

# CA16212- INDEPTH Kickoff Meeting, Clermont-Ferrand, March 12-14th, 2018

$l$ -scaled (piecewise) Bézier curve

$$\left( B_{r,l}^{(0)}(\Gamma) \right) (t) = \sum_{i \in \mathbb{Z}} \Gamma(l(s+i-r)) B_{l,r,l}(t)$$

let  $(\Gamma(s))_{s \in \mathbb{Z}}$  be a sequence

uniform  $l$ -scaled  $B$ -spline function with degree  $r$  associated to  $\Gamma$

$$N_{s,r,l}(t) = N_{s,r}\left(\frac{t}{l}\right) \quad \left( S_{l,r}^{(0)}(\Gamma) \right) (t) = \sum_{s \in \mathbb{Z}} \Gamma(l(s)) N_{s,r,l}(t)$$

## Theorem 9.2 **WrapScienceJ : an Integrative Multipurpose Platform**

$$\left( S_{l,r}^{(\omega)}(\Gamma) \right) \left( l(n + \frac{1}{2}) \right) = \frac{r!}{(r-\omega)!} \left( B_{l,r}^{(\omega)} * \Gamma \right) \left( l(n - \frac{r}{2}) \right)$$

$$\left( S_{l,r}^{(\omega)}(\Gamma) \right) \left( \frac{r+1}{2} \right) = \left( S_{l,r}^{(\omega)} * \Gamma \right) (n)$$

Digital Derivative

Digitization, Quantization, Noise Models

A digital  $\omega$ -derivative mask is a sequence  $\mathbf{u} = (u(i))_{i \in \mathbb{Z}}$  such that

$$h\Gamma(i) = f(ih) + \epsilon_{\Gamma,i}(i)$$

$$\sum_{i \in \mathbb{Z}} i^k u(i) = 0 \text{ for } 0 \leq k < \omega \text{ and } \sum_{i \in \mathbb{Z}} u(i) = (-1)^{\omega-1} \omega!$$

**Rémy Malgouyres**

digital  $\omega$ -derivative operator

the composition  $\mathbf{u} * \mathbf{v}$

Stochastic Noise on Values: independent random variables

Université Clermont Auvergne, LIMOS, France

$$\Delta_{\mathbf{u}}(\mathbf{v})(n) = (\mathbf{u} * \mathbf{v})(n) = \sum_{i \in \mathbb{Z}} u(i)v(n-i)$$

finite difference operator

$$\Delta_1^r(\mathbf{v})(n) = \frac{1}{r!} (v(n+r) - v(n))$$

Sampling of the Gaussian

$$x \mapsto \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{x^2}{2\sigma^2}\right)$$

remy.malgouyres@uca.fr

http://malgouyres.org

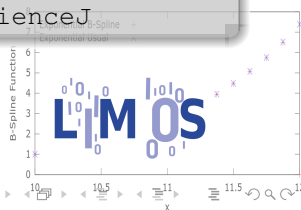
http://malgouyres.org/wrapScienceJ

$A$  est un anneau isomorphe à  $\mathbb{Z}$  ou à  $\mathbb{R}$ . Un espace analysable sur  $(A, +, \cdot, \leq)$  est un quadruplet,  $(E, \Omega, \mu, \leq)$ , où

- $(E, +, \cdot, \leq) \in$
- $\Omega$  est une  $\sigma$
- $\mu$  est une  $\pi$
- et  $\leq$  est un



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Clermont Auvergne



$$B_{i,r}(t) =$$

# INDEPTH Open Data and Protocol Comparison Mission

## Huge amounts of Data Distributed on Heterogeneous Storage

## Possibility to Query and Correlate any Subset of the Data

Theorem 9.2 For  $r \geq 1$  and  $\omega \in [0, 1]$ , we have

$$(B_{i,r}^{(\omega)}(\Gamma)) \left( l \left( n + \frac{1}{2} \right) \right) = \frac{r!}{(r-\omega)!} (B_{i,r}^{(\omega)} * \Gamma) \left( l \left( n - \left\lfloor \frac{r}{2} \right\rfloor \right) \right)$$

Theorem 9.1 For  $n \in \mathbb{Z}$  and  $\omega \in [0, \dots, r-1]$ , we have

$$(S_{i,r}^{(\omega)}(\Gamma)) \left( l \left( n + \frac{r+1}{2} \right) \right) = (S_{i,r}^{(\omega)} * \Gamma)(n)$$

## Specification of What is an Acquisition Protocol for Comparison

A digital  $\omega$ -derivative mask is a sequence  $\mathbf{u} = (u(i))_{i \in \mathbb{Z}}$  such that

$$\sum_{i \in \mathbb{Z}} i^k u(i) = 0$$

digital  $\omega$ -derivative of  $\mathbf{v}$  is

$$\Delta_{\mathbf{u}}(\mathbf{v})(n) = (\mathbf{u} * \mathbf{v})(n) = \sum_{i \in \mathbb{Z}} u(i) v(n-i)$$

|               |
|---------------|
| 1             |
| 1 1           |
| 1 2 1         |
| 1 3 3 1       |
| 1 4 6 4 1     |
| 1 5 10 10 5 1 |

binomial smoothing mask

## My Server Can Make Coffee Approach

- Configure One Server for Many Tasks
- Combines Data Stored on One/Few Server(s)

