

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

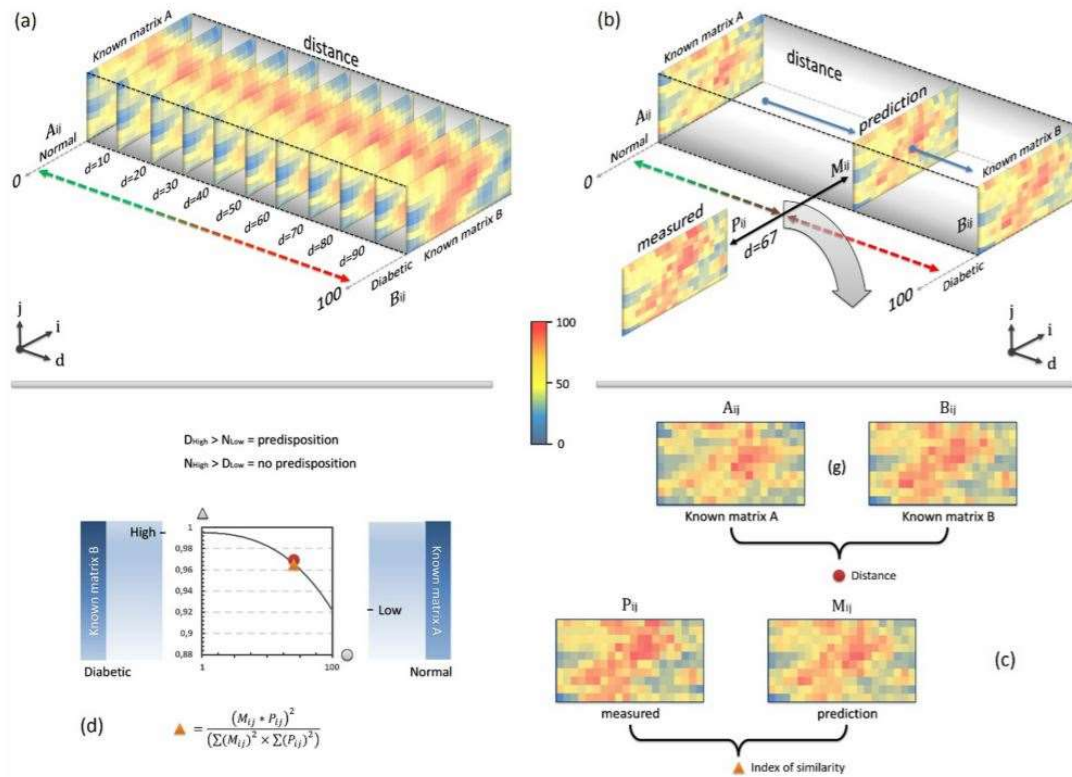


Figure.1

-(from figure.1)

$d \rightarrow$ variable.

$A_{ij} \rightarrow$ known matrix.

$B_{ij} \rightarrow$ known matrix.

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

$\text{Max}(A_{ij}) \rightarrow$ the maximum value in the matrix A_{ij} .

$\text{Max}(B_{ij}) \rightarrow$ the maximum value in the matrix B_{ij} .

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

$M_{ijd} \rightarrow$ unknown matrix depends on d .

