| Team ID | PNT2022TMID23253 |
|---------|--------------------------------------|
| Project | A Novel method for Handwritten digit |
| Name | recognition system |

Analyzing the Data

```
print(X train.shape) print(X test.shape)
(60000, 28, 28)
(10000, 28, 28)
X train[0]
                                                                         0,
                                                                    0,
array([[ 0,
                Ο,
                     Ο,
                          Ο,
                               Ο,
                                     Ο,
                                          Ο,
                                               0,
                                                     0,
                                                          Ο,
                                                               Ο,
    Ο,
                                                                             Ο,
                                     Ο,
                                          Ο,
                                                0,
                                                     0,
                                                          0,
Ο,
          Ο,
                Ο,
                     Ο,
                          Ο,
                                Ο,
                                                                0,
0],
       [ 0,
                Ο,
                     Ο,
                          Ο,
                               Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                     Ο,
                                                                          0,
          Ο,
                Ο,
                     Ο,
                          Ο,
                                Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                     Ο,
                                                                          Ο,
0,
     0],
                0,
                                                               0,
       [ 0,
                     Ο,
                          Ο,
                               Ο,
                                     0,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                                     0,
                                                                          Ο,
          Ο,
                Ο,
                     Ο,
                          Ο,
                                Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                     Ο,
                                                                          0,
     0],
0,
                                                               Ο,
          Ο,
                     Ο,
                          0,
                               Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                                     Ο,
                                                                          0,
                Ο,
       [
          Ο,
                Ο,
                     Ο,
                          Ο,
                               Ο,
                                     Ο,
                                          0,
                                                0,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                     0,
                                                                          0,
Ο,
     0],
      [ 0,
                Ο,
                     Ο,
                          Ο,
                                Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                     Ο,
                                                                          0,
          Ο,
                0,
                     0,
                          0,
                               0,
                                     0,
                                          0,
                                                0,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                     Ο,
                                                                          Ο,
Ο,
     0],
       [ 0,
               0,
                    0,
                          Ο,
                               Ο,
                                    Ο,
                                         Ο,
                                              0,
                                                    Ο,
                                                          0,
                                                               0,
                                                                     Ο,
                                                                          3,
         18,
              18, 18, 126, 136, 175, 26, 166, 255, 247, 127,
Ο,
       [ 0,
              0, 0,
                        0,
                              0, 0,
                                        0, 0, 30, 36, 94, 154, 170,
       253, 253, 253, 253, 253, 225, 172, 253, 242, 195,
                                                              64,
                                                                   Ο,
Ο,
      [ 0,
              Ο,
                   Ο,
                        Ο,
                              0, 0,
                                        0, 49, 238, 253, 253, 253, 253,
       253, 253, 253, 253, 251,
                                   93,
                                        82,
                                             82, 56, 39,
                                                             Ο,
                                                                   Ο,
0,
     0],
       [ 0,
                                     Ο,
                                         Ο,
                                              18, 219, 253, 253, 253, 253,
              Ο,
                    Ο,
                         Ο,
                              Ο,
        253, 198, 182, 247, 241,
                                     Ο,
                                          Ο,
                                               Ο,
                                                   Ο,
                                                        Ο,
                                                             Ο,
0,
     0],
                     0,
                          0,
                                               Ο,
       [ 0,
                                                    80, 156, 107, 253, 253,
               Ο,
                               Ο,
                                     Ο,
                                          Ο,
        205,
              11,
                     Ο,
                         43, 154,
                                          Ο,
                                               Ο,
                                     Ο,
                                                    Ο,
                                                         Ο,
                                                              Ο,
                                                                   0, 0,
0,
     0],
       [ 0,
                     0,
                                     0,
                                          Ο,
                                                0,
                                                     Ο,
                                                         14,
                                                               1, 154, 253,
                Ο,
                          Ο,
                               Ο,
                          0,
               Ο,
         90,
                     0,
                               0,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                               Ο,
                                                                   Ο,
     0],
Ο,
       [ 0,
                Ο,
                     Ο,
                          Ο,
                               Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                               0, 139, 253,
                                                     Ο,
       190,
                2,
                     Ο,
                          Ο,
                                Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                          Ο,
                                                               Ο,
                                                                    Ο,
Ο,
     0],
       [ 0,
                Ο,
                     Ο,
                          Ο,
                               Ο,
                                     Ο,
                                          Ο,
                                                Ο,
                                                     Ο,
                                                          Ο,
                                                              0, 11, 190,
```

```
Ο,
      253, 70, 0, 0, 0, 0, 0, 0,
                                            0, 0, 0,
                                                               Ο,
0,
    0],
                                    0,
                                0,
                                         Ο,
     [ 0, 0, 0, 0,
                           Ο,
                                             Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                               35,
      241, 225, 160, 108,
                           1,
                                Ο,
                                    Ο,
                                         Ο,
