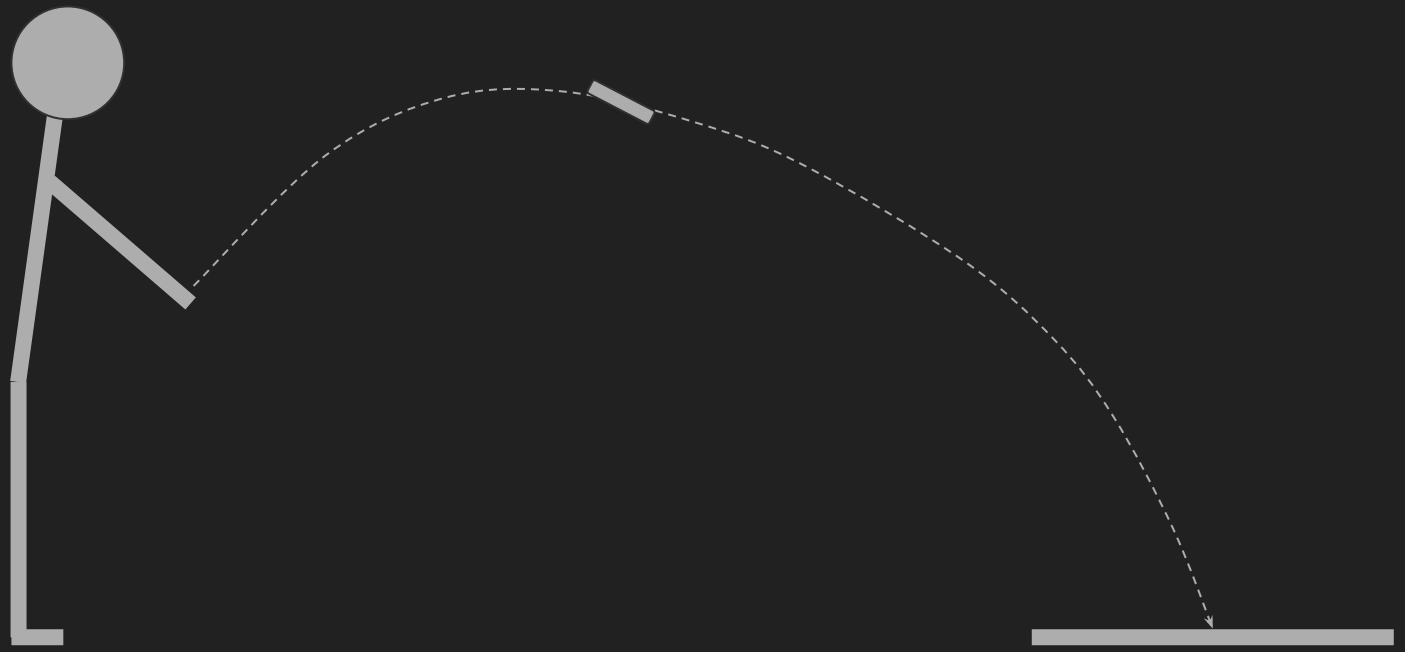
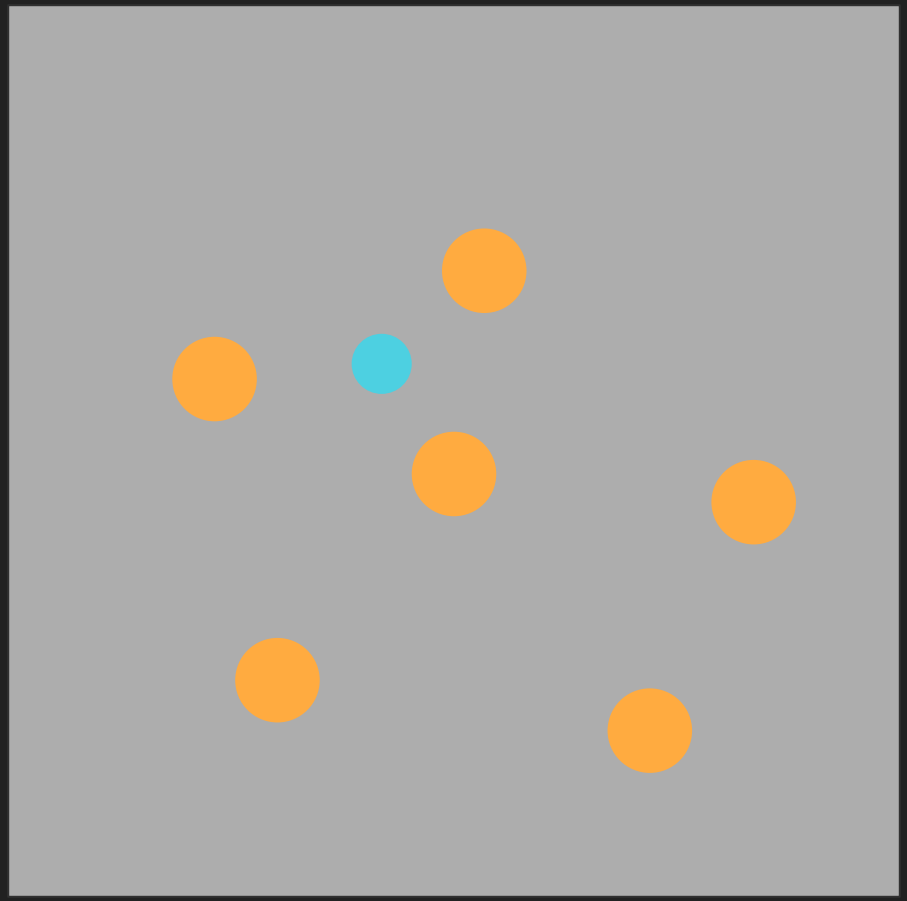
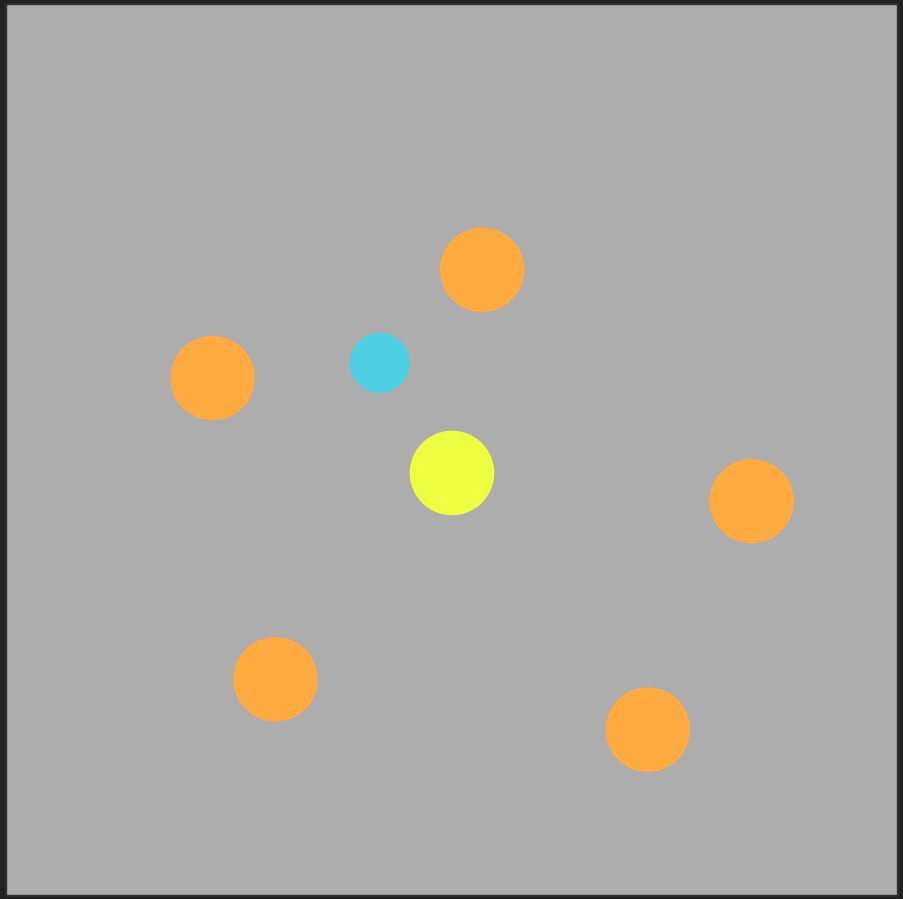
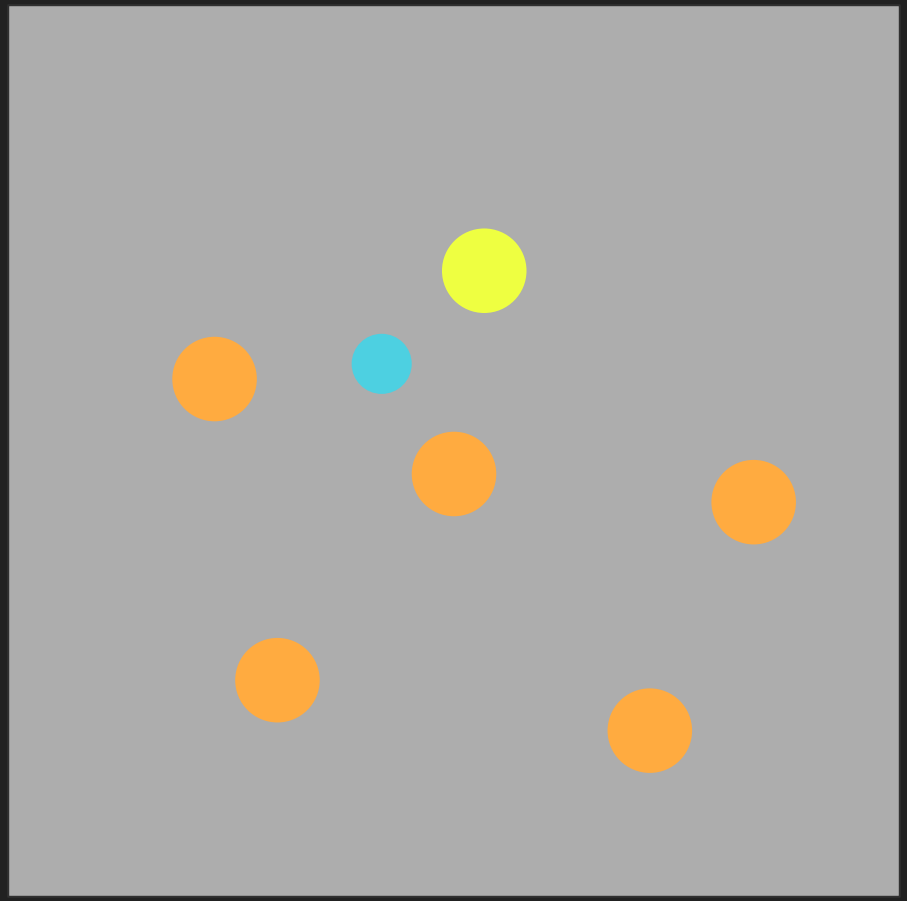
JavaScript, GPU et palet breton

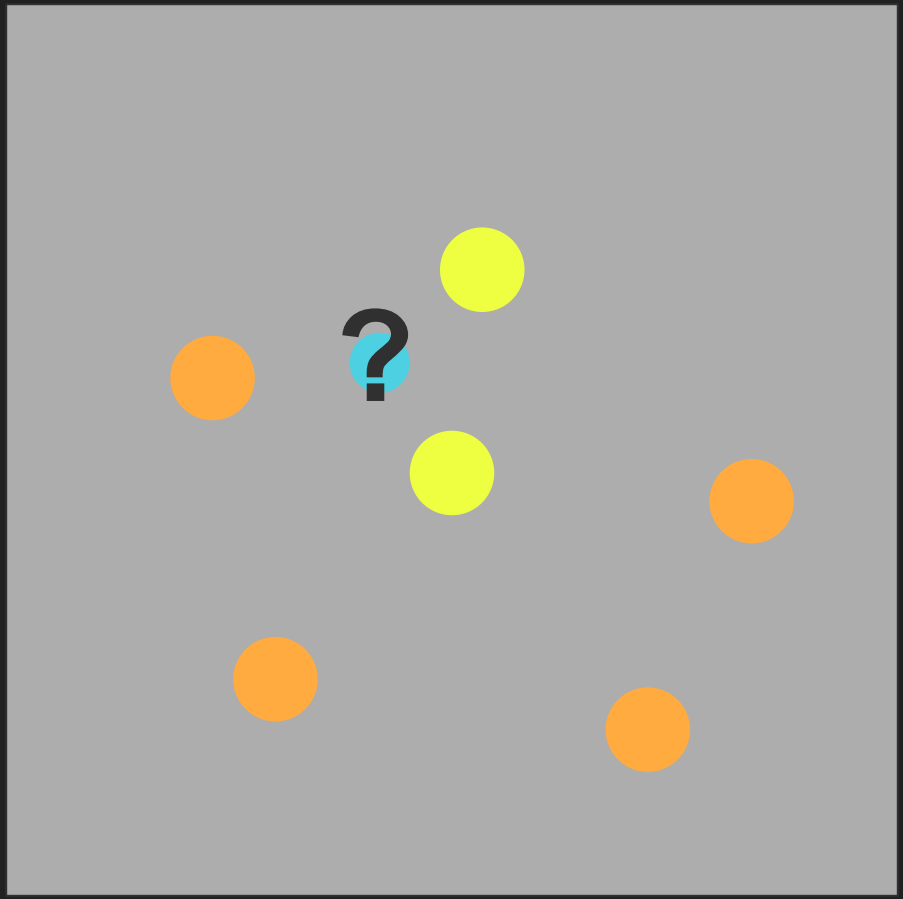
Palet breton ?



