Лабораторная работа № 11

«Применение метода LU разложения»

Цель работы

Реализовать задачу по вариантам.

Поиск обратной матрицы с помощью LU разложения

```
import numpy as np


def fill_matrix(n, a, b):
    m = np.random.random((n, n)) * (b - a) + a
    return m


def decompose_lu(a):
    lu = np.matrix(np.zeros([a.shape[0], a.shape[1]]))

    for k in range(a.shape[0]):
        for j in range(k, a.shape[0]):
            lu[k, j] = a[k, j] - lu[k, :k] * lu[:k, j]
        for i in range(k + 1, a.shape[0]):
            lu[i, k] = (a[i, k] - lu[i, : k] * lu[: k, k]) / lu[k, k]

    l = lu.copy()
    for i in range(l.shape[0]):
        l[i, i] = 1
        l[i, i + 1:] = 0

    u = lu.copy()
    for i in range(1, u.shape[0]):
        u[i, :i] = 0

    return np.matrix(l), np.matrix(u)

def find_inv(a, l, u):
    n = len(a)
    a_inv = []
    for i in range(0, n):
        row = []
        for j in range(0, n):
            row.append(0)
        a_inv.append(row)
```

```
    for i in range(n-1, -1, -1):
        for j in range(n-1, -1,-1):
            if i < j:
                sum = 0
                for k in range(i + 1, n):
                    sum += (u[i, k]*a_inv[k][j])
                a_inv[i][j] = (-(1/u[i, i]))*sum
            elif i == j:
                sum = 0
                for k in range(j + 1, n):
                    sum += (u[j, k] * a_inv[k][j])
                a_inv[j][i] = (1/u[j, j])*(1 - sum)
            elif i > j:
                sum = 0
                for k in range(j + 1, n):
                    sum += (l[k, j] * a_inv[i][k])
                a_inv[i][j] = -sum

    print(a_inv)
    e = np.dot(a, a_inv)
    m = len(e)
    for i in range(0, m):
        x = []
        for j in range(0, m):
            x.append(f"{e[i, j]:.0f}")
        print(x)


if __name__ == '__main__':
    a = fill_matrix(5, 1, 10)
    print(f"MATRIX A: \n{a}\n")

    l, u = decompose_lu(a)

    l_inv = np.linalg.inv(l)
    u_inv = np.linalg.inv(u)
    A_inv = np.dot(u_inv, l_inv)
    find_inv(a, l, u)
```

```
 MATRIX A:
 [[1.89255096 6.58353864 4.79399088 5.51422745 3.02536854]
  [4.82680207 2.24936251 1.70291153 9.05285067 7.93768799]
  [6.9068237  8.07202994 8.69446958 8.8500695  7.47056331]
  [7.40956798 9.10743164 7.24824365 4.92313901 4.54023144]
  [8.08763686 9.71899467 4.21939598 1.51649889 7.65281616]]

 [[-0.2149101755871673, 0.10889724110014723, -0.16471219765244033, 0.3617699801
 ['1', '0', '0', '-0', '0']
 ['-0', '1', '0', '0', '-0']
 ['-0', '-0', '1', '0', '-0']
 ['-0', '-0', '0', '1', '-0']
 ['0', '0', '0', '-0', '1']
```

Платные продукты Colab - Отменить подписку

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