Spectral forecast: A general purpose prediction model as an alternative to classical neural networks
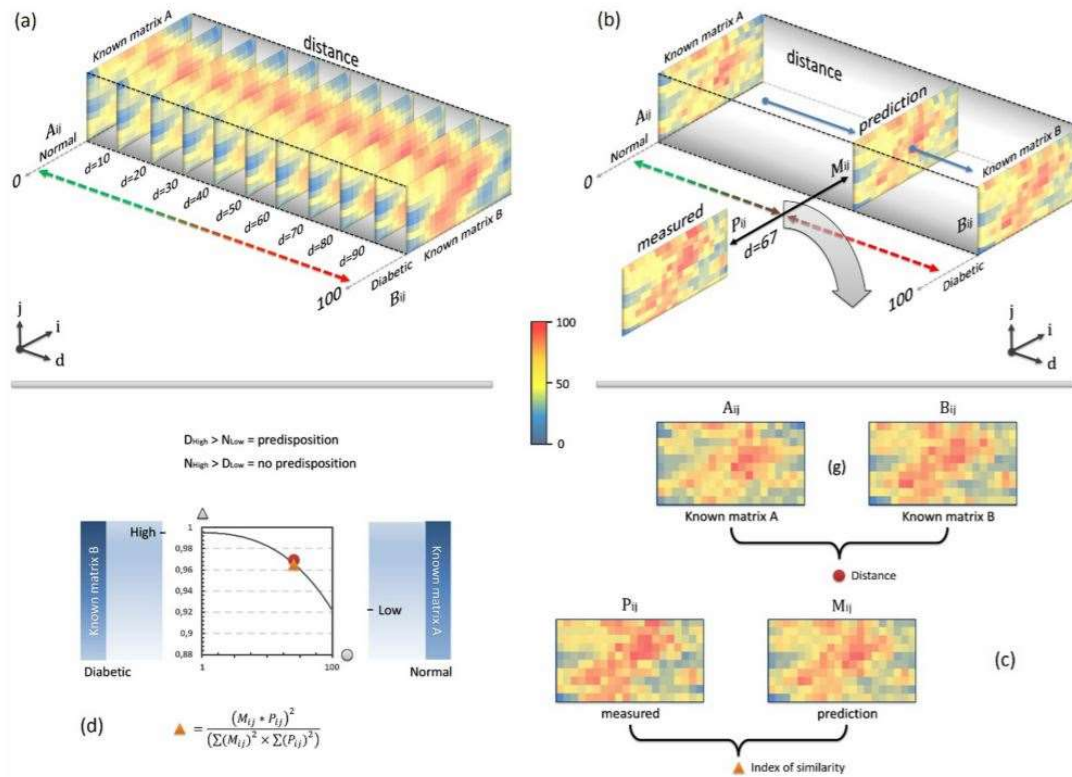

Figure.1

-(from figure.1)

d → variable.

A_{ij} → known matrix.

B_{ij} → known matrix.

$$M_{ijd} = \left[\left(\frac{d}{\mathrm{Max}(A_{ij})}\right) \times A_{ij}\right] + \left[\left(\frac{(\mathrm{Max}(d) - d)}{\mathrm{Max}(B_{ij})}\right) \times B_{ij}\right], \quad (1)$$

$\mathrm{Max}(A_{ij})$ → the maximum value in the matrix A_{ij}.

$\mathrm{Max}(B_{ij})$ → the maximum value in the matrix B_{ij}.

$\mathrm{Max}(d)$ → the maximum value of d ($\mathrm{Max}(d)$ = 100 from figure 1).

M_{ijd} → unknown matrix depends on d.