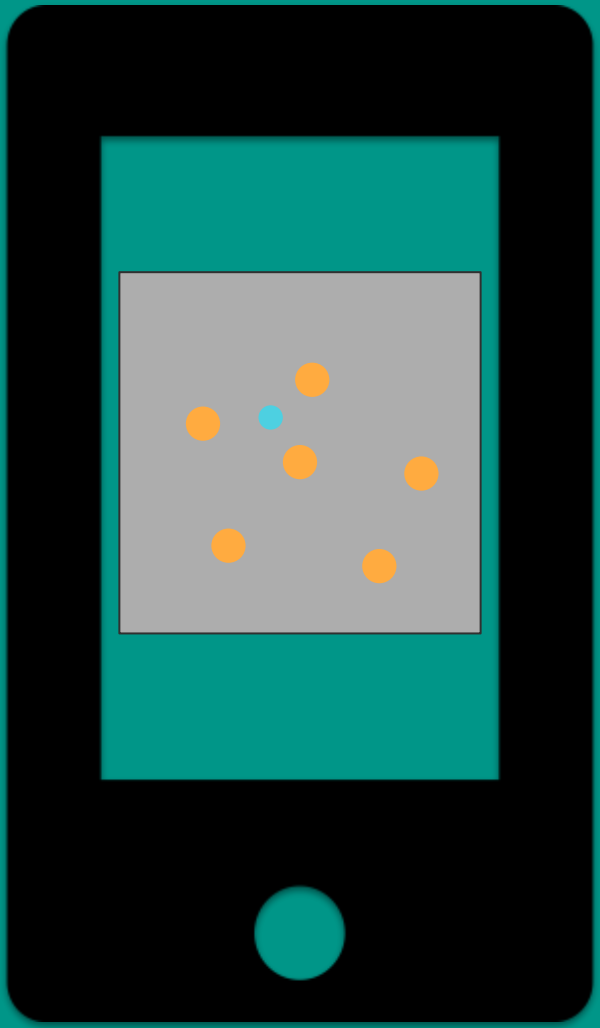


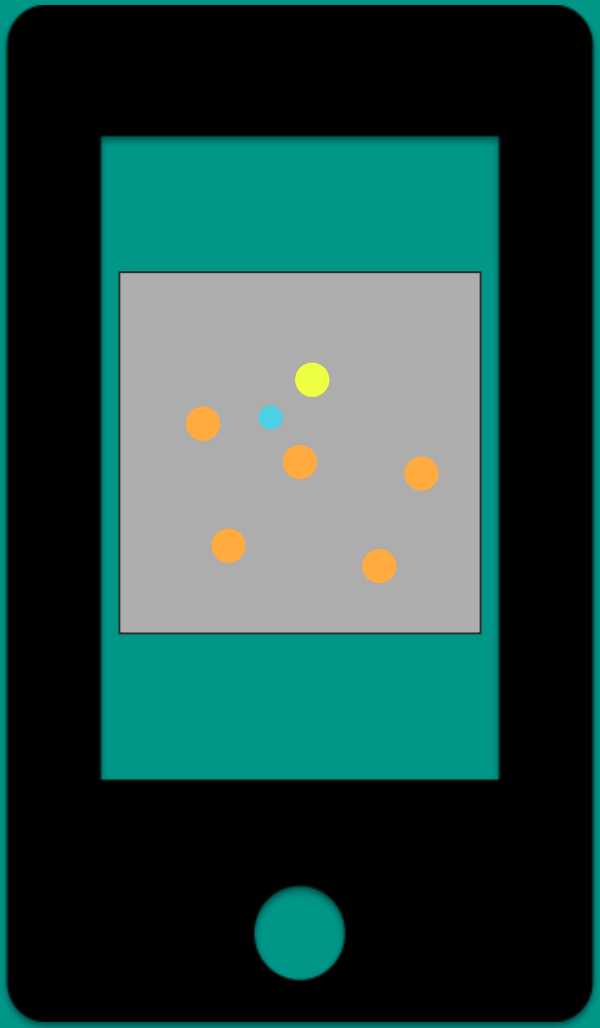






T’as bougé le palet !





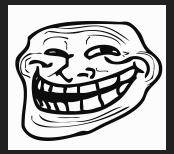
C++, OpenCV, CUDA, SIMD

C++, OpenCV, CUDA, SIMD

nope

JavaScript

JavaScript



?

JavaScript

+ GPU.js

GPU ?

GPU ?

les shaders !

CPU

DÉFINITION DES COORDONNÉES

GPU

CPU

https://openclassrooms.com/courses/developpez-vos-applications-3d-avec-opengl-3-3/introduction-aux-shaders-1