## Infrastructure Doesn't Scale

- Software Maintenance Doesn't Scale

## Service Oriented Architecture SOA Approach

- Each Service Makes only One Task
- Services Deploy Independently (Light Server Configuration)
- Infrastructure Scales Conveniently at Low Cost
- Software Maintenance Does Scale at Low Cost

$A$  est un anneau isomorphe à  $\mathbb{R}$  ou  $\mathbb{C}$ . Soit  $(A, +, \cdot, \leq)$  est un quadruplet,  $(E, \Omega, \mu, \leq)$ , où

- 1  $(E, +, \cdot)$  est une  $A$ -algèbre;
- 2  $\Omega$  est une  $\sigma$ -algèbre d'ensemble  $E$ ;
- 3  $\mu$  est une mesure invariante par translation sur  $\Omega$  à valeur dans  $A$ ;
- 4 et  $\leq$  est un ordre complet, compatible avec la multiplication externe.

# Who Uses Which Approach in the IT World ?

## My Server Can Make Coffee Approach

- Small Size Businesses
- Secondary Sector
- High Tech Labs in Universities

## Service Oriented Architecture SOA Approach

- The *GAFA*'s
- Multinationals, Airline/Railways Companies
- *Uber, BlaBlaCar, Airbnb...*

## Why is That ?

## My Server Can Make Coffee Approach

- We don't have the Knowhow
- We can afford to waste
- We *Publish or Perish*

## Service Oriented Architecture SOA Approach

- One Billion *R&D* isn't that much and it's money well spent
- We *Bring Down the Costs or Perish*

# Overview of the WrapScienceJ Inversion of Control Structure

## Higher Level Java Programming

### Java Data Structures

Method Parameters  
e.g Statistical Sample  
or Ressource ID  
(file path, URL,...)

Digitization, Higher Level Models  
Method Output Data  
e.g Statistical Sample

Method Parameters  
e.g Statistical Sample  
or Ressource ID  
(file path, URL,...)

## Java Interoperability Layer (Java Interfaces)

Implements

Implements

Implements

Implements

Java Wrapper  
and HTTPS Client

JNI based  
Wrapper  
or HTTPS API

JNI based  
Wrapper  
or HTTPS API

Java API  
Wrapper

HTTPS API

Existing  
dedicated tool  
R stats, PERL algo

Intensive  
C/C++ API  
e.g. HPC on GPU

Existing  
Java API  
e.g. ImageJ

Existing  
Interoperability  
Platform

Theorem 9.2 For  $r \geq 1$  and  $\omega \leq r-1$ , we have

$$\left(B_{r,\omega}^{(\omega)}(\Gamma)\right)\left(l(n+\frac{1}{2})\right) = \frac{r!}{1} \left(B_{r,\omega}^{(\omega)} * \Gamma\right)\left(l(n-\lfloor\frac{r}{2}\rfloor)\right)$$

A digital  $\omega$ -derivative mask is a sequence  $u = (u(i))_{i \in \mathbb{Z}}$  such that

$$\sum_{i \in \mathbb{Z}} i^k u(i) = 0 \text{ for } 0 \leq k < \omega \text{ and } \sum_{i \in \mathbb{Z}} i^{\omega} u(i) = (-1)^{\omega} \omega!$$

digital  $\omega$ -derivative operator

$$d_u(v)(n) = (u * v)(n) = \sum_{i \in \mathbb{Z}} u(i) v(n-i)$$

|               |
|---------------|
| 1             |
| 1 1           |
| 1 2 1         |
| 1 3 3 1       |
| 1 4 6 4 1     |
| 1 5 10 10 5 1 |

binomial smoothing mask

finite difference operator

$$\Delta_r^{\omega}(v)(n) = \frac{1}{r} (v(n+\frac{1}{2}) - v(n))$$

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- $(E, +, \cdot, \leq)$  est une  $A$ -algèbre Existing
- $\Omega$  est une  $\sigma$ -algèbre de parties de  $E$  Interoperability
- $\mu$  est une mesure invariante par translation sur  $\Omega$  à valeur dans  $\mathbb{R}$  Platform
- $\leq$  est un ordre complet compatible avec la multiplication externe.

$$B_{i,r}(t) = \begin{cases} \frac{1}{r!} (t - t_{i-1})^r & \text{if } t \in [t_{i-1}, t_i) \\ 0 & \text{otherwise} \end{cases}$$

# WrapScienceJ Honey Pot Function

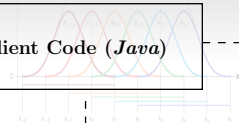
1-scaled B-spline basis curve

$$(B_{i,r}^{(0)}(\Gamma))(t) = \sum_{s \in \mathbb{Z}} \Gamma(l(s+i-r)) B_{s,r}(t)$$

## Bio-informatics Client Code (Java)

can use 1-scaled B-spline function with degree  $r$  associated to  $\Gamma$

$$\frac{d}{dt} (B_{i,r}^{(0)}(\Gamma))(t) = \frac{r}{t} (B_{i,r-1}^{(0)}(\Gamma)(t) - B_{i-r-1}^{(0)}(\Gamma)(t))$$



$$S_{i,r,r}(t) = \frac{1}{t}$$

$$(S_{i,r,r}^{(0)}(\Gamma))(t) = \sum_{s \in \mathbb{Z}} \Gamma(l(s)) S_{s,r,r}(t)$$

$$\frac{d}{dt} (S_{i,r,r}^{(0)}(\Gamma))(t) = \frac{1}{t} (S_{i,r-1}^{(0)}(\Gamma) - S_{i-r-1}^{(0)}(\Gamma)(r^{-1}(\Gamma)))$$

