Intoduction to OpenAlea, a platform for plant modelling



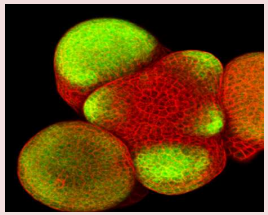
Thomas Cokelaer, Christophe Pradal, Christophe Godin
on behalf of the OpenAlea project

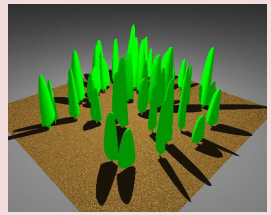
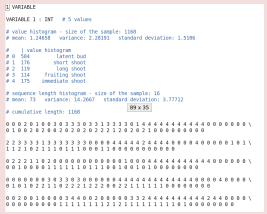


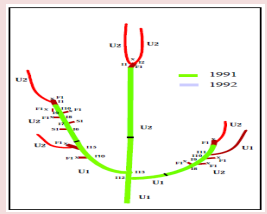
IHC 2010, Lisbon, 25 August

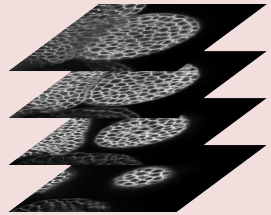
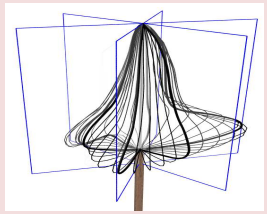
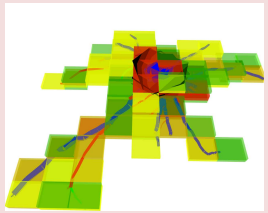
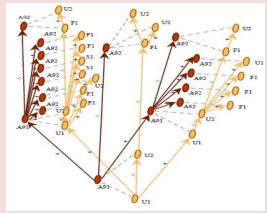
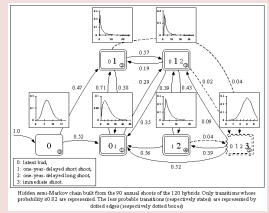
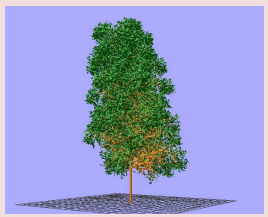
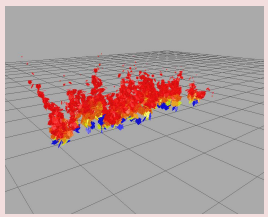
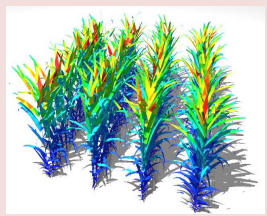
Background: plant modelling at a glance

- Different scales:
  - cell
  - branch
  - tree
  - forest
- Heteregeneous data:
  - raw data
  - digitesed data
  - tree databases
  - 3D images
- Many tools required:
  - topology
  - Geometry
  - simulation
- Many models possible:
  - theoritical
  - mechanical
  - probabilist






Outline

1. OpenAlea in a nutshell
   - Goals
   - Architecture
   - VisuAlea: a Visual Programming Environment
   - Packages
   - Community
2. Applications
   - MAppleT
   - TopVine
3. Conclusions

The OpenAlea project

An open source project to

- address the needs of Plant research community
- develop new models rapidly

A common platform to

- share developments between various labs
- share databases
- share training efforts

A common software = efficiency + quality + reproductibilty

- Reuse **existing** software and tools
- Enhance accessibility to data and software (via common web sites)
- Set quality rules

OpenAlea Architecture

OpenAlea is not

- an application

OpenAlea is

- a set of components (or packages, or tools)
  - Common language is Python → multi-platform
  - Models components may be written in other languages