CPU

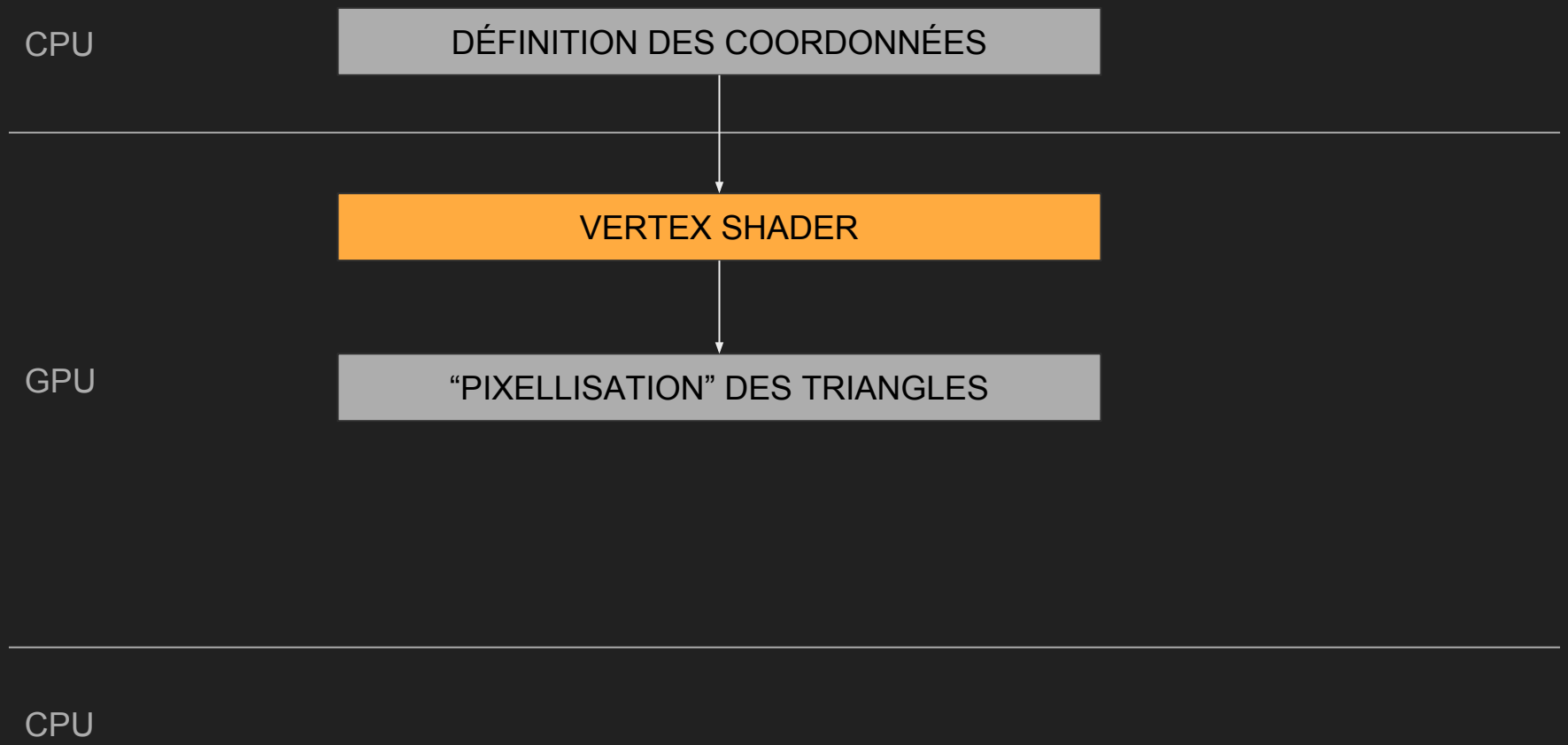
DÉFINITION DES COORDONNÉES

VERTEX SHADER

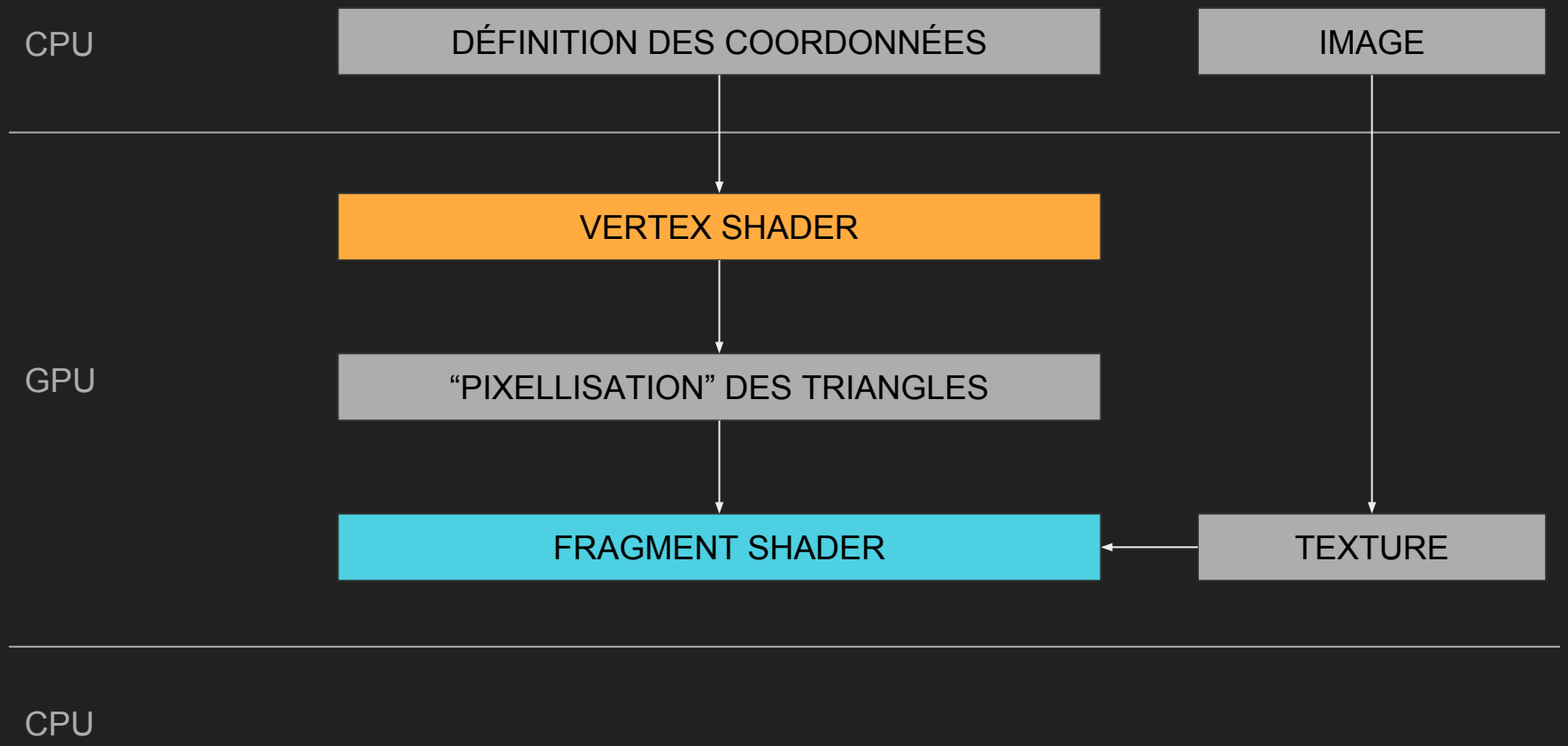
GPU

CPU

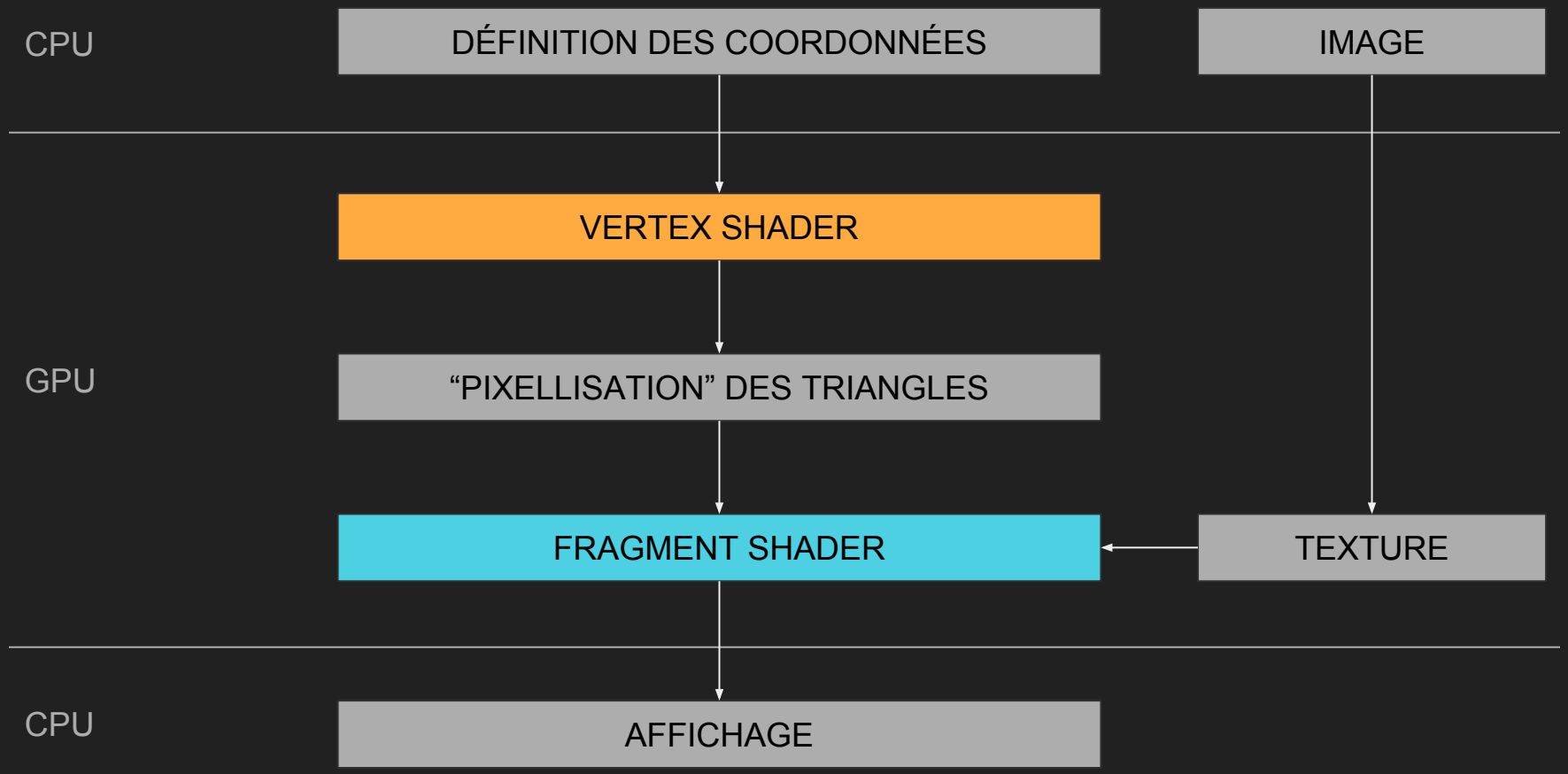
https://openclassrooms.com/courses/developpez-vos-applications-3d-avec-opengl-3-3/introduction-aux-shaders-1



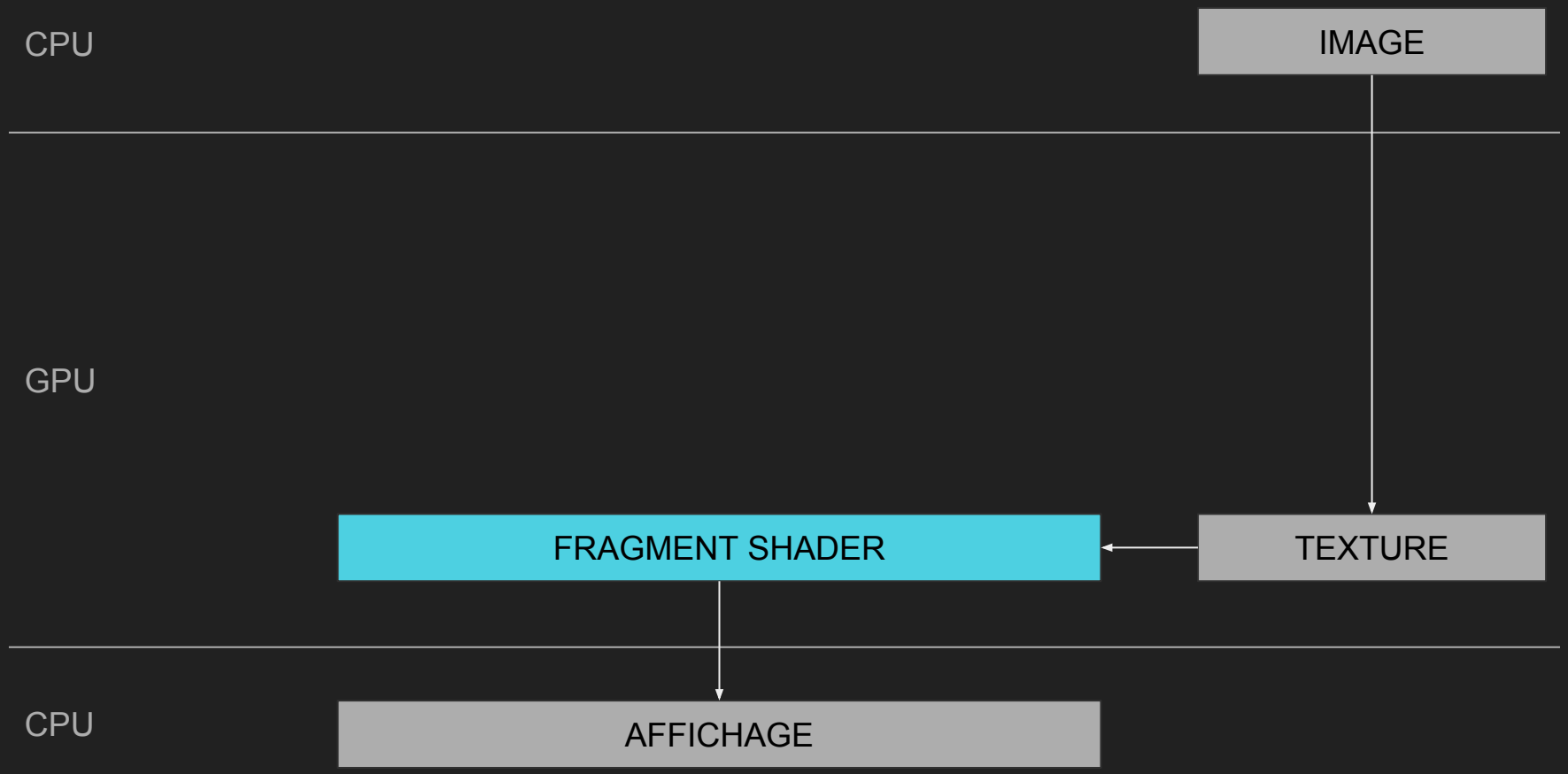
https://openclassrooms.com/courses/developpez-vos-applications-3d-avec-opengl-3-3/introduction-aux-shaders-1