Theorem 9.1 For  $n \in \mathbb{Z}$  and  $\omega \in \{0, \dots, r-1\}$ , we have

$$(S_{i,r}^{(0)}(\Gamma)) \left( l \left( n + \frac{r+1}{2} \right) \right) = (S_{i,r}^{(0)} * r)(n)$$

Theorem 9.2 For  $r \geq 1$  and  $\omega \leq r-1$ , we have

$$(B_{i,r}^{(\omega)}(\Gamma)) \left( l \left( n + \frac{1}{2} \right) \right) = \frac{r!}{(r-\omega)!} (B_{i,r}^{(\omega)} * \tilde{u}) \left( l \left( n - \lfloor \frac{r}{2} \rfloor \right) \right)$$

uses

Digital Derivative

Digitization Quantization, Noise Models

A digital  $\omega$ -derivative mask is a sequence  $u = \{u(i)\}_{i \in \mathbb{Z}}$  such that

$$\sum_{i \in \mathbb{Z}} i^k u(i) = 0 \text{ for } 0 \leq k < \omega \text{ and } \sum_{i \in \mathbb{Z}} i^\omega u(i) = (-1)^\omega \omega!$$

digital  $\omega$ -derivative operator

$$\Delta_u(v)(n) = (u * v)(n) = \sum_{i \in \mathbb{Z}} u(i)v(n-i)$$

## Java Interoperability Layer

compression:  $u * v$

$\omega + \omega'$ -derivative mask

Uniform Noise (for Uniform Bias) on Values:  $0 \leq |e_k(i)| \leq Kh^\alpha$

Stochastic Noise on Values: independent random variables

expected value 0 and standard deviation  $\sigma(h) \leq Kh^\alpha$

## Additional Interfaces

finite difference operator

$$\Delta_1^-(v)(n) = \frac{1}{t} (v(n+1) - v(n))$$

Implements

Implements

sample of  $\frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{x^2}{2\sigma^2}\right)$

Switch

|               |
|---------------|
| 1             |
| 1 1           |
| 1 2 1         |
| 1 3 3 1       |
| 1 4 6 4 1     |
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binomial smoothing mask

Free GPL

Open Source

Implementation

$A$  est un anneau isomorphe à  $\mathbb{Z}$  ou  $\mathbb{R}$ . Un  $\sigma$ -algèbre analysable sur  $(A, +, \cdot, \leq)$  est un quadruplet,  $(E, \Omega, \mu, \leq)$ , où

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- $\Omega$  est une  $\sigma$ -algèbre de parties de  $E$ ;
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- et  $\leq$  est un ordre complet, compatible avec la multiplication externe.

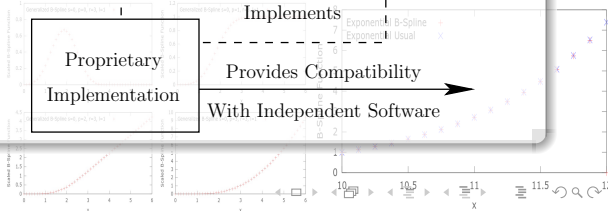
Proprietary

Implementation

Implements

Provides Compatibility

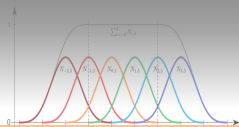
With Independent Software



Bernstein polynomials  
 $s$ -shifted  $l$ -scaled  
 $B_{i,r}(t) = \binom{r}{i} t^i (1-t)^{r-i}$   $B_{i,r,l}(t) = \begin{cases} B_{i,r}(\frac{t-s}{l}) & \text{if } \frac{t-s}{l} \in [0, 1] \\ 0 & \text{otherwise.} \end{cases}$   
 $l$ -scaled (piecewise) Bézier curve

$$(B_{i,r}^{(0)}(\Gamma))(t) = \sum_{s \in \mathbb{Z}} \Gamma(l(s+i-r)) B_{i,r,l}(t)$$

$$\frac{d}{dt} (B_{i,r}^{(0)}(\Gamma))(t) = \frac{r}{l} (B_{i,r-1}^{(0)}(\Gamma)(t) - B_{i,r-1}^{(0)}(\Gamma)(t))$$



$$N_{s,r,l}(t) = \begin{cases} 1 & \text{if } s \leq t < s+1 \\ 0 & \text{otherwise.} \end{cases} \quad N_{s,r,l}(t) = \frac{t-s}{l} N_{s,r-1,l}(t) + \frac{s+r+1-t}{l} N_{s+1,r-1,l}(t)$$

let  $(\Gamma(s))_{s \in \mathbb{Z}}$  be a sequence

uniform  $l$ -scaled  $B$ -spline function with degree  $r$  associated to  $\Gamma$

