Лабораторная работа 7

Вариант 1

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Целью работы является исследование свойств автоассоциативных сетей с узким горлом, алгоритмов обучения, а также применение сетей для выполнения линейного и нелинейного анализа главных компонент набора данных.

In [2]:

```
import numpy as np

import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
from keras.layers import Layer

import matplotlib.pyplot as plt
```

In [4]:

```
train, test = keras.datasets.cifar10.load_data()
```

In [5]:

```
X_train, y_train = train
X_test, y_test = test
```

In [6]:

```
X_train = np.array([X_train[i] for i in range(len(X_train)) if y_train[i] == 1])
X_test = np.array([X_test[i] for i in range(len(X_test)) if y_test[i] == 1])
```

In [7]:

```
class AutoEncoder(tf.keras.Model):
    def __init__(self):
        super().__init__()
        self.encoder = keras.Sequential([
            keras.layers.Flatten(),
            keras.layers.Dense(32*32*3 / 4, activation='relu'),
            keras.layers.Dense(32*32*3 / 16, activation='sigmoid'),
        ])
        self.decoder = keras.Sequential([
            keras.layers.Dense(32*32*3 / 4, activation='relu'),
            keras.layers.Dense(32*32*3, activation='sigmoid'),
            keras.layers.Reshape((32, 32, 3)),
        ])

    def call(self, input):
        input = input / 255
        encoded = self.encoder(input)
        decoded = self.decoder(encoded)
        return decoded * 255

    def call_change_kernel_neuron(self, input, id, value):
        input = input / 255
        encoded = np.array(self.encoder(input))
        print('real values: ', encoded[:, id])
        encoded[:, id] = value
        decoded = self.decoder(encoded)
        return decoded * 255
```

In [9]:

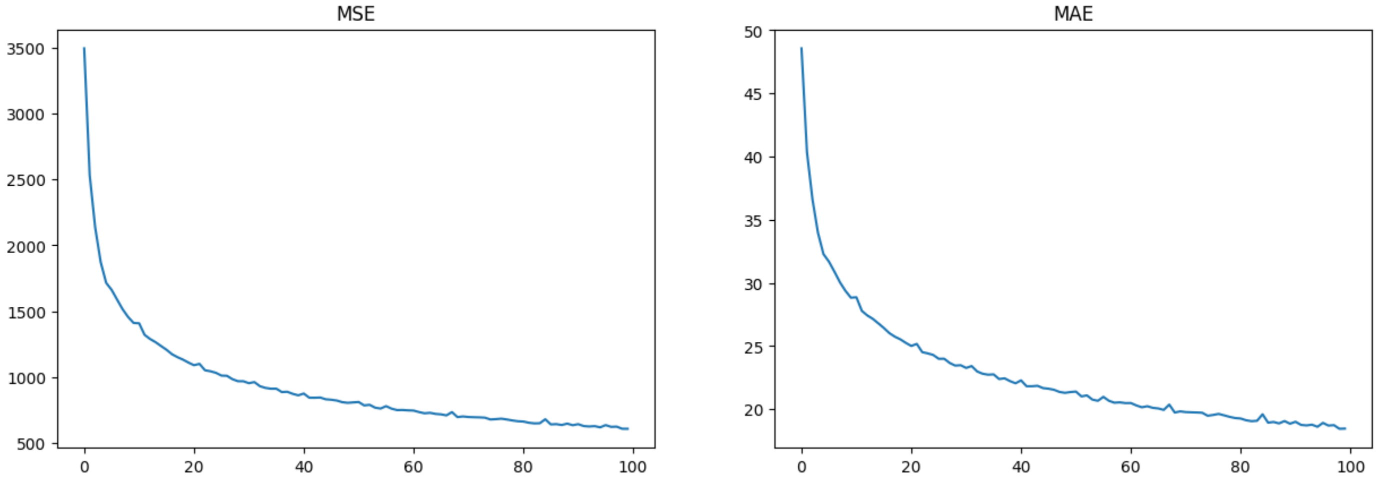
```
model = AutoEncoder()
```

In [10]:
```
model.compile(
    loss='mse',
    optimizer='adam',
    metrics=['mae'],
)
```

In [ ]:
```
train_info = model.fit(
    X_train, X_train,
    validation_data=(X_test, X_test),
    batch_size=128,
    epochs=100,
)
```

In [13]:
```
fig, ax = plt.subplots(1, 2)
fig.set_figwidth(15)
ax[0].set_title('MSE')
ax[1].set_title('MAE')
ax[0].plot(range(100), train_info.history['loss'])
ax[1].plot(range(100), train_info.history['mae'])
```

Out[13]:
```
[<matplotlib.lines.Line2D at 0x7f9b50e30a30>]
```



In [28]:
```
def plot_results(original, decoded):
    plt.figure(figsize=(40, 8))

    for i in range(3):
        # display original
        ax = plt.subplot(2, 10, i + 1)
        plt.imshow(original[i])

        ax.get_xaxis().set_visible(False)
        ax.get_yaxis().set_visible(False)

        # display reconstruction
        ax = plt.subplot(2, 10, i + 1 + 10)
        plt.imshow(decoded[i])

        ax.get_xaxis().set_visible(False)
        ax.get_yaxis().set_visible(False)

    plt.show()
```

In [29]:
```
random_train = X_train[np.random.choice(X_train.shape[0], 3)]
random_train_decoded = tf.cast(model(random_train), 'int32')
```

In [30]:
```
plot_results(random_train, random_train_decoded)
```