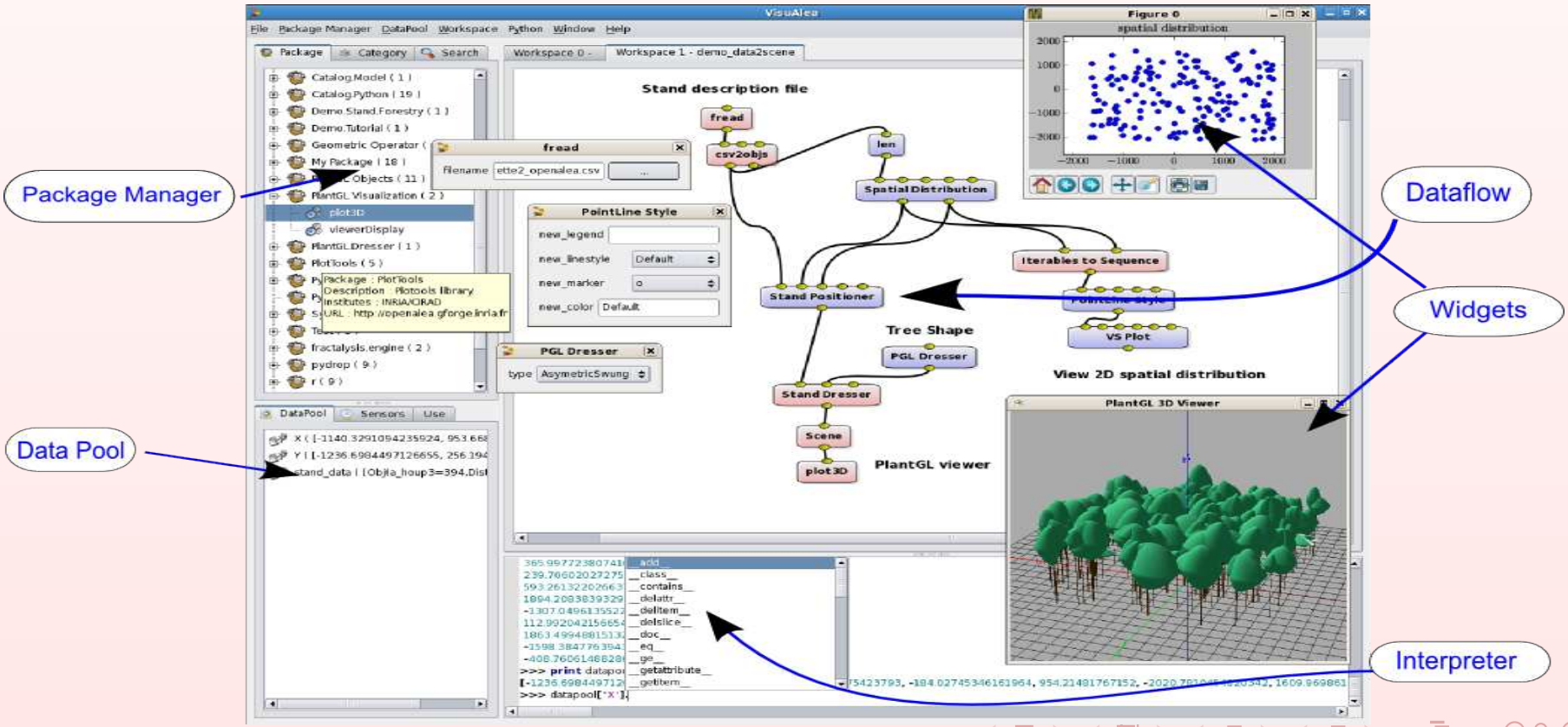
OpenAlea provides

- easy access to many packages from various labs
- easy access to other applications like GroIMP, LPy, cpfg, ...
- a common platform **VisuAlea** to allow dynamic composition of models using components available.

VisuAlea and Visual Programming

Advantages

- Interactive creation and modification of flexible workflows
- Visual representation of the structure of a model
- Dynamic composition of software components



Packages samples

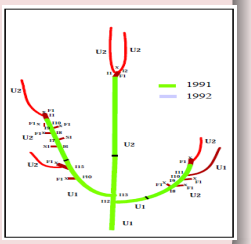
PlantGL (Boudon, Pradal et al.)

Plant Geometrical Library and 3D viewer



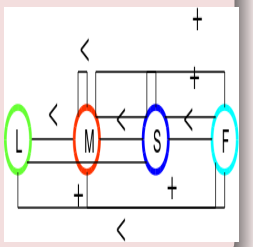
MTG (Godin et al.)

Multiscale Tree graph library (MTG).