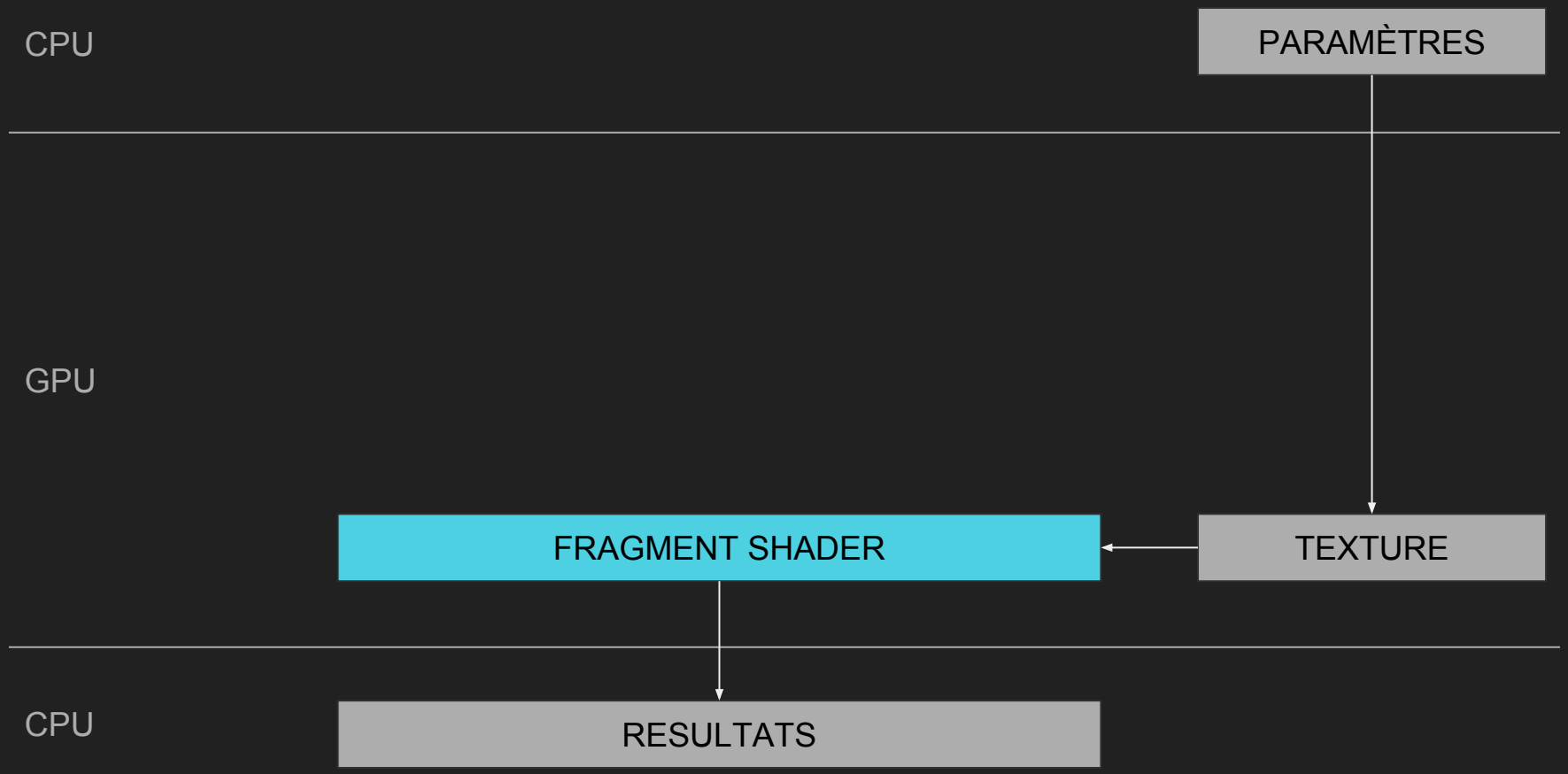


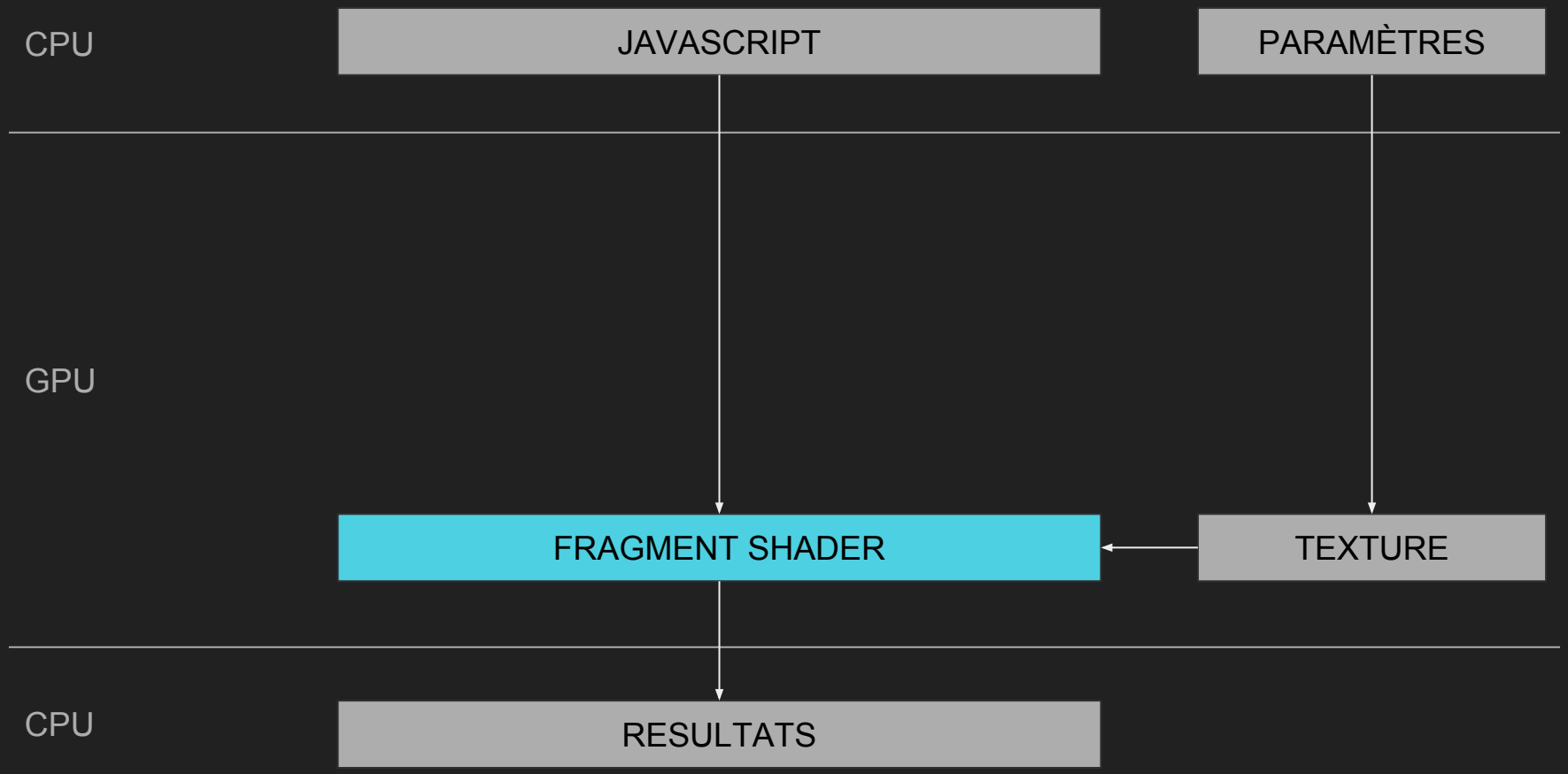
https://openclassrooms.com/courses/developpez-vos-applications-3d-avec-opengl-3-3/introduction-aux-shaders-1

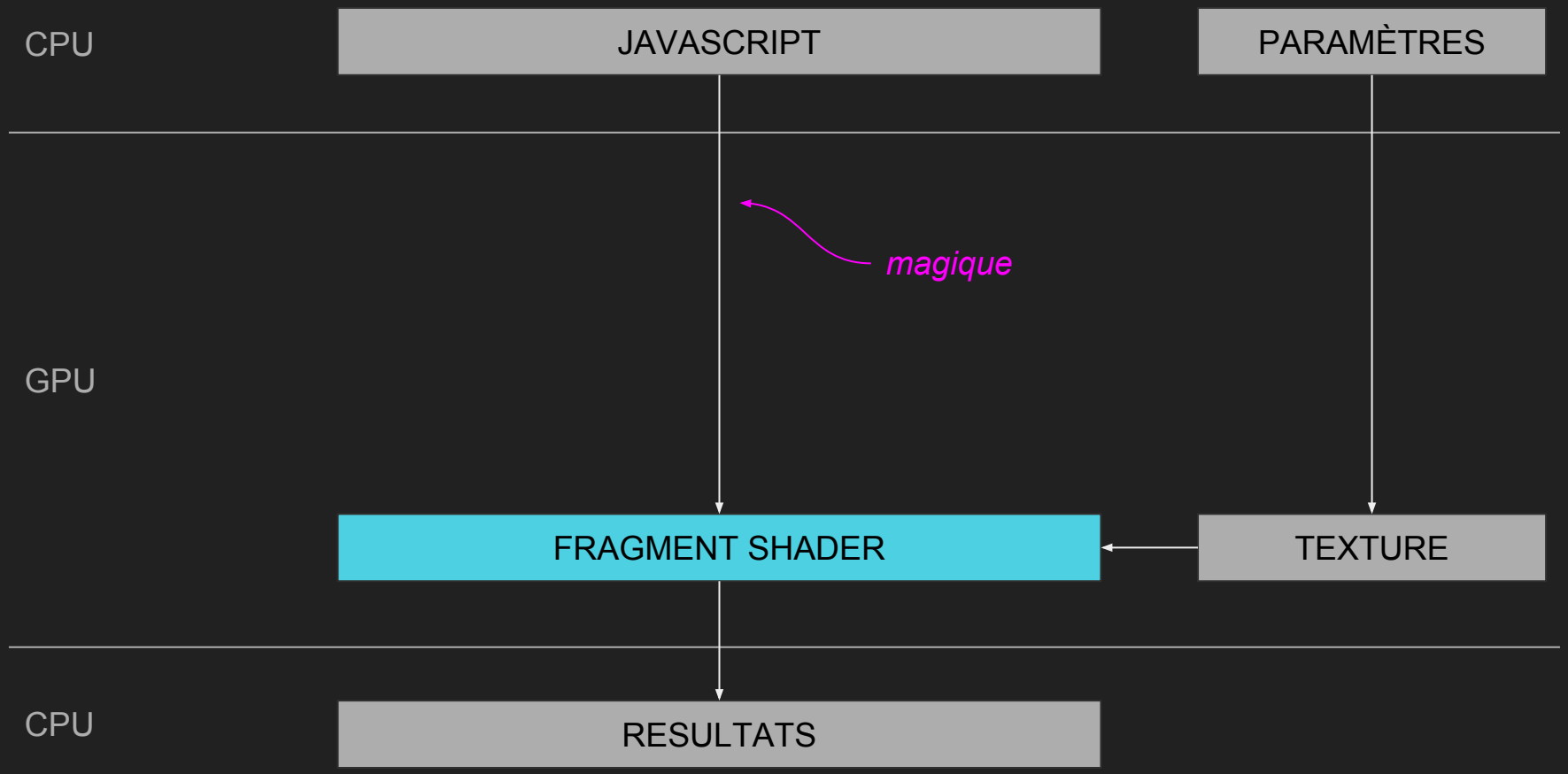


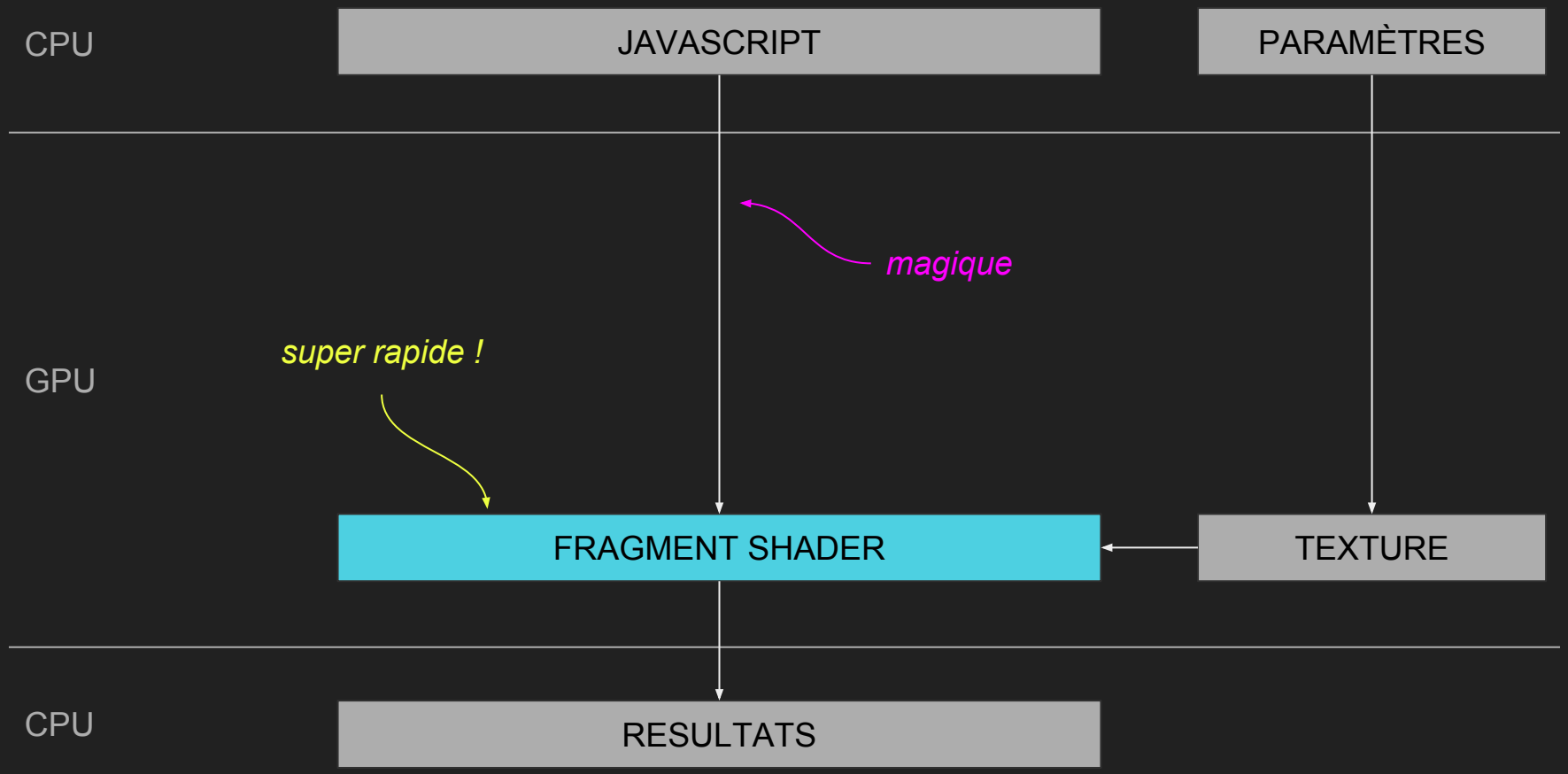
https://openclassrooms.com/courses/developpez-vos-applications-3d-avec-opengl-3-3/introduction-aux-shaders-1