Matrix A

10	23	45	63	44	35	47	63	50	29	25	23	43	17	32	8,3	18	4	4,2	2,3
5,1	7,9	19	38	28	23	34	38	35	25	22	47	64	30	9,1	10	5,4	13	20	15
34	46	27	43	34	17	17	18	13	12	44	35	37	16	48	36	36	17	6,4	13
18	37	31	22	23	13	16	13	30	15	31	65	56	58	48	42	30	28	35	38
15	15	13	9,1	9,1	9,4	13	45	35	46	44	65	64	51	47	43	36	7,5	9,8	8,9
7,7	12	8,8	16	11	9	33	43	30	17	75	55	49	39	36	21	6,9	6,3	7,3	9,8
7,4	13	17	19	29	24	29	20	21	13	47	47	74	30	36	31	8,3	30	46	37
33	32	28	36	45	31	20	30	34	21	25	35	14	14	35	48	35	40	28	28
58	41	18	17	21	16	31	19	20	42	35	36	15	21	37	9,5	14	18	15	18
12	16	14	22	11	37	47	44	29	38	26	15	13	27	12	13	16	11	12	33

Matrix B

19	43	52	46	47	47	68	66	70	62	40	50	76	53	45	32	65	37	19	9,5
16	17	42	41	34	34	39	46	48	54	56	50	71	61	33	34	25	30	34	34
38	40	41	40	31	27	28	33	40	44	68	54	67	54	56	50	48	37	28	38
28	38	38	39	43	44	49	50	65	56	63	60	70	72	75	62	57	54	50	44
23	28	29	34	43	52	51	76	59	53	57	81	87	79	67	70	67	49	43	29
23	33	35	42	49	58	62	71	60	53	82	78	66	64	60	57	46	48	34	27
29	34	45	53	65	72	60	62	55	48	63	59	80	66	58	44	44	46	54	39
42	41	51	64	78	64	49	46	52	52	54	63	45	37	48	48	47	57	43	32
47	41	33	33	47	45	45	50	50	60	56	40	38	29	36	32	29	30	25	25
13	25	24	28	28	44	58	74	55	50	37	39	33	33	34	38	44	31	30	31

Matrix M
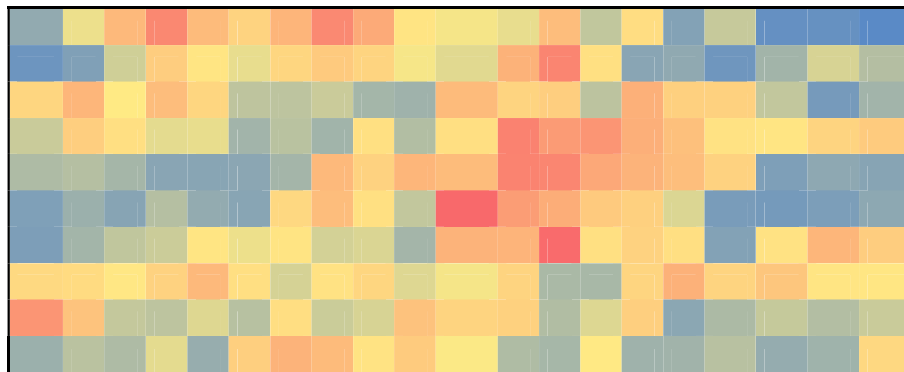
To implement equation (1)

Input: matrix A_{ij}, matrix B_{ij} and d value

Output: matrix M_{ijd}

-File.txt form matrix A_{ij} and matrix B_{ij} (excel file)

