Loading Cifar10

In [1]:
```
from keras.datasets import cifar10
(x_train,_),(x_test,_)=cifar10.load_data()
```

Checking dimension

In [2]:
```
print(x_train.shape)
```

```
(50000, 32, 32, 3)
```

Image pre processing

In [2]:
```
def pre_process(X):
    X = X/255.0
    X = X.reshape((len(X), 3072))
    return X

x_train  =  pre_process(x_train)
x_test  =  pre_process(x_test)

print("X_train", x_train.shape)
print("X_test", x_test.shape)
```

```
X_train (50000, 3072)
X_test (10000, 3072)
```

Visualization the training images

In [3]:
```
import matplotlib.pyplot as plt
def show_data(X, n=10, height=32, width=32,depth=3 , title=""):
    plt.figure(figsize=(20, 5))
    for i in range(n):
        ax = plt.subplot(2,n,i+1)
        plt.imshow(X[i].reshape((height,width,depth)))
        plt.gray()
        ax.get_xaxis().set_visible(False)
        ax.get_yaxis().set_visible(False)
    plt.suptitle(title, fontsize = 20)

show_data(x_train,title="Training images")
```

Training images

Building the Stacked Autoencoder

In [4]:
```
from keras.layers import Input, Dense
from keras.models import Model
```

Building the layers

- Input layer = 3072 neurons
- Hidden layer_1 = 768 neurons
- Hidden layer_2 = 192 neurons
- Code layer = 48 neurons
- Hidden layer_3 = 192 neurons
- Hidden layer_4 = 768 neurons
- Output layer = 3072 neurons

In [5]:
```
# encoder
input_layer = Input(shape=(3072,), name="INPUT")
hidden_layer_1 = Dense(768, activation='relu', name="HIDDEN_1")(input_layer)
hidden_layer_2 = Dense(192, activation='relu', name="HIDDEN_2")(hidden_layer_1)

# code
code_layer = Dense(48, activation='relu', name="CODE")(hidden_layer_2)

# decoder
hidden_layer_3 = Dense(192, activation='relu', name="HIDDEN_3")(code_layer)
hidden_layer_4 = Dense(768, activation='relu', name="HIDDEN_4")(hidden_layer_3 )
output_layer = Dense(3072, activation='sigmoid', name="OUTPUT")(hidden_layer_4)
```

Compiling the layers

In [6]:
```
stacked_autoencoder=Model(input_layer, output_layer)
stacked_autoencoder.compile(optimizer="Adam",loss="binary_crossentropy")
stacked_autoencoder.summary()
```

```
Model: "model"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
INPUT (InputLayer)           [(None, 3072)]            0
_________________________________________________________________
HIDDEN_1 (Dense)             (None, 768)               2360064
_________________________________________________________________
HIDDEN_2 (Dense)             (None, 192)               147648
_________________________________________________________________
CODE (Dense)                 (None, 48)                9264
_________________________________________________________________
HIDDEN_3 (Dense)             (None, 192)               9408
_________________________________________________________________
HIDDEN_4 (Dense)             (None, 768)               148224
_________________________________________________________________
OUTPUT (Dense)               (None, 3072)              2362368
=================================================================
Total params: 5,036,976
Trainable params: 5,036,976
Non-trainable params: 0
_________________________________________________________________
```