                                              Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
Ο,
      [ 0, 0, 0, 0,
                               Ο,
                                    Ο,
                                         Ο,
                                              Ο,
                                                  Ο,
                                                       0,
                                                            Ο,
                                                                0,
                          Ο,
        81, 240, 253, 253, 119,
                              25,
                                   0,
                                         0,
                                              Ο,
                                                  0,
                                                       Ο,
                                                            Ο,
                                                                Ο,
Ο,
    0],
      [ 0,
            0, 0, 0, 0, 0,
                                   Ο,
                                         Ο,
                                              Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                0,
            45, 186, 253, 253, 150, 27,
                                         Ο,
                                             Ο,
                                                  Ο,
         Ο,
                                                       Ο,
                                                            Ο,
                                                                Ο,
         Ο,
             0],
      [ 0,
             Ο,
                Ο,
                     0, 0, 0,
                                   Ο,
                                         Ο,
                                              Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                0,
         0,
             0, 16, 93, 252, 253, 187,
                                             Ο,
                                                       Ο,
                                        0,
                                                  Ο,
                                                                Ο,
                                                            Ο,
         Ο,
             0],
      [ 0,
             0, 0,
                     0, 0, 0, 0,
                                        0,
                                            0,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                0,
                 0,
                     0, 249, 253, 249,
                                        64,
         Ο,
             Ο,
                                             Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                Ο,
         0,
             0],
                                                  Ο,
             0, 0, 0, 0, 0, 0,
                                        0,
      [ 0,
                                             Ο,
                                                       Ο,
                                                            Ο,
                                                                Ο,
         Ο,
            46, 130, 183, 253, 253, 207,
                                        2,
                                             Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                Ο,
            0],
         Ο,
                     0, 0, 0,
                                             0,
      [ 0,
            Ο,
                 Ο,
                                   Ο,
                                       Ο,
                                                  Ο,
                                                      0, 0,
                                                               39,
       148, 229, 253, 253, 253, 250, 182,
                                        0,
                                             0,
                                                  Ο,
                                                       Ο,
                                                           0,
            0],
         Ο,
            0, 0, 0, 0, 0, 0,
                                            Ο,
                                                 0, 24, 114, 221,
      [ 0,
                                       Ο,
       253, 253, 253, 253, 201, 78,
                                   Ο,
                                        0,
                                             Ο,
                                                  Ο,
                                                      Ο,
                                                          Ο,
            0],
         Ο,
                                   0,
      [ 0,
            Ο,
                  Ο,
                      Ο,
                           Ο,
                               Ο,
                                       0, 23, 66, 213, 253, 253,
                     81,
       253, 253, 198,
                          2,
                               Ο,
                                   Ο,
                                       Ο,
                                            0, 0,
                                                     0, 0, 0,
         Ο,
            0],
      [ 0,
                  0,
                      0,
                          0, 0, 18, 171, 219, 253, 253, 253, 253,
             Ο,
       195,
                          0, 0,
                                   0, 0,
                 9,
                      Ο,
                                            0, 0,
            80,
                                                     Ο,
                                                          Ο,
         Ο,
             0],
                  0,
      [ 0,
             0,
                      0, 55, 172, 226, 253, 253, 253, 253, 244, 133,
        11,
             Ο,
                  Ο,
                      Ο,
                          0, 0, 0, 0, 0, 0,
                                                     Ο,
         Ο,
             0],
             Ο,
                  Ο,
                      0, 136, 253, 253, 253, 212, 135, 132,
      [ 0,
                                                          16,
                                                                0,
                              0,
         0,
             Ο,
                  Ο,
                       Ο,
                           Ο,
                                   Ο,
                                        Ο,
                                            Ο,
                                                  0,
                                                      Ο,
             0],
         0,
                  Ο,
                      Ο,
                           Ο,
                                Ο,
                                    Ο,
                                         Ο,
                                              Ο,
                                                  Ο,
                                                       Ο,
                                                           Ο,
      [ 0,
             Ο,
                                                                0,
         Ο,
                  Ο,
                       Ο,
                           Ο,
                                Ο,
                                    Ο,
                                         Ο,
                                             0,
                                                  Ο,
                                                       Ο,
             Ο,
                                                           Ο,
                                                                Ο,
         Ο,
             0],
                  Ο,
                      Ο,
      [ 0,
             Ο,
                           Ο,
                                Ο,
                                    Ο,
                                         Ο,
                                             Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                0,
         0,
             Ο,
                  Ο,
                      Ο,
                           Ο,
                                Ο,
                                    Ο,
                                         Ο,
                                             Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                0,
         Ο,
             0],
      [ 0,
             Ο,
                  Ο,
                      Ο,
                           Ο,
                                0, 0,
                                       0,
                                             Ο,
                                                  Ο,
                                                       Ο,
                                                            Ο,
                                                                0,
                                                  Ο,
                                Ο,
                                   Ο,
                                        Ο,
                                             Ο,
                                                       Ο,
                                                            0,
         Ο,
             Ο,
                  Ο,
                      Ο,
                           Ο,
                                                                0,
             0]], dtype=uint8)
         Ο,
 y train[0]
```

plt.imshow(X train[0])