The program done in JavaScript

```javascript
"use strict";

var ins = 0;

var matrix_Aji = [];
var matrix_Bji = [];
var maxA = 0;
var maxB = 0;
var max_d = 100;
var d = process.argv[2];
var Mjid = [];

var fs = require('fs');
try {
    var dataA = fs.readFileSync('matrixA.txt').toString();
    var dataB = fs.readFileSync('matrixB.txt').toString();
} catch (err) {
    console.error(err);
}
var regex = /\r?\n|\r|\t/;
dataA = dataA.split(regex);
dataB = dataB.split(regex);


for (let i = 0; i < 10; i++) {
    matrix_Aji[i] = [];
    matrix_Bji[i] = [];
    for (let j = 0; j < 20; j++) {
        matrix_Aji[i][j] = parseFloat(dataA[j + ins].replace(/,/g, '.'));
        matrix_Bji[i][j] = parseFloat(dataB[j + ins].replace(/,/g, '.'));
    }
    ins += 20;
}


for (let i = 0; i < 10; i++) {

    if (maxA < Math.max(...matrix_Aji[i])) {
```

```javascript
            maxA = Math.max(...matrix_Aji[i]);
        }
        if (maxB < Math.max(...matrix_Bji[i])) {
            maxB = Math.max(...matrix_Bji[i]);
        }

}

var mul_A = d / maxA;
var mul_B = (max_d - d) / maxB;

for (let i = 0; i < 10; i++) {
    Mjid[i] = [];
    for (let j = 0; j < 20; j++) {
        Mjid[i][j] = (mul_A * matrix_Aji[i][j]) + (mul_B * matrix_Bji[i][j])
        //la formule de l'equation(1) par rapport au chaque element de matrice.

    }
    ins += 20;
}


var matrix_output = fs.createWriteStream("Matrix_Mjid.txt");
matrix_output.once('open', function (fd) {
    for (let i = 0; i < 10; i++) {
        for (let j = 0; j < 20; j++) {

            matrix_output.write(Mjid[i][j] + '\t');

        }
        matrix_output.write('\n');
    }
    matrix_output.end();
});

var matrix_output_r = fs.createWriteStream("Matrix_Mjid_round.txt");
matrix_output_r.once('open', function (fd) {
    for (let i = 0; i < 10; i++) {
        for (let j = 0; j < 20; j++) {
            matrix_output_r.write(Math.round(Mjid[i][j]) + '\t');
        }
        matrix_output_r.write('\n');
    }
    matrix_output_r.end();
});
```

Operation in terminal


```
JS devoir.js                     6    var matrix_Bji = [];
☰ Matrix_Mjid_round.txt          7    var maxA = 0;
☰ Matrix_Mjid.txt
☰ matrixA.txt          OUTPUT  TERMINAL  DEBUG CONSOLE  PROBLEMS           1: powershell  ∨
☰ matrixB.txt
                       Windows PowerShell
                       Copyright (C) 2016 Microsoft Corporation. All rights reserved.

                       PS C:\Users\france\Desktop\bioinfo\lab final> node devoir.js 50
                       PS C:\Users\france\Desktop\bioinfo\lab final> █
```

1 → new files (matrix Mjid and the other with round the values).

2 → input value of d.

The output matrix from terminal in file.txt


```
☰ Matrix_Mjid_round.txt
 1    18  41  60  69  57  51  70  80  75  55  40  44  73  42  47  24  49  24  14  7
 2    12  15  37  49  38  35  45  52  51  48  47  61  84  55  25  26  18  26  33  30
 3    45  54  41  52  41  27  27  31  32  34  69  55  63  42  65  53  52  33  20  30
 4    29  46  42  37  40  34  39  38  58  43  57  79  78  81  76  64  53  50  52  51
 5    23  26  26  26  31  36  38  74  58  61  62  91  93  80  70  69  63  33  32  22
 6    18  27  26  35  36  39  58  70  55  42  97  82  71  63  59  47  31  32  25  22
 7    22  28  38  43  56  57  54  49  46  36  68  65  96  58  57  46  31  46  62  47
 8    47  45  48  61  75  58  42  46  53  44  48  60  35  30  51  60  50  60  44  37
 9    66  51  31  30  42  36  47  41  42  63  56  47  32  31  46  25  26  29  24  27
10    15  25  24  31  24  50  65  72  51  54  39  32  28  37  28  30  36  25  26  40
```

The output matrix from excel file

Matrix M

Distance d:

50

REFERENCES

Spectral forecast: A general purpose prediction model as an alternative to classical neural networks, Chaos 30, 033119 (2020)
https://aip.scitation.org/doi/pdf/10.1063/1.5120818

Additional article material from

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