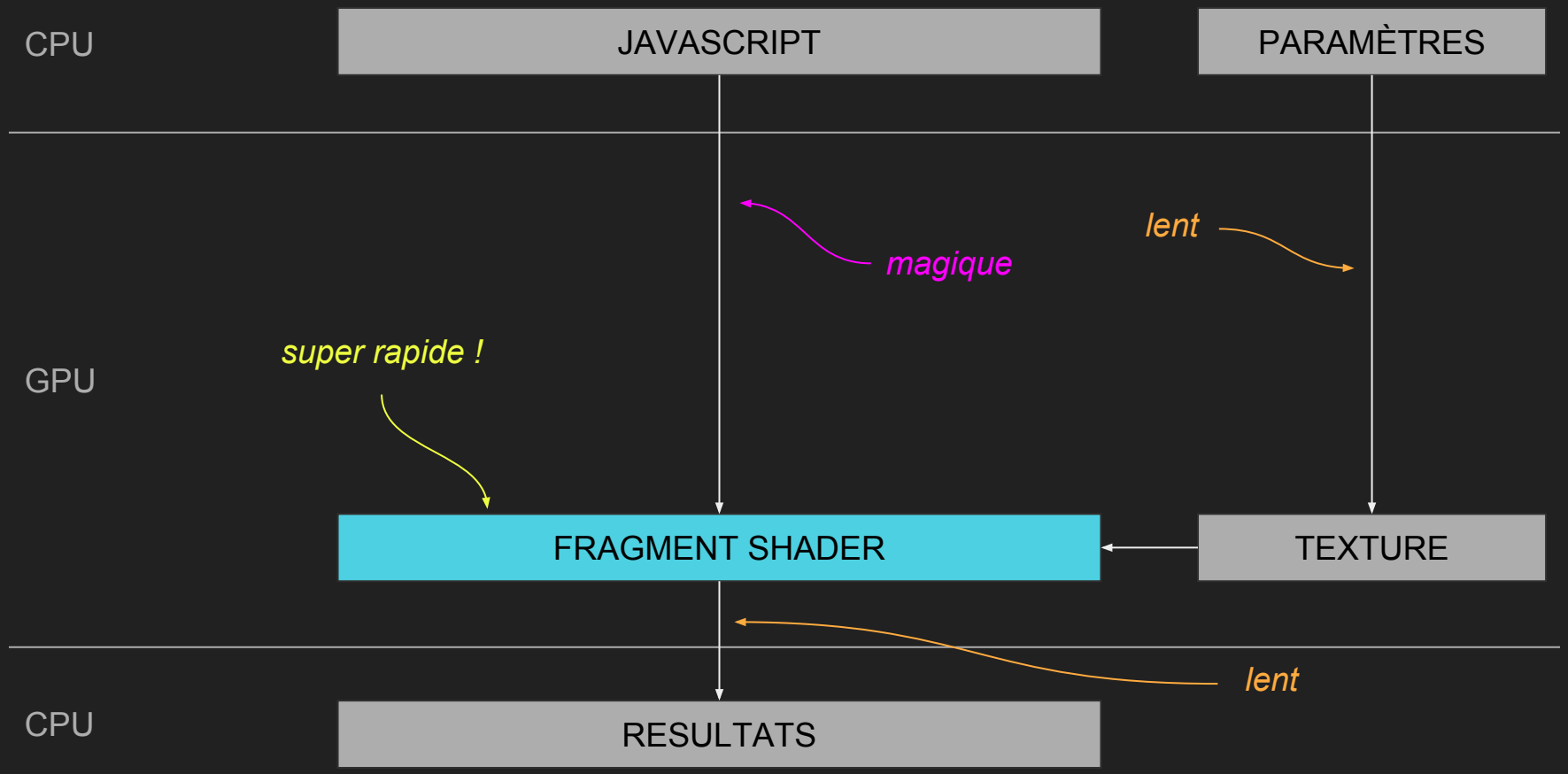

CPU
IMAGE
GPU
FRAGMENT SHADER
TEXTURE
CPU
AFFICHAGE


CPU
PARAMÈTRES
GPU
FRAGMENT SHADER
TEXTURE
CPU
RESULTATS


CPU
JAVASCRIPT
PARAMÈTRES
GPU
FRAGMENT SHADER
TEXTURE
CPU
RESULTATS


CPU
JAVASCRIPT
PARAMÈTRES
magique
GPU
FRAGMENT SHADER
TEXTURE
CPU
RESULTATS


CPU
JAVASCRIPT
PARAMÈTRES
magique
GPU
super rapide !
FRAGMENT SHADER
TEXTURE
CPU
RESULTATS


CPU
JAVASCRIPT
PARAMÈTRES
magique
lent
GPU
super rapide !
FRAGMENT SHADER
TEXTURE
lent
CPU
RESULTATS

```
const gpu = new GPU();
```

//initialisation du shader et définition de fonctions utilitaires

```
const gpu = new GPU();


const multiplyMatrix =
gpu.createKernel(function(a, b) {
  //TODO
}).setOutput([512, 512]);
```

```
//initialisation du shader et définition de fonctions utilitaires

uniform highp sampler2D user_a;
uniform highp vec2 user_aSize;
uniform highp vec3 user_aDim;

uniform highp sampler2D user_b;
uniform highp vec2 user_bSize;
uniform highp vec3 user_bDim;

void kernel() {
  //TODO
}
```

```
const gpu = new GPU();


const multiplyMatrix =
gpu.createKernel(function(a, b) {
  var sum = 0;
  for (var i = 0; i < 512; i++) {
    sum += a[this.thread.y][i] *
           b[i][this.thread.x];
  }
  return sum;
}).setOutput([512, 512]);
```

```
//initialisation du shader et définition de fonctions utilitaires

uniform highp sampler2D user_a;
uniform highp vec2 user_aSize;
uniform highp vec3 user_aDim;

uniform highp sampler2D user_b;
uniform highp vec2 user_bSize;
uniform highp vec3 user_bDim;

highp float kernelResult = 0.0;

void kernel() {
  float user_sum=0.0;
  for (float user_i=0.0; (user_i<512.0); user_i++){
    user_sum+=(
      get(user_a, vec2(user_aSize[0],user_aSize[1]),
        vec3(user_aDim[0],user_aDim[1],user_aDim[2]),
        threadId.y, user_i) *
      get(user_b, vec2(user_bSize[0],user_bSize[1]),
        vec3(user_bDim[0],user_bDim[1],user_bDim[2]),
        user_i, threadId.x)
    );
  }
  kernelResult = user_sum;
  return;
}
```

```
const c = multiplyMatrix(a, b);
```

```
uniform highp vec3 uOutputDim;
uniform highp vec2 uTexSize;
varying highp vec2 vTexCoord;

void main(void) {
  index =
    floor(vTexCoord.s * float(uTexSize.x)) +
    floor(vTexCoord.t * float(uTexSize.y)) *
    uTexSize.x;
  threadId = indexTo3D(index, uOutputDim);
  kernel();
  gl_FragColor = encode32(kernelResult);
}
```

0.532s

0.196s

x2.72 sur PC

4.301s

0.304s

x14.13 sur smartphone

The algorithm

PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE

PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

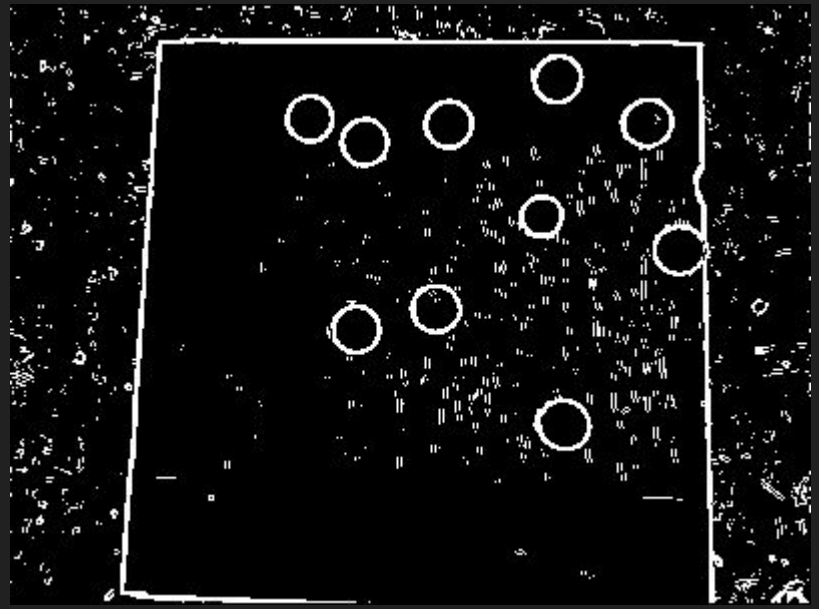
PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE



PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

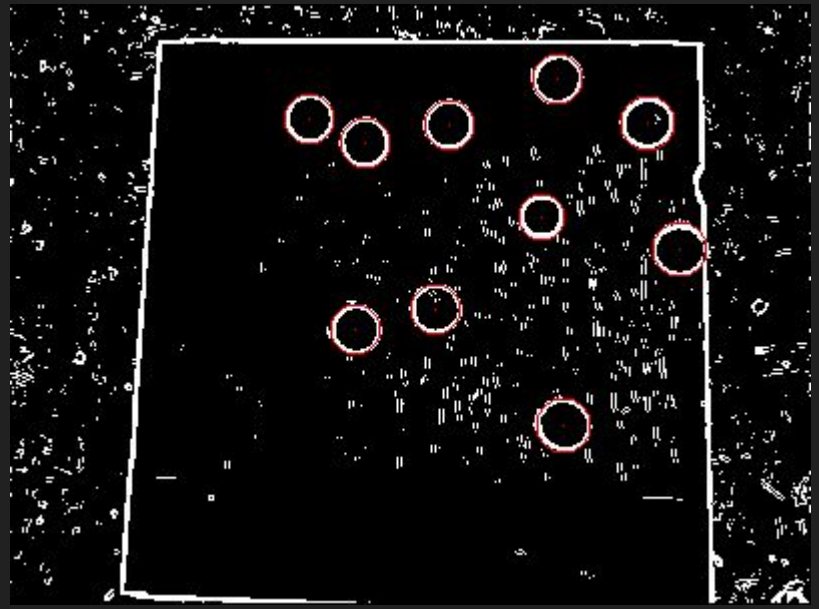
PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE



PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

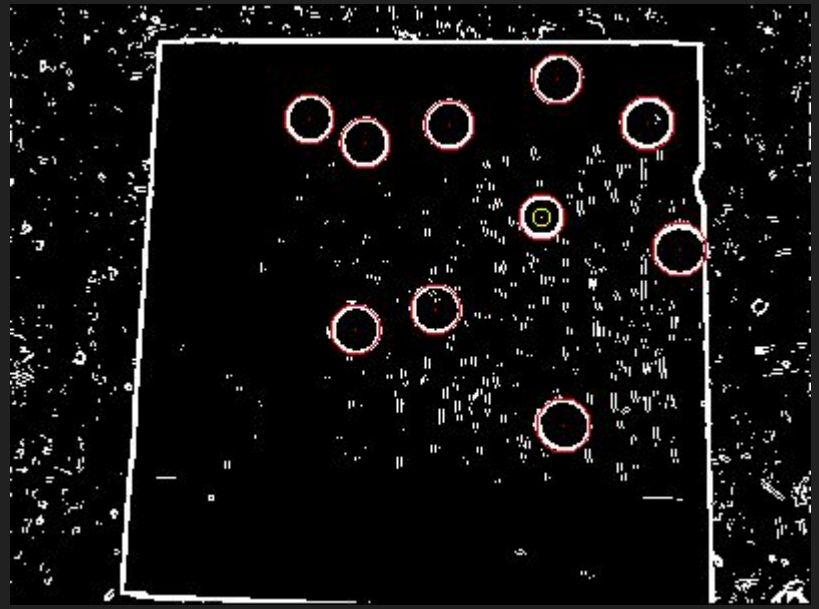
PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE



PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

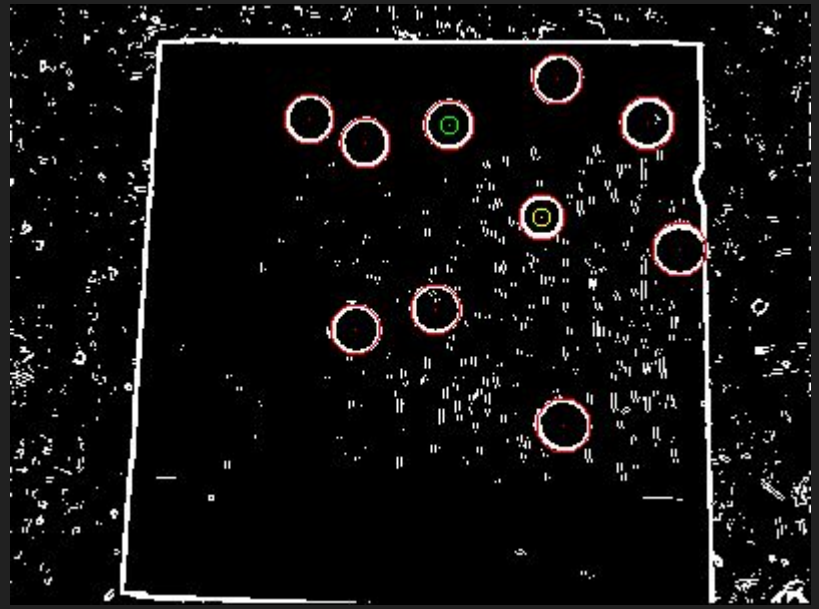
PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE



PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

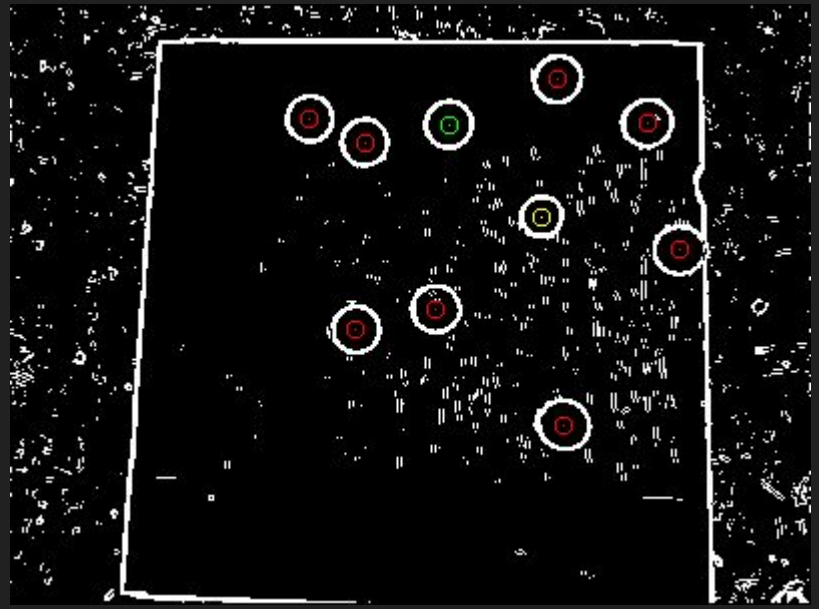
PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE



PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE

```
<input type='file' accept='image/*' capture='camera' />
```

PRISE DE PHOTO

↓

DÉTECTION DE CONTOUR (SOBEL)

↓

DÉTECTION DE CERCLES

↓

PLUS PETIT CERCLE

↓

GRAND CERCLE LE PLUS PROCHE DU PETIT

↓

AFFICHAGE

```
<input type='file' accept='image/*' capture='camera' />
```

> npm install sobel

PRISE DE PHOTO

```
<input type='file' accept='image/*' capture='camera' />
```

DÉTECTION DE CONTOUR (SOBEL)

> npm install sobel

DÉTECTION DE CERCLES

PLUS PETIT CERCLE

```
var smallestCircle =
minBy(circles, c => c.radius)
```

GRAND CERCLE LE PLUS PROCHE DU PETIT

AFFICHAGE

PRISE DE PHOTO

```
<input type='file' accept='image/*' capture='camera' />
```

DÉTECTION DE CONTOUR (SOBEL)

> npm install sobel

DÉTECTION DE CERCLES

PLUS PETIT CERCLE

```
var smallestCircle =
minBy(circles, c => c.radius)
```

GRAND CERCLE LE PLUS PROCHE DU PETIT

```
var nearestCircle =
minBy(otherCircles, c => squareDistance(c, smallestCircle))
```

AFFICHAGE

PRISE DE PHOTO

```
<input type='file' accept='image/*' capture='camera' />
```

DÉTECTION DE CONTOUR (SOBEL)

> npm install sobel

DÉTECTION DE CERCLES

PLUS PETIT CERCLE

```
var smallestCircle =
minBy(circles, c => c.radius)
```

GRAND CERCLE LE PLUS PROCHE DU PETIT

```
var nearestCircle =
minBy(otherCircles, c => squareDistance(c, smallestCircle))
```

AFFICHAGE

```
<img src={imageDataEncodedInBase64} />
```

PRISE DE PHOTO

```
<input type='file' accept='image/*' capture='camera' />
```

DÉTECTION DE CONTOUR (SOBEL)

> npm install sobel

DÉTECTION DE CERCLES

← CA SE COMPLIQUE ICI

PLUS PETIT CERCLE

```
var smallestCircle =
minBy(circles, c => c.radius)
```

GRAND CERCLE LE PLUS PROCHE DU PETIT

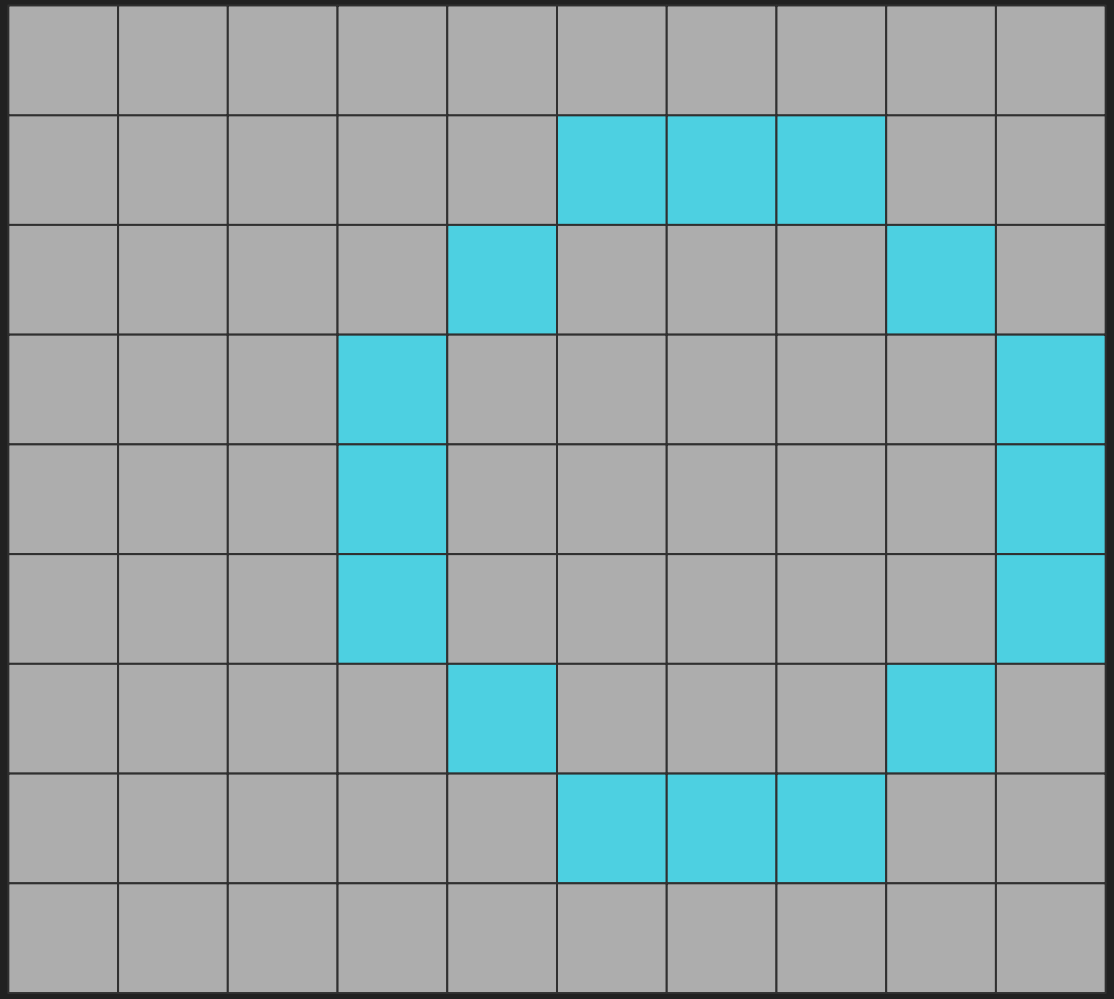
```
var nearestCircle =
minBy(otherCircles, c => squareDistance(c, smallestCircle))
```

