transforms
from torchvision.transforms import ToTensor
import torch.nn as nn
import torch.nn.functional as F
import matplotlib.pyplot as plt
```

Loading dataset

In [2]:
```
num_workers = 0

batch_size = 64


transform = transforms.ToTensor()


train_data = datasets.MNIST(root='data', train=True,
                                    download=True, transform=transform)
test_data = datasets.MNIST(root='data', train=False,
                                   download=True, transform=transform)


train_loader = torch.utils.data.DataLoader(train_data, batch_size=batch_size,
    num_workers=num_workers)
test_loader = torch.utils.data.DataLoader(test_data, batch_size=batch_size,
    num_workers=num_workers)
```

```
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```

In [4]:
```
class Net(nn.Module):
    def __init__(self):
        super(Net, self).__init__()
        self.fc1 = nn.Linear(28*28, 500)

        self.fc2 = nn.Linear(500, 250)

        self.fc3=nn.Linear(250,100)

        self.fc4 = nn.Linear(100, 10)

    def forward(self, x):
        x = x.view(-1, 28*28)
        x = torch.relu(self.fc1(x))

        x = torch.relu(self.fc2(x))

        x= torch.relu(self.fc3(x))
        return F.log_softmax(self.fc4(x), dim=1)

model = Net()
optimizer = torch.optim.Adam(model.parameters(), lr=0.01)#for regularization
                                                         #weight_decay=1e-5
criterion = nn.CrossEntropyLoss()

print(model)
```

```
Net(
  (fc1): Linear(in_features=784, out_features=500, bias=True)
  (fc2): Linear(in_features=500, out_features=250, bias=True)
  (fc3): Linear(in_features=250, out_features=100, bias=True)
  (fc4): Linear(in_features=100, out_features=10, bias=True)
)
```

For training

In [5]:
```
n_epochs = 15

model.train() # model for training
trainloss_data=[]

for epoch in range(n_epochs):

    train_loss = 0.0


    for data, target in train_loader:

        optimizer.zero_grad()

        output = model(data)

        #count+=1
        loss = criterion(output, target)


        loss.backward()

        optimizer.step()

        train_loss += loss.item()*data.size(0)

    train_loss = train_loss/len(train_loader.dataset)
```

```
    trainloss_data.append(train_loss)

    print('Epoch: {} \tTraining Loss: {:.6f} '.format(epoch+1,train_loss))
```