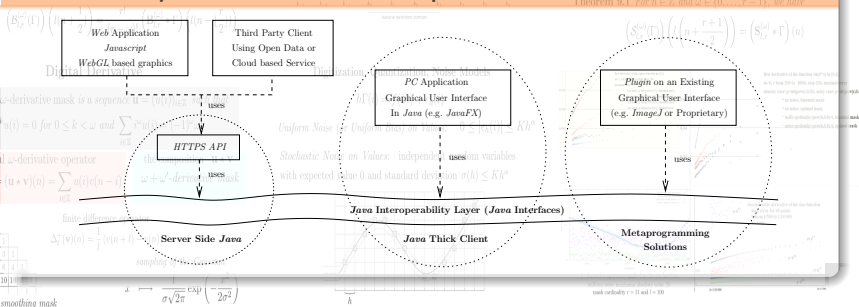
$$N_{s,r,l}(t) = N_{s,r}(\frac{t}{l}) \quad (S_{i,r}^{(0)}(\Gamma))(t) = \sum_{s \in \mathbb{Z}} \Gamma(l(s+i-r))$$

# WrapScienceJ and Graphical User Interfaces

Theorem 9.2 For  $r \geq 1$  and  $\omega \leq r$

Theorem 9.1 For  $n \in \mathbb{Z}$  and  $\omega \in [0, \dots, r-1]$ , we have

$$(S_{i,r}^{(\omega)}(\Gamma))\left(l\left(n + \frac{\omega}{r}\right)\right) = (S_{i,r-1}^{(\omega)}(\Gamma))\left(l\left(n + \frac{r-\omega}{r}\right)\right)$$

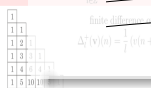


A digital  $\omega$ -derivative mask is a sequence  $u = (u_i)_{i \in \mathbb{Z}}$

$$\sum_{i \in \mathbb{Z}} u_i v(i) = 0 \text{ for } 0 \leq k < \omega \text{ and } \sum_{i \in \mathbb{Z}} i^k u_i v(i) = 0 \text{ for } k \geq \omega$$

digital  $\omega$ -derivative operator

$$\Delta_u(v)(n) = (u * v)(n) = \sum_{i \in \mathbb{Z}} u_i v(n-i)$$



binomial smoothing mask

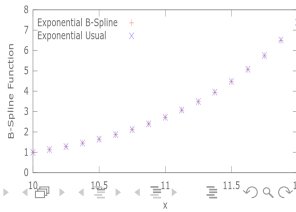
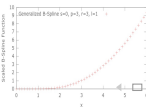
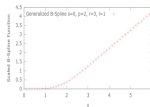
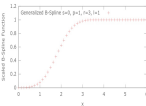
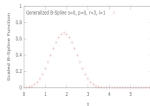
finite difference operator

$$\Delta_1(v)(n) = \frac{1}{l} (v(n+l) - v(n))$$

$$x \mapsto \frac{\exp(-\frac{x^2}{2\sigma^2})}{\sigma\sqrt{2\pi}}$$

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- $\mu$  est une mesure invariante par translation sur  $\Omega$  à valeur dans  $A$ ;
- et  $\leq$  est un ordre complet, compatible avec la multiplication externe.



$$B_{i,j,r}(t) = \binom{r}{i} t^i (1-t)^{r-i} \quad B_{i,j,r}(t) = \begin{cases} B_{i,j}(-s) & \text{if } i \in [s, s+1] \\ 0 & \text{otherwise.} \end{cases}$$

$$N_{s,i}(t) = \begin{cases} 1 & \text{if } s \leq i < s+1 \\ 0 & \text{otherwise.} \end{cases} \quad N_{s,i}(t) = \frac{t-s}{t} N_{s,i-1}(t) + \frac{s+r+1-t}{t} N_{s,i+1}(t)$$

# WrapScience API Style and Design Patterns

$$(g^{\otimes r}(f))(t) = \sum_{i_1, \dots, i_r=0}^r \sum_{j_1, \dots, j_r=0}^r (i_1 + \dots + i_r - j_1 - \dots - j_r) g(t)$$

```

VoxelDouble voxelEdgesLength = image.setTitle("Original Image")
    .retrieveMetaData()
    .getImageCalibration()
    .getVoxelLength();

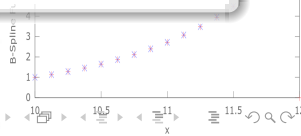
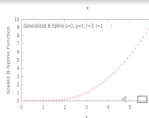
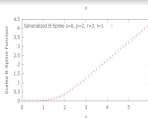
ImageCore binarizedImage = image.duplicate()
    .getImageBlur()
    .getGaussianBlurCalibrated(0.6, 0.6, 0.6, voxelEdgesLength)
    .getImageConvolved(ConvolutionNormalizationPolicy
        .Gray8 Scale MaximizeContrast)
    .setTitle("Thresholded Image (" + ThresholdingOption.Otsu + " Method)")
    .getImageThresholding()
    .thresholdImageAndBinarize(ThresholdingOption.Otsu, true);

ImageCore labeledImage = binarizedImage.duplicate()
    .setTitle("Labeled Image (" + ThresholdingOption.Otsu + ")")
    .getImageConnectedComponents()
    .getLabeledComponents(
        labelingPolicy, // Full 3D or Slice-by-slice 2D
        white, // Foreground
        false, // Remove components on the border
        componentVolumeThreshold, // Lower threshold on components
        true // Set a uniform random color on each component
    )
    .getImage();

```

A est un anneau  $(A, +, \cdot, \leq)$  et  $\text{RenderToolFactoryIJ3D.getInstance().getRenderTool().display(labeledImage);}$   
 $\text{binarizedImage.getPreferredRenderTool().display(binarizedImage);}$   
 $\text{GlobalOptions.getDefaultRenderTool().display(image);}$

- 1  $(E, +, \cdot)$  est une  $\sigma$ -algèbre de parties de  $E$
- 2  $\Omega$  est une  $\sigma$ -algèbre de parties de  $E$
- 3  $\mu$  est une mesure invariante par translation sur  $\Omega$  à valeur dans  $A$ ;
- 4 et  $\leq$  est un ordre complet, compatible avec la multiplication externe.