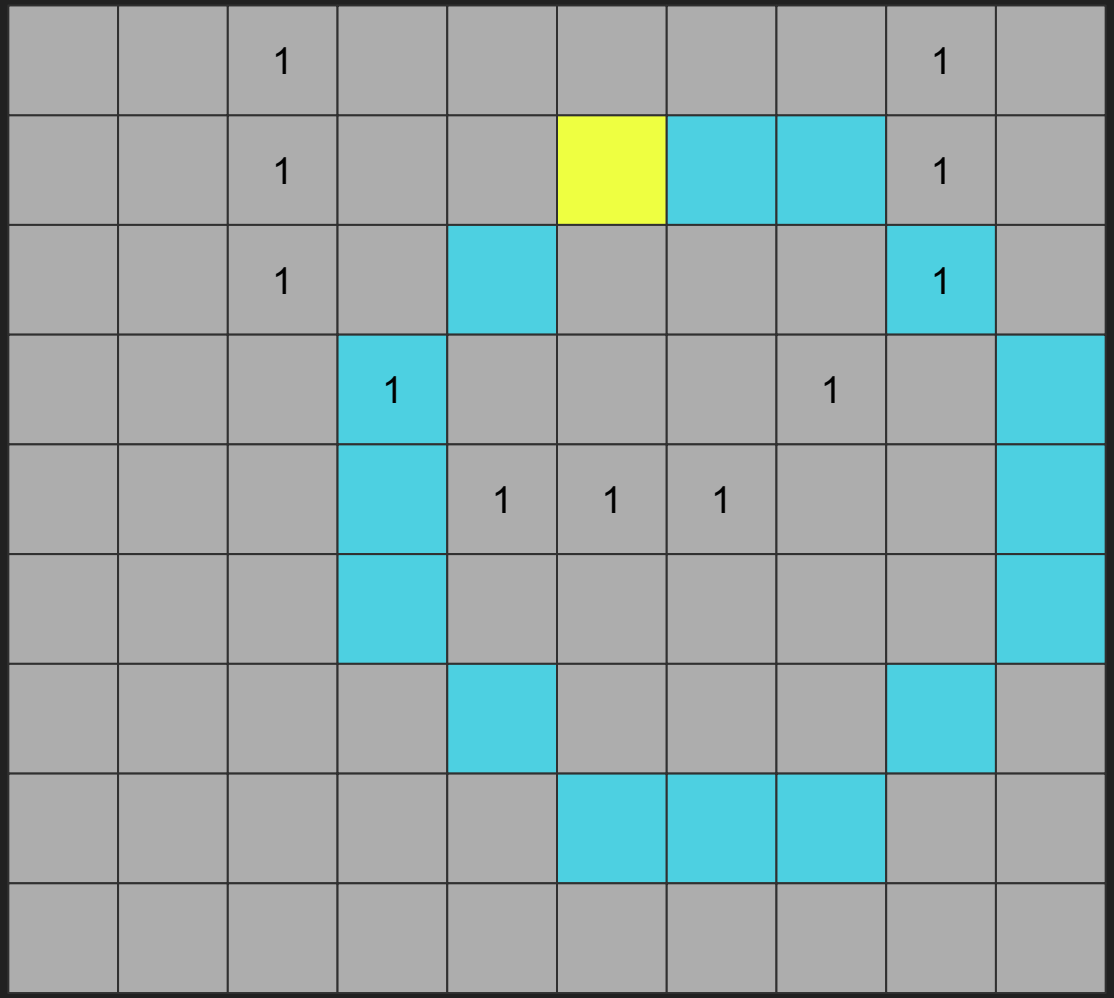
AFFICHAGE

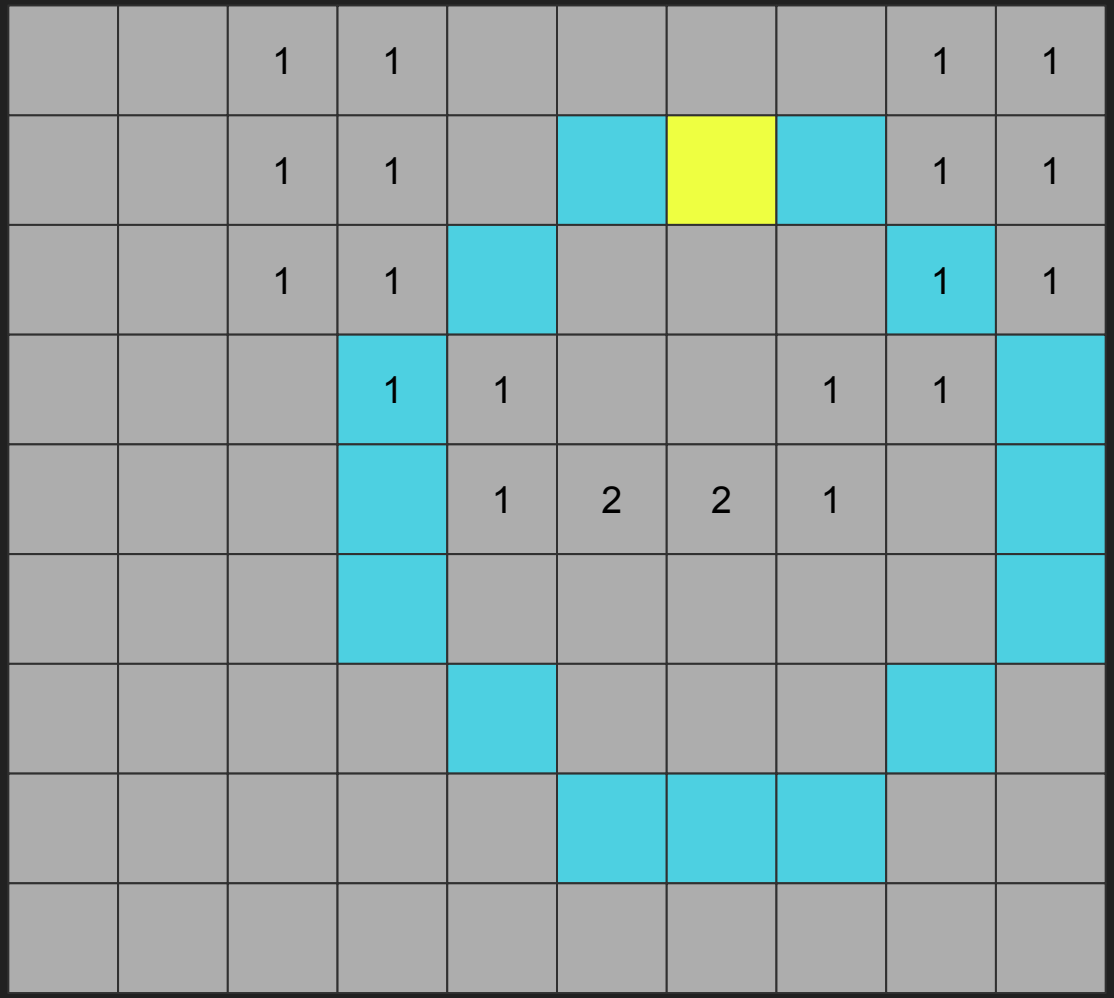
```
<img src={imageDataEncodedInBase64} />
```

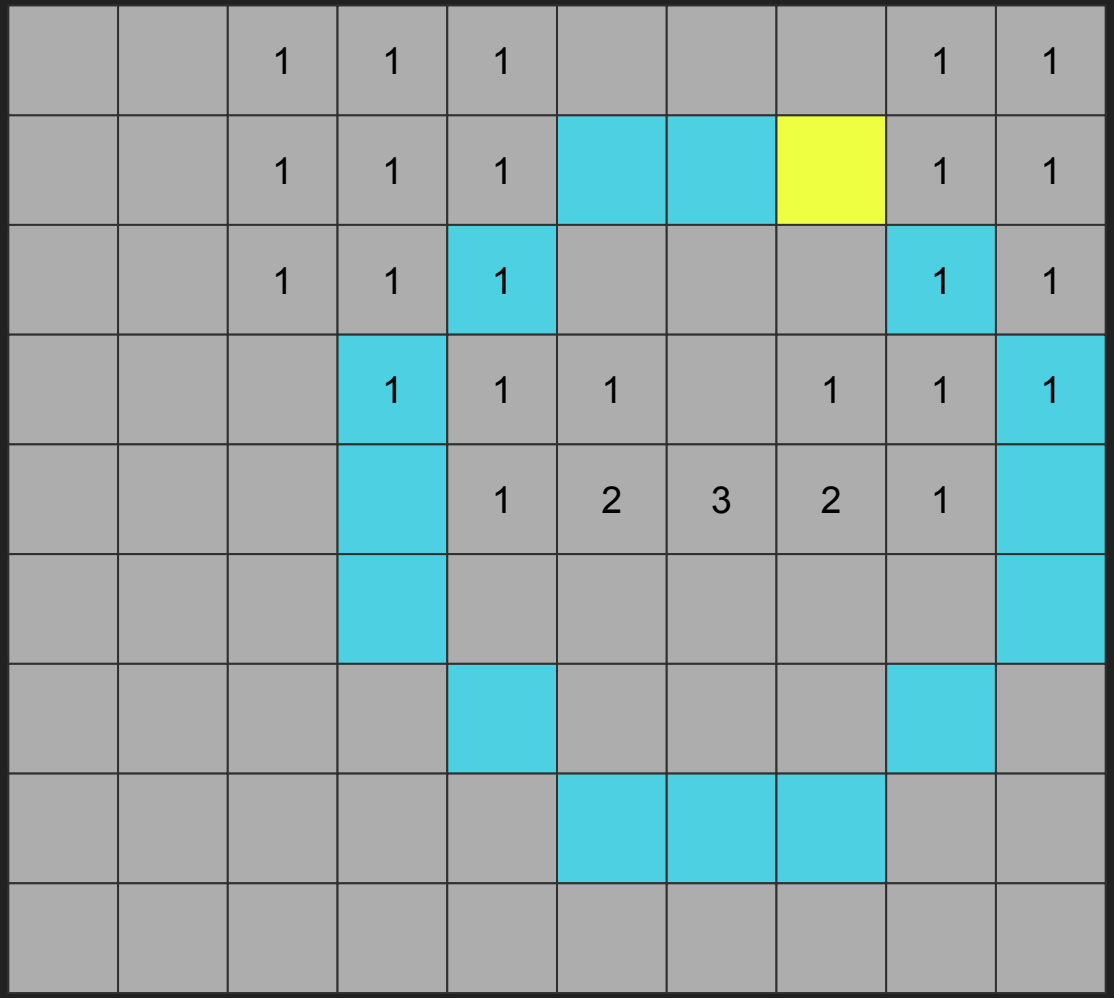
HOUGH TRANSFORM

ou comment éviter de parcourir tous les pixels




1
1
1
1
1
1
1
1
1
1
1


1 1 1 1
1 1 1 1
1 1 1 1
1 1 1 1
1 2 2 1


1 1 1 1 1
1 1 1 1 1
1 1 1 1 1
1 1 1 1 1 1
1 2 3 2 1

		3	2	2		2		2	2
	2	2	2	2	2		2	2	2
1	2	2	2	2	2	2	2	2	2
2	2		2	2	4	4	4	2	2
3		2		2	4	16	4	2	
2	2		2	2	4	4	4	2	2
1	2	2	2	2	2	2	2	2	2
	2	2	2	2	2		2	2	2
		3	2	2		2		2	2

		3	2	2		2		2	2
	2	2	2	2	2		2	2	2
1	2	2	2	2	2	2	2	2	2
2	2		2	2	4	4	4	2	2
3		2		2	4	16	4	2	
2	2		2	2	4	4	4	2	2
1	2	2	2	2	2	2	2	2	2
	2	2	2	2	2		2	2	2
		3	2	2		2		2	2