Fitting the model

In [7]:
```
stacked_autoencoder.fit(x_train, x_train, epochs=100,batch_size=256,validation_data=(x_test, x_test))
```

```
Epoch 1/100
196/196 [==============================] - 2s 9ms/step - loss: 0.6605 - val_loss: 0.6126
Epoch 2/100
196/196 [==============================] - 1s 7ms/step - loss: 0.6078 - val_loss: 0.6032
Epoch 3/100
196/196 [==============================] - 1s 7ms/step - loss: 0.6008 - val_loss: 0.5992
Epoch 4/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5973 - val_loss: 0.5958
Epoch 5/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5946 - val_loss: 0.5947
Epoch 6/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5935 - val_loss: 0.5946
Epoch 7/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5937 - val_loss: 0.5934
Epoch 8/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5912 - val_loss: 0.5910
Epoch 9/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5900 - val_loss: 0.5899
Epoch 10/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5886 - val_loss: 0.5906
Epoch 11/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5887 - val_loss: 0.5891
Epoch 12/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5881 - val_loss: 0.5893
Epoch 13/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5875 - val_loss: 0.5889
Epoch 14/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5876 - val_loss: 0.5887
Epoch 15/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5876 - val_loss: 0.5889
Epoch 16/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5872 - val_loss: 0.5894
Epoch 17/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5875 - val_loss: 0.5884
Epoch 18/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5872 - val_loss: 0.5884
Epoch 19/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5872 - val_loss: 0.5886
Epoch 20/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5866 - val_loss: 0.5881
Epoch 21/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5867 - val_loss: 0.5879
Epoch 22/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5861 - val_loss: 0.5877
Epoch 23/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5860 - val_loss: 0.5874
Epoch 24/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5863 - val_loss: 0.5872
Epoch 25/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5855 - val_loss: 0.5871
Epoch 26/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5859 - val_loss: 0.5871
Epoch 27/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5859 - val_loss: 0.5870
Epoch 28/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5855 - val_loss: 0.5869
Epoch 29/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5848 - val_loss: 0.5871
Epoch 30/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5858 - val_loss: 0.5876
Epoch 31/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5846 - val_loss: 0.5868
Epoch 32/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5846 - val_loss: 0.5872
Epoch 33/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5851 - val_loss: 0.5873
Epoch 34/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5855 - val_loss: 0.5878
Epoch 35/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5849 - val_loss: 0.5868
Epoch 36/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5848 - val_loss: 0.5867
Epoch 37/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5844 - val_loss: 0.5873
Epoch 38/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5846 - val_loss: 0.5865
Epoch 39/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5845 - val_loss: 0.5866
Epoch 40/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5846 - val_loss: 0.5865
Epoch 41/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5852 - val_loss: 0.5864
Epoch 42/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5844 - val_loss: 0.5864
Epoch 43/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5848 - val_loss: 0.5872
Epoch 44/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5844 - val_loss: 0.5867
Epoch 45/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5847 - val_loss: 0.5865
Epoch 46/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5839 - val_loss: 0.5865
Epoch 47/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5839 - val_loss: 0.5866
Epoch 48/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5841 - val_loss: 0.5865
Epoch 49/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5840 - val_loss: 0.5866
Epoch 50/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5841 - val_loss: 0.5864
Epoch 51/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5842 - val_loss: 0.5866
Epoch 52/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5843 - val_loss: 0.5867
Epoch 53/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5846 - val_loss: 0.5862
Epoch 54/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5844 - val_loss: 0.5864
Epoch 55/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5842 - val_loss: 0.5862
Epoch 56/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5835 - val_loss: 0.5868
Epoch 57/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5843 - val_loss: 0.5865
Epoch 58/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5835 - val_loss: 0.5866
Epoch 59/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5839 - val_loss: 0.5862
Epoch 60/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5843 - val_loss: 0.5864
Epoch 61/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5840 - val_loss: 0.5864
Epoch 62/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5839 - val_loss: 0.5865
Epoch 63/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5841 - val_loss: 0.5864
Epoch 64/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5837 - val_loss: 0.5864
Epoch 65/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5837 - val_loss: 0.5865
Epoch 66/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5832 - val_loss: 0.5872
Epoch 67/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5831 - val_loss: 0.5864
Epoch 68/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5836 - val_loss: 0.5864
Epoch 69/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5833 - val_loss: 0.5863
Epoch 70/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5839 - val_loss: 0.5864
Epoch 71/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5836 - val_loss: 0.5862
Epoch 72/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5836 - val_loss: 0.5863
Epoch 73/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5834 - val_loss: 0.5864
Epoch 74/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5830 - val_loss: 0.5863
Epoch 75/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5836 - val_loss: 0.5865
Epoch 76/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5832 - val_loss: 0.5862
Epoch 77/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5832 - val_loss: 0.5858
Epoch 78/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5831 - val_loss: 0.5860
Epoch 79/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5825 - val_loss: 0.5862
Epoch 80/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5831 - val_loss: 0.5858
Epoch 81/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5828 - val_loss: 0.5861
Epoch 82/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5829 - val_loss: 0.5857
Epoch 83/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5831 - val_loss: 0.5859
Epoch 84/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5827 - val_loss: 0.5857
Epoch 85/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5826 - val_loss: 0.5861
Epoch 86/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5825 - val_loss: 0.5857
Epoch 87/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5822 - val_loss: 0.5859
Epoch 88/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5824 - val_loss: 0.5856
Epoch 89/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5830 - val_loss: 0.5857
Epoch 90/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5825 - val_loss: 0.5857
Epoch 91/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5823 - val_loss: 0.5864
Epoch 92/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5820 - val_loss: 0.5857
Epoch 93/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5825 - val_loss: 0.5857
Epoch 94/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5828 - val_loss: 0.5858
Epoch 95/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5827 - val_loss: 0.5859
Epoch 96/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5820 - val_loss: 0.5858
Epoch 97/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5823 - val_loss: 0.5856
Epoch 98/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5827 - val_loss: 0.5859
Epoch 99/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5818 - val_loss: 0.5859
Epoch 100/100
196/196 [==============================] - 1s 7ms/step - loss: 0.5826 - val_loss: 0.5857
```

Out[7]:
```
<tensorflow.python.keras.callbacks.History at 0x7f52604f7908>
```

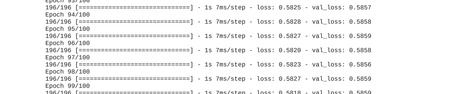
Predicting

In [8]:
```
decoded_data = stacked_autoencoder.predict(x_test)
```

Visualization of both original and decoded data

In [9]:
```
show_data(x_test, title="original data")
show_data(decoded_data, title="decoded data")
```

original data



decoded data

In [ ]:
```
```