Bernstein polynomials

s-shifted l-scaled

Cox-de Boor

$$B_{i,r}(t) = \binom{r}{i} t^i (1-t)^{r-i} \quad B_{i,r,l}(t) = \begin{cases} B_{i,r}(\frac{t-s}{l}) & \text{if } t \in [s, s+l] \\ 0 & \text{otherwise.} \end{cases}$$

l-scaled (piecewise) Bézier curve

$$N_{s,r}(t) = \begin{cases} 1 & \text{if } s \leq t < s+1 \\ 0 & \text{otherwise.} \end{cases} \quad N_{s,r}(t) = \frac{t-s}{l} N_{s,r-1}(t) + \frac{s+r+1-t}{l} N_{s+1,r-1}(t)$$

let  $(\Gamma(s))_{s \in \mathbb{Z}}$  be a sequence

uniform l-scaled B-spline function with degree r associated to  $\Gamma$

# WrapScienceJ Application : Segmentation and Auto Crop

Theorem 1

A digital

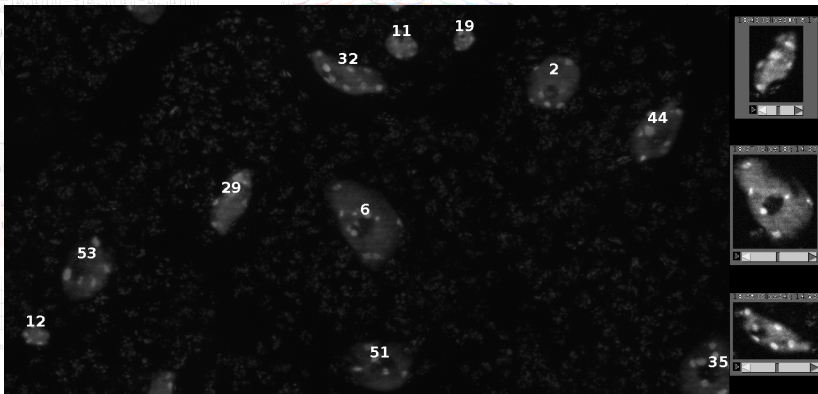
$$\sum_{i \in \mathbb{Z}} i^k$$

digital

$$\Delta_n(v)(n) =$$

|     |
|-----|
| 1   |
| 1 1 |
| 1 2 |
| 1 3 |
| 1 4 |
| 1 5 |

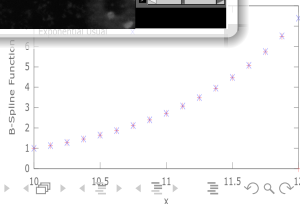
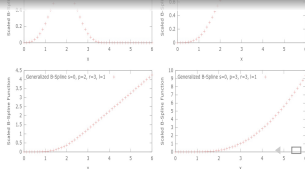
binomial



A est un anneau commutatif à 1, ou à 0. Un espace analytique. Sur

$(A, +, \cdot, \leq)$  est un quadruplet,  $(E, \Omega, \mu, \leq)$ , où

- ①  $(E, +, \cdot)$  est une A-algèbre ;
- ②  $\Omega$  est une  $\sigma$ -algèbre de parties de E
- ③  $\mu$  est une mesure invariante par translation sur  $\Omega$  à valeur dans A ;
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Bernstein polynomials

s-shifted l-scaled

Cox-de Boor

$$B_{i,r}(t) = \binom{r}{i} t^i (1-t)^{r-i} \quad B_{i,r,l}(t) = \begin{cases} B_{i,r}(\frac{t-s}{l}) & \text{if } t \in [s, s+l] \\ 0 & \text{otherwise.} \end{cases}$$

l-scaled (piecewise) Bézier curve

$$N_{s,r}(t) = \begin{cases} 1 & \text{if } s \leq t < s+1 \\ 0 & \text{otherwise.} \end{cases} \quad N_{s,r}(t) = \frac{t-s}{r} N_{s,r-1}(t) + \frac{s+r+1-t}{r} N_{s+1,r-1}(t)$$