2.065 s

sur PC

5.346 s

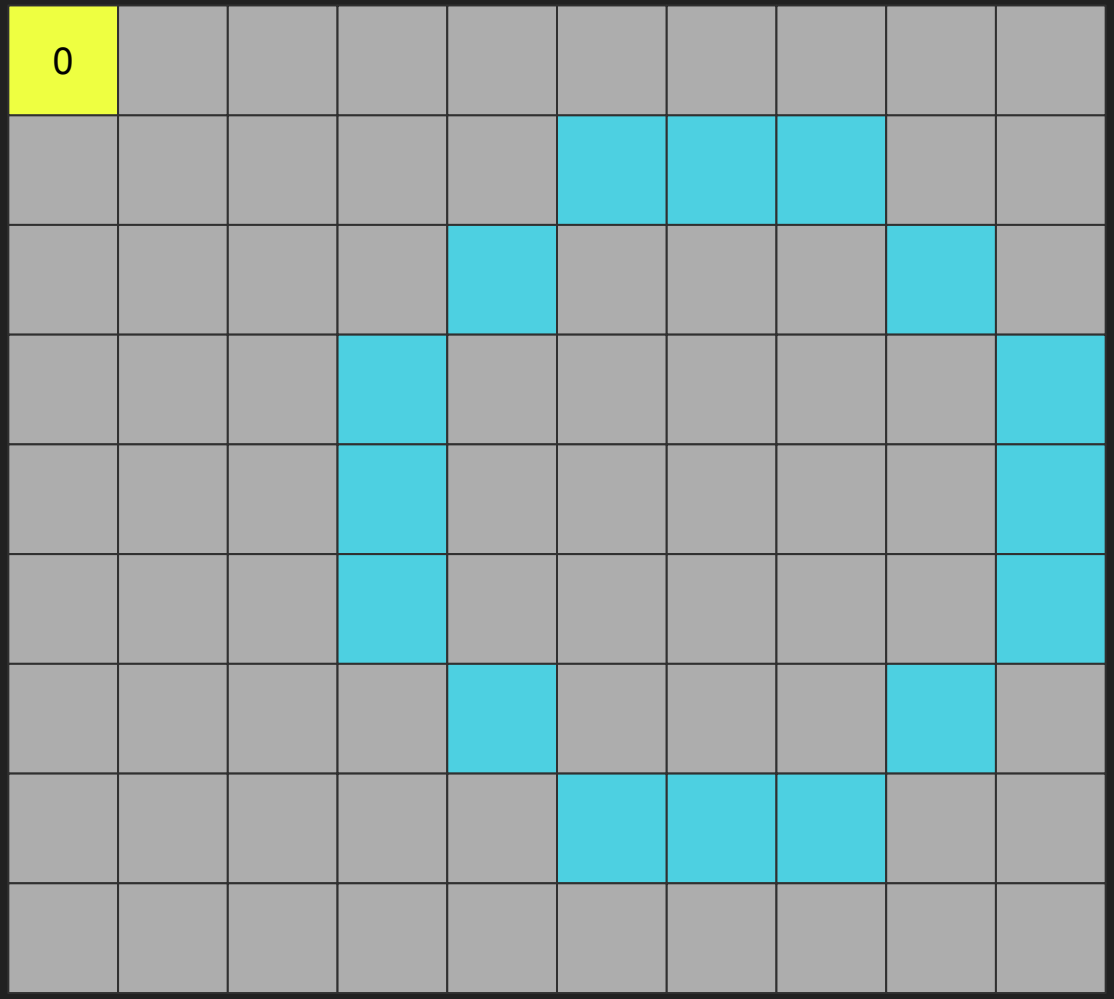
sur smartphone

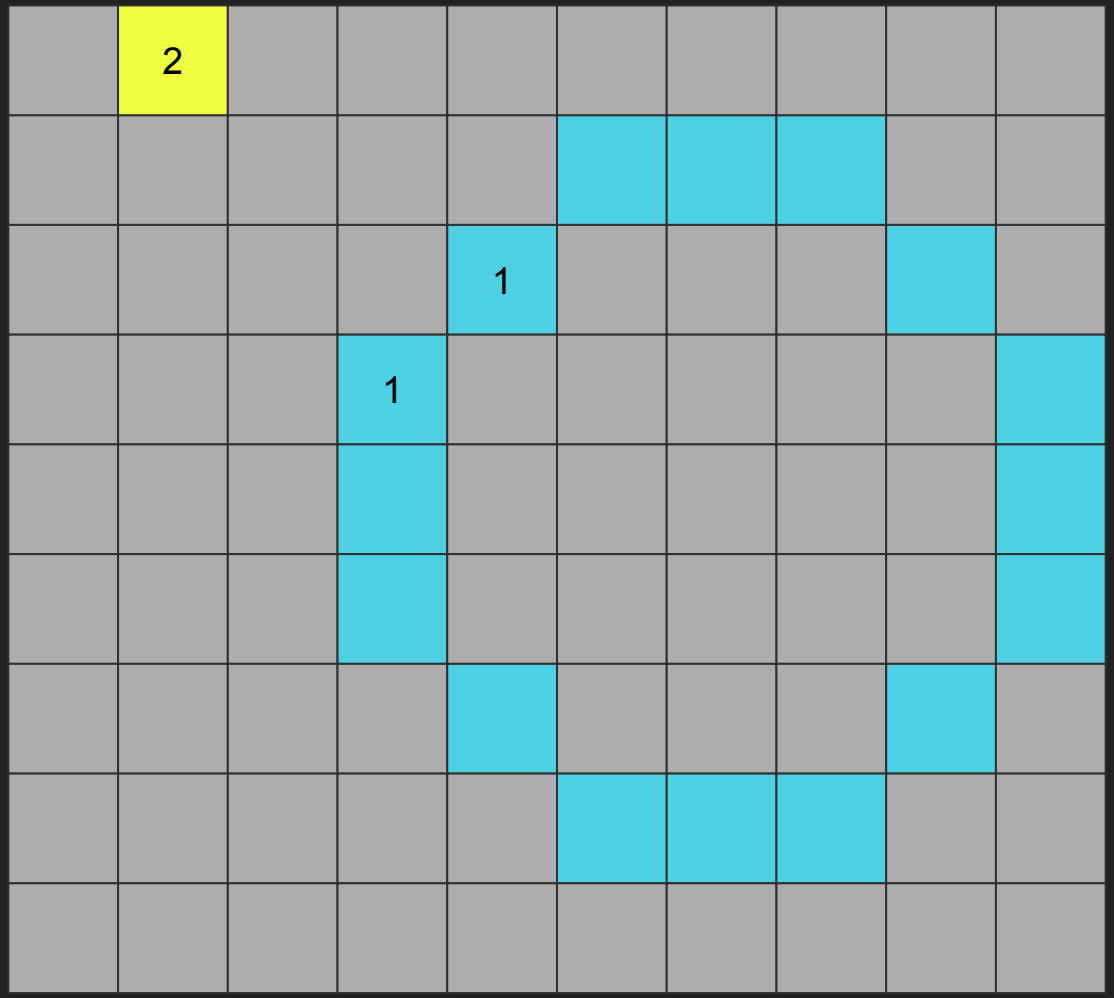
Difficilement parallélisable

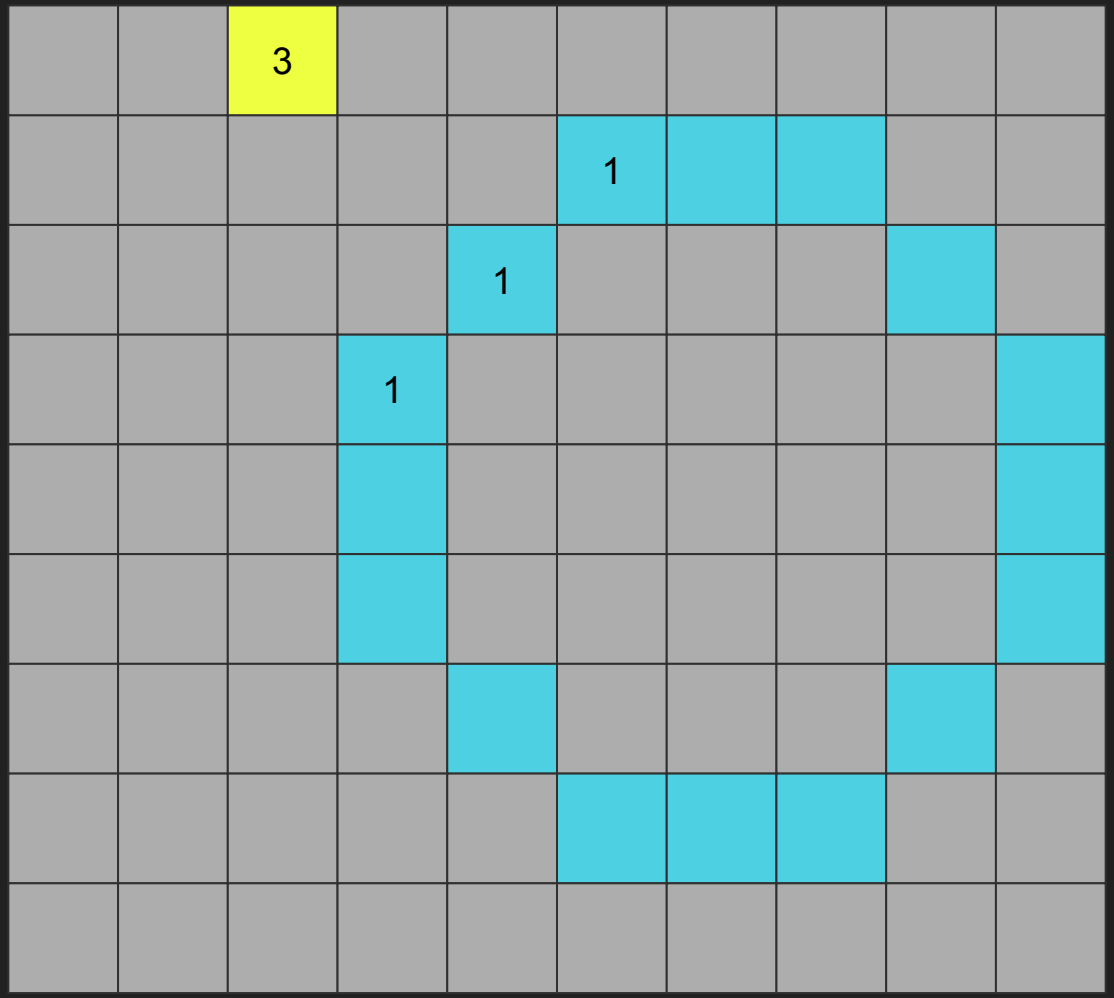
trop compliqué à mon goût

BRUTE FORCE

ou comment parcourir tous les pixels


0


2
1
1


3
1
1
1

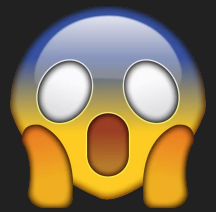
					1	1	1		
				1				1	
			1						1
			1			16			1
			1						1
				1				1	
					1	1	1		

Premiers essais

7.080 s

sur PC

7.080 s




CPU
GPU
PRISE DE PHOTO
SEUILLAGE (SOBEL)
DÉTECTION DE CERCLES
PLUS PETIT CERCLE
GRAND CERCLE LE PLUS PROCHE DU PETIT
AFFICHAGE

Limiter les allers-retours

Fusionner les étapes (kernels)

Pour chaque rayon :

- Executer Hough Transform
- Identifier les cercles potentiels
- Merger avec les résultats précédents

Limiter les allers-retours

Fusionner les étapes (kernels)

Pour tous les rayons :

- Executer Hough Transform
- Identifier les cercles potentiels
- Merger avec les résultats précédents

Limiter les allers-retours

Brancher la sortie d’une étape sur l’entrée de la suivante

gpu.combineKernels(...)

```
const add = gpu.createKernel(function(a, b) {
      return a[this.thread.x] + b[this.thread.x];
}).setOutput([20]);

const multiply = gpu.createKernel(function(a, b)
{
      return a[this.thread.x] * b[this.thread.x];
}).setOutput([20]);
```

```
const ab = add(a, b)
```

aller-retour

```
const result = multiply(ab, c);
```

aller-retour

```
const superKernel = gpu.combineKernels(add,
multiply, function(a, b, c) {
      return multiply(add(a, b), c);
});

const result = superKernel(a, b, c);
```

aller-retour

1.256 s

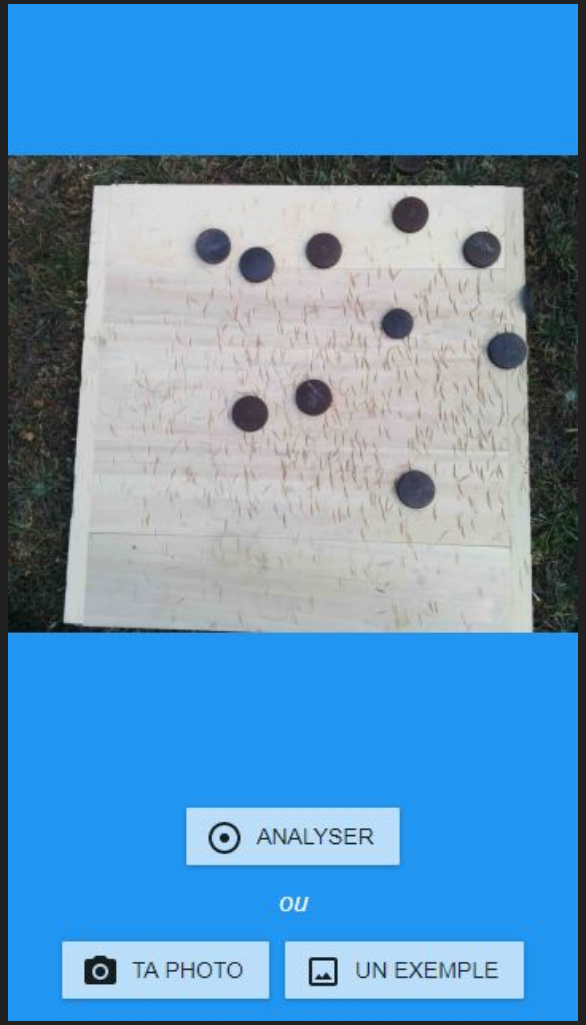
sur PC

2.112 s

sur smartphone

2.112 s

sur smartphone



https://acailly.github.io/palet/