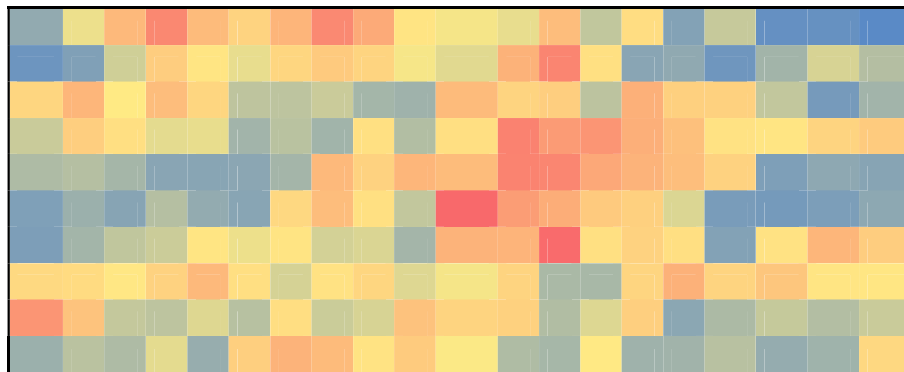
Matrix A

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}

```
matrixA.txt x matrixB.txt
matrixA.txt
1 10,39857837 23,48750403 44,80102933 63,27170479 44,12667079 35,14903746 46,52994188 62,68843531 50,45178674 28,989355
2 5,09251571 7,880717484 19,218235 37,55939605 28,46701111 22,76284912 33,96570218 38,39242371 34,94626695 24,822578
3 34,1093194 46,17994981 26,51787877 43,29102302 34,17465381 16,72241345 16,59969557 18,42594266 13,1062374 12,331754
4 18,28486877 37,05337102 30,53979195 22,22670387 22,85612855 12,74956376 16,04163866 12,66990318 30,29219184 15,043655
5 14,51904497 15,42599297 13,11843953 9,115874019 9,068278702 9,383229575 12,97601663 44,72221897 35,48462937 45,922358
6 7,71853895 11,80611183 8,8076074 15,50384542 10,53782129 9,016032781 33,38051912 43,36707404 30,3585572 17,334623
7 7,382801382 12,88641973 17,09983884 18,6752663 28,63168397 23,54020716 28,87729158 19,80012897 20,72385858 13,083221
8 32,98597491 32,3138911 27,66937018 35,65935442 44,95337048 30,6011921 20,09235246 29,68481212 34,23281044 21,326184
9 58,35229186 41,31254945 17,58083485 16,55778216 21,37614913 15,7982152 30,94081044 18,53095051 20,38094073 41,552064
10 11,73438174 16,1555078 14,43196889 22,16333671 11,10351384 36,55870914 47,27105998 44,04763085 29,11774388 38,001278
```

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

The program done in 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])) {
```

```

        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
Matrix_Mjid_round.txt
Matrix_Mjid.txt
matrixA.txt
matrixB.txt

6 var matrix_Bji = [];
7 var maxA = 0;
8 var maxB = 0;

OUTPUT TERMINAL DEBUG CONSOLE PROBLEMS
Windows PowerShell
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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																				
18	41	60	69	57	51	70	80	75	55	40	44	73	42	47	24	49	24	14	7	
12	15	37	49	38	35	45	52	51	48	47	61	84	55	25	26	18	26	33	30	
45	54	41	52	41	27	27	31	32	34	69	55	63	42	65	53	52	33	20	30	
29	46	42	37	40	34	39	38	58	43	57	79	78	81	76	64	53	50	52	51	
23	26	26	26	31	36	38	74	58	61	62	91	93	80	70	69	63	33	32	22	
18	27	26	35	36	39	58	70	55	42	97	82	71	63	59	47	31	32	25	22	
22	28	38	43	56	57	54	49	46	36	68	65	96	58	57	46	31	46	62	47	
47	45	48	61	75	58	42	46	53	44	48	60	35	30	51	60	50	60	44	37	
66	51	31	30	42	36	47	41	42	63	56	47	32	31	46	25	26	29	24	27	
15	25	24	31	24	50	65	72	51	54	39	32	28	37	28	30	36	25	26	40	

Distance d:

50

REFERENCES

Spectral forecast: A general purpose prediction model as an alternative to classical neural networks, Chaos 30, 033119 (2020)

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Paul A. Gagniuc et al. Spectral forecast: A general purpose prediction model as an alternative to classical neural networks. Chaos 30, 033119 (2020); doi: 10.1063/1.5120818

https://aip.scitation.org/doi/suppl/10.1063/1.5120818/suppl_file/supplementary+material.xlsm