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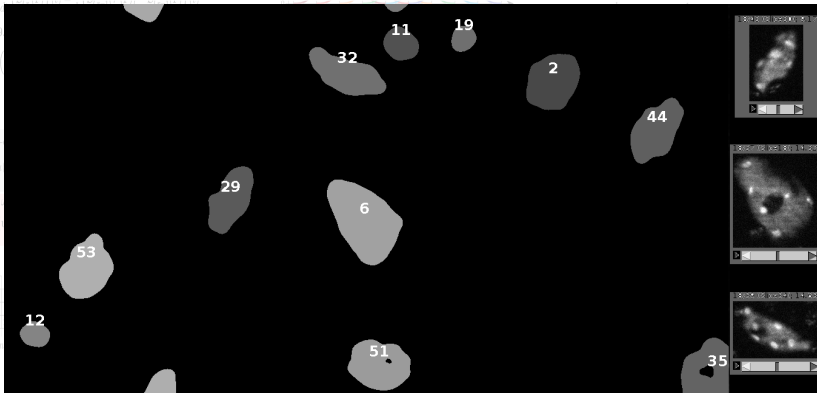
$$\sum_{i \in \mathbb{Z}} i^k$$

digital

$$\Delta_n(v)(n) =$$

|     |
|-----|
| 1   |
| 1 1 |
| 1 2 |
| 1 3 |
| 1 4 |
| 1 5 |

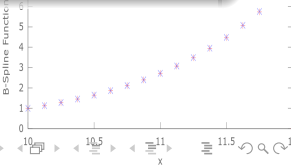
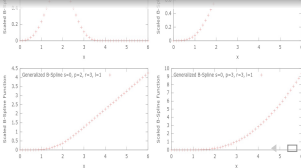
binomial



A est un anneau commutatif à 1, ou à 0. Un espace analytique. Soit

$(A, +, \cdot, \leq)$  est un quadruplet,  $(E, \Omega, \mu, \leq)$ , où

- ①  $(E, +, \cdot)$  est une A-algèbre ;
- ②  $\Omega$  est une  $\sigma$ -algèbre de parties de E
- ③  $\mu$  est une mesure invariante par translation sur  $\Omega$  à valeur dans A ;
- ④ et  $\leq$  est un ordre complet, compatible avec la multiplication externe.



$$B_{i,p}(t) =$$

# WrapScienceJ Workflow : For the Bioinformatician (1/2)

```


/*
public class ProcessMetaData extends MetaDataSet {
    >>
    >> /** Kind of blurring mask ("binomial or gaussian) */
    >> private ChoiceInListSetSingle m metaKindOfBlur;
    >>
    >> /** Smoothing mask Width (for binomial blur) or standard deviation (gaussian blur) */
    >> private DoubleSetSingle m metaSigmaX;
    >>
    >> /** Smoothing mask Height (for binomial blur) or standard deviation (gaussian blur) */
    >> private DoubleSetSingle m metaSigmaY;
    >>
    >> /** Smoothing mask Depth (for binomial blur) or standard deviation (gaussian blur) */
    >> private DoubleSetSingle m metaSigmaZ;
    >>
    >> /** Thresholding is made more dynamic by elevating the values to some exponent
    >> /* 3 >= typically >= 1 */
    >>
    >> */
    >> private DoubleSetSingle m thresholdDynamics;
    >>
    >> /** Nucleus Lowest Volume Threshold */
    >> private DoubleSetSingle m nucleusVolumeThreshold;
    >>
    >> /** Bounding box's margin on first coordinate for cropping */
    >> private DoubleSetSingle m xMarginReal;
    >>
    >> /** Bounding box's margin on second coordinate for cropping */
    >> private DoubleSetSingle m yMarginReal;
    >>
    >> /** Bounding box's margin on third coordinate for cropping */
    >> private DoubleSetSingle m zMarginReal;


```

Theorem 9.

A digital

$$\sum_{i \in \mathbb{Z}} i^k$$

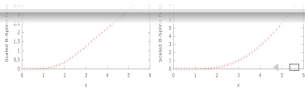
digital

$$\Delta_u(v)(n) = ($$

|               |
|---------------|
| 1             |
| 1 1           |
| 1 2 1         |
| 1 3 3 1       |
| 1 4 6 4 1     |
| 1 5 10 10 5 1 |

binomial sum

A est un anneau  
 $(A, +, \cdot, \leq)$  est un

①  $(E, +, \cdot)$ ②  $\Omega$  est un③  $\mu$  est un④ et  $\leq$  est un ordre complet, compatible avec la multiplication externe.

# WrapScienceJ Workflow : For the Bioinformatician (2/2)

```

1  /**
2  * public class Nuclei Auto Crop extends PluginFilterGenericIJ {
3  * }
4  * /**
5  *  * @see PluginFilterGenericIJ#getProcess(ImageCore)
6  *  */
7  * @Override
8  * public GenericImageProcessConcrete getProcess(ImageCore image) {
9  *     return new AutoCropSegmentProcess(
10 *         image,
11 *         "AutoCrop",
12 *         RetrievalPolicy.ForceDialog,
13 *         "wrapProcess"+File.separator+"predefined"+File.separator,
14 *         OutputDataKind.CreatedFromInputCopy,
15 *         RenderToolFactoryIJ3D.getInstance().getRenderTool(),
16 *         GlobalOptions.getDefaultGuiFramework());
17 * }
18 *
19 * /**
20 *  * Allows to test the plugin
21 *  * @param args
22 *  */
23 * public static void main(String[] args) {
24 *     try {
25 *         Nuclei Auto Crop plugin = new Nuclei Auto Crop();
26 *         GenericImageProcessConcrete process = plugin.getProcess(
27 *             ImageCoreFactoryIJ.getInstance().getImageCore(
28 *                 TestImageThresholding.getSampleImageGray8(5)
29 *             )
30 *         );
31 *         process.testPlugin(process.getRenderTool(), "ConnectedComponents3D", null);
32 *     } catch (IOException e) {
33 *         e.printStackTrace();
34 *     }
35 * }