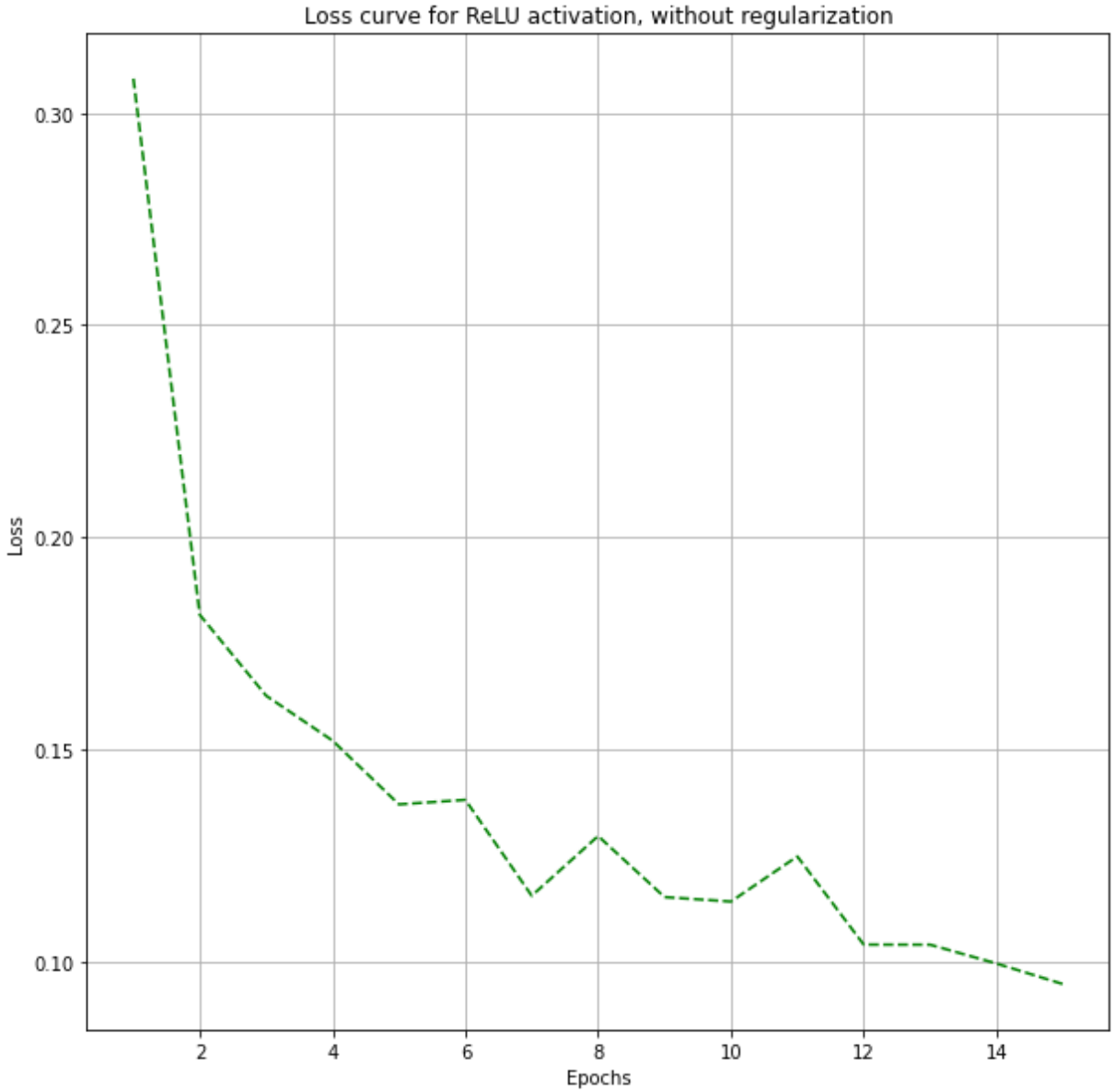
```
Epoch: 1        Training Loss: 0.308040
Epoch: 2        Training Loss: 0.181709
Epoch: 3        Training Loss: 0.162660
Epoch: 4        Training Loss: 0.152082
Epoch: 5        Training Loss: 0.137056
Epoch: 6        Training Loss: 0.138126
Epoch: 7        Training Loss: 0.115535
Epoch: 8        Training Loss: 0.129611
Epoch: 9        Training Loss: 0.115225
Epoch: 10       Training Loss: 0.114168
Epoch: 11       Training Loss: 0.124805
Epoch: 12       Training Loss: 0.104027
Epoch: 13       Training Loss: 0.104006
Epoch: 14       Training Loss: 0.099566
Epoch: 15       Training Loss: 0.094724
```

In [6]:

```
x=np.arange(1,16,1)
plt.figure(figsize=(10, 10))
plt.plot(x,trainloss_data,'--',color='green')
plt.xlabel("Epochs")
plt.ylabel("Loss")
plt.grid(True)
plt.title("Loss curve for ReLU activation, without regularization")
```

Out[6]:

```
Text(0.5, 1.0, 'Loss curve for ReLU activation, without regularization')
```



For testing

In [7]:
```
model.eval()
val_loss, correct = 0, 0
for data, target in test_loader:
    output = model(data)
    val_loss += criterion(output, target).data.item()
    pred = output.data.max(1)[1] # get the index of the max log-probability
    correct += pred.eq(target.data).cpu().sum()

val_loss /= len(test_loader)

accuracy = 100. * correct.to(torch.float32) / len(test_loader.dataset)
print("Accuracy: ",accuracy)
```

```
Accuracy:  tensor(96.5400)
```

In [ ]:
```
```