```

Theorem 0

A digital

$$\sum_{i \in \mathbb{Z}}$$

digital

$$\Delta_u(v)(n) = \beta$$

|     |
|-----|
| 1   |
| 1 1 |
| 1 2 |
| 1 3 |
| 1 4 |
| 1 5 |

binomial

A est un an

(A, +, ·, ≤)

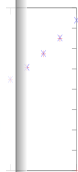
1 (E, +, ·)

2 Ω est un

3 μ est un

4 et ≤ est

12.10.2020  
14.10.2020  
15.10.2020



# WrapScienceJ Workflow : For the Biologist (1/2)

## Parameters for Metadata

### AutoCrop

Mask Width / X standard dev.: 0.6000

Mask Height / Y standard dev.: 0.6000

Mask Depth / Z standard dev.: 0.6000

Kind of Blur: gaussian

Threshold Dynamics: 1.0000

Nucleus Lowest Volume: 15.0000

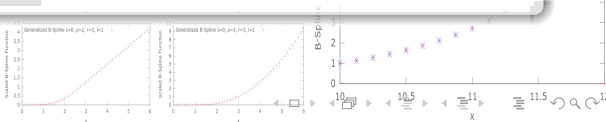
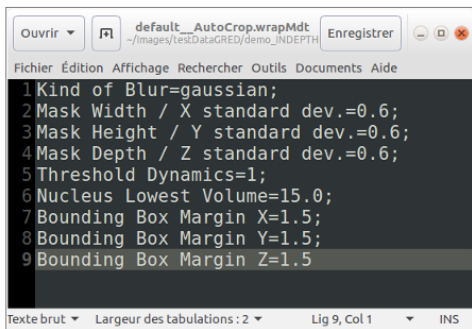
Bounding Box Margin X: 0.8000

Bounding Box Margin Y: 0.8000

Bounding Box Margin Z: 0.8000

OK

Cancel



$$B_{i,r}(t) = \frac{r!}{i!(r-i)!} t^i (1-t)^{r-i}$$

# WrapScienceJ Workflow : For the Biologist (2/2)

 $\Gamma$ -scaled (piecewise) B-spline curve

 $\Gamma$ -shifted B-spline

$$\left( S_{i,r}^{(0)}(\Gamma) \right) (t) = \sum_{n \in \mathbb{Z}} \sum_{l=0}^r \Gamma(l|s) \frac{d}{dt} \left( S_{i,r-1}^{(0)}(\Gamma) \right) (t) = \frac{r}{t} \left( S_{i,r-1}^{(0)}(r^{-l} \Gamma) \right) (t)$$

Theorem 9.2 For  $r \geq 1$  and  $\omega \leq r-1$ , we

$$\left( S_{i,r}^{(\omega)}(\Gamma) \right) \left( l(n + \frac{1}{2}) \right) = \frac{r!}{(r-\omega)!} \left( S_{i,r-\omega}^{(0)}(\Gamma) \right) (n)$$

## Digital Derivative

A digital  $\omega$ -derivative mask is a sequence

$$\sum_{n \in \mathbb{Z}} \delta_n u(n) = 0 \text{ for } 0 \leq k < \omega \text{ and } \sum_{n \in \mathbb{Z}} \delta_n u(n) = 1$$

digital  $\omega$ -derivative operator

$$\Delta_\omega(v)(n) = (u * v)(n) = \sum_{n \in \mathbb{Z}} u(n) v(n-i)$$

finite difference operator

$$\Delta_1(v)(n) = \frac{1}{t} (v(n+1) - v(n))$$



binomial smoothing mask

$A$  est un anneau isomorphe à  $\mathbb{Z}$  ou à  $\mathbb{R}$   
 $(A, +, \cdot, \leq)$  est un quadruplet,  $(E, \Omega, \mu,$

1  $(E, +, \cdot, \leq)$  est une  $A$ -algèbre;

2  $\Omega$  est une  $\sigma$ -algèbre de parties de

3  $\mu$  est une mesure invariante par tran-

4 et  $\leq$  est un ordre complet, compatible avec la multiplication externe.

Fichier Édition Voir Marque-pages Aller à Outils Aide

/home/remy/images/testDataGRED/demo\_INDEPTH/Exp6\_DAPI.autoCropOutput

| Nom                            | Description      | Taille                      | Modifié          |
|--------------------------------|------------------|-----------------------------|------------------|
| Exp6_DAPI_autoCrop.log         | journal d'applic | 284 octets                  | 12/03/2018 11:59 |
| Exp6_DAPI_crop_001.tif         | image TIFF       | 1,2 Mio                     | 12/03/2018 11:59 |
| Exp6_DAPI_crop_001_ROI.wrapMdt | document texte   | 58 octets                   | 12/03/2018 11:59 |
| Exp6_DAPI_crop_002.tif         | image TIFF       | 22/41 (Slice24); 17.00x13.6 | 11:59            |
| Exp6_DAPI_crop_002_ROI.wrapMdt | document texte   |                             | 11:59            |
| Exp6_DAPI_crop_003.tif         | image TIFF       |                             | 11:59            |
| Exp6_DAPI_crop_003_ROI.wrapMdt | document texte   |                             | 11:59            |
| Exp6_DAPI_crop_004.tif         | image TIFF       |                             | 11:59            |
| Exp6_DAPI_crop_004_ROI.wrapMdt | document texte   |                             | 11:59            |
| Exp6_DAPI_crop_005.tif         | image TIFF       |                             | 11:59            |
| Exp6_DAPI_crop_005_ROI.wrapMdt | document texte   | 57 octets                   | 12/03/2018 11:59 |
| Exp6_DAPI_crop_006.tif         | image TIFF       | 499,4 Kio                   | 12/03/2018 11:59 |
| Exp6_DAPI_crop_006_ROI.wrapMdt | document texte   | 60 octets                   | 12/03/2018 11:59 |

Ouvrir Enregistrer

Exp6\_DAPI\_crop\_003\_ROI.wrapMdt  
 ~/images/testDataGRED/demo\_INDEPTH/Exp6\_DAPI.autoCropOutput

1 xMin=1304; yMin=928; zMin=0; xMax=1374; yMax=1003; zMax=32

Ouvrir Enregistrer

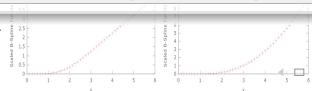
Exp6\_DAPI\_autoCrop.log  
 ~/images/testDataGRED/demo\_INDEPTH/Exp6\_DAPI.autoCropOutput

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```

1# Auto Crop Parameters :
2Mask Width / X standard dev.=0.6; Mask Height / Y standard
dev.=0.6; Mask Depth / Z standard dev.=0.6; Kind of
Blur=gaussian; Threshold Dynamics=1.0; Nucleus Lowest
Volume=15.0; Bounding Box Margin X=1.5; Bounding Box Margin
Y=1.5; Bounding Box Margin Z=1.5
  
```

Texte brut Largeur des tabulations : 2 Lig 1, Col 1 INS



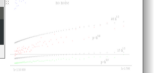
$$S_{i,r}^{(0)}(\Gamma) (t) = \sum_{n \in \mathbb{Z}} \Gamma(l|s) N_{n,r}(t)$$

$$S_{i,r-1}^{(0)}(\Gamma) - S_{i,r-1}^{(0)}(r^{-l} \Gamma)$$

 $\in \{0, \dots, r-1\}$ , we have

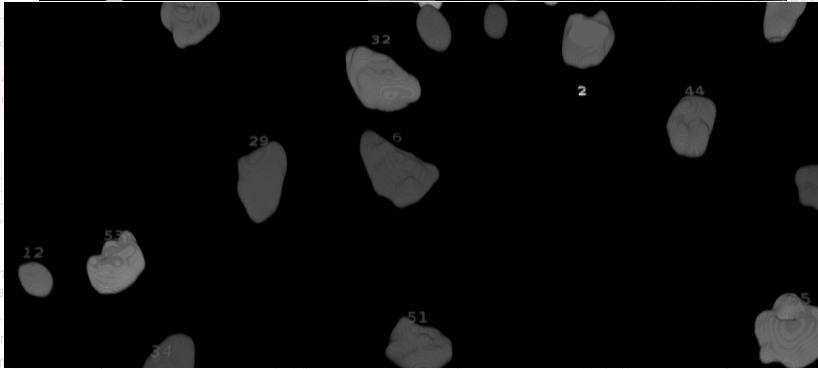
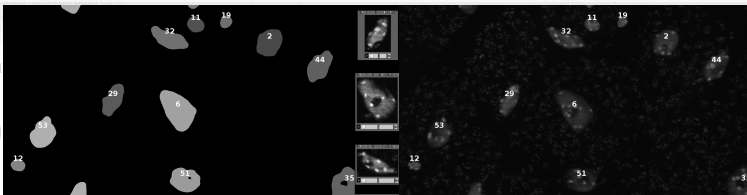
$$+ \frac{1}{2} \Big) = \left( S_{i,r}^{(0)} * \Gamma \right) (n)$$

the derivative of the function  $\exp(t^2)$  is  $2t \exp(t^2)$ .  
 with  $\exp(t^2) = \sum_{n=0}^{\infty} \frac{t^{2n}}{n!}$ , we obtain  
 $2t \exp(t^2) = \sum_{n=0}^{\infty} \frac{2t^{2n+1}}{n!} = \sum_{n=1}^{\infty} \frac{2t^{2n}}{(n-1)!} = \sum_{n=0}^{\infty} \frac{2t^{2n}}{n!} = 2 \exp(t^2)$



$$B_{i,p}(t) = \begin{cases} 0 & \text{if } t < 0 \text{ or } t > 1 \\ \prod_{j=0}^{p-1} (t - t_j) & \text{otherwise} \end{cases}$$

# Questions about *WrapScienceJ*?



A digital

$$\sum_{i \in \mathbb{Z}} i^n$$

digital

$$\Delta_u(v)(n) =$$

|     |
|-----|
| 1   |
| 1 1 |
| 1 2 |
| 1 3 |
| 1 4 |
| 1 5 |

binomial

A est un anneau  
(A, +, \cdot, \leq)

① (E, +, \cdot)

② \Omega est un

③ \mu est un

④ et \leq est un ordre complet, compatible avec la multiplication externe.