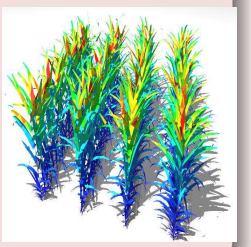
Stats (Guedon et al.)

Statistical Analysis, data exploration.



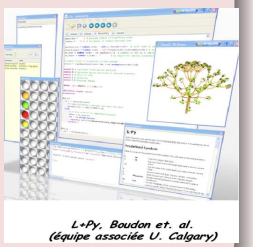
Caribu - (Fournier, Chelles et al.)

simulation and radiative transfer - (Fournier, Chelles et al.)



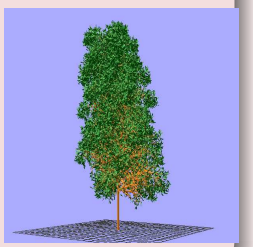
Lpy (Boudon)

Lsystem in Python run within VisuAlea



Weberpenn models (Pradal)

Implementation of the Weber & Penn models



The OpenAlea community

3 types of Members

- Computer scientists: maintain OpenAlea core (web site, storage, mailings lists,...)
- Developers: integrate their own models and documentation for users
- Users: create scenarii and provide databases.

Free community

- OpenAlea Licence: CeCIll-C
- OpenAlea packages are under CeCILL licence
- Components licence depend on developers choices.

Some partners

INRIA Virtual Plants (Montpellier), UMR Lepse (Montpellier), UMR DAP (Montpellier), UMR PSH (Avignon), UMR EMMAH (Avignon), UMR AIVA (Mpt), UMR EPC (Paris-Grignon), UMR PIAF (Clermont-Ferrand), UMR RDP (ENS Lyon), UMR Labri (Bordeaux), EPI INRIA Mistis (Grenoble), UMR SAGAH (Angers), Calgary U. (Canada), Gottingen U. (Germany), Wageningen U. (Netherlands), California U. (USA), CPIB (UK)

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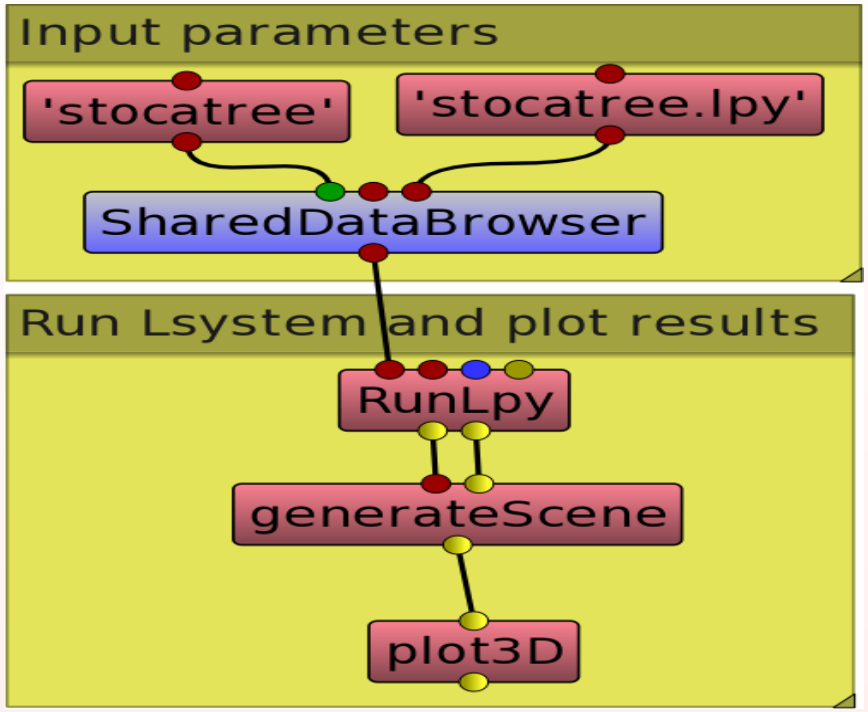
2 Applications
- MAppleT
- TopVine

3 Conclusions

MappleT: statistical and biomechanics

Apple tree model

- Original MAppleT Lsystem (from L-studio) written in LPy
- New implementation can use other OpenAlea packages such as statistical analysis, 3D Geometrical tools, light interception, ...



reference

Costes et al, Funct. Plant Biol. 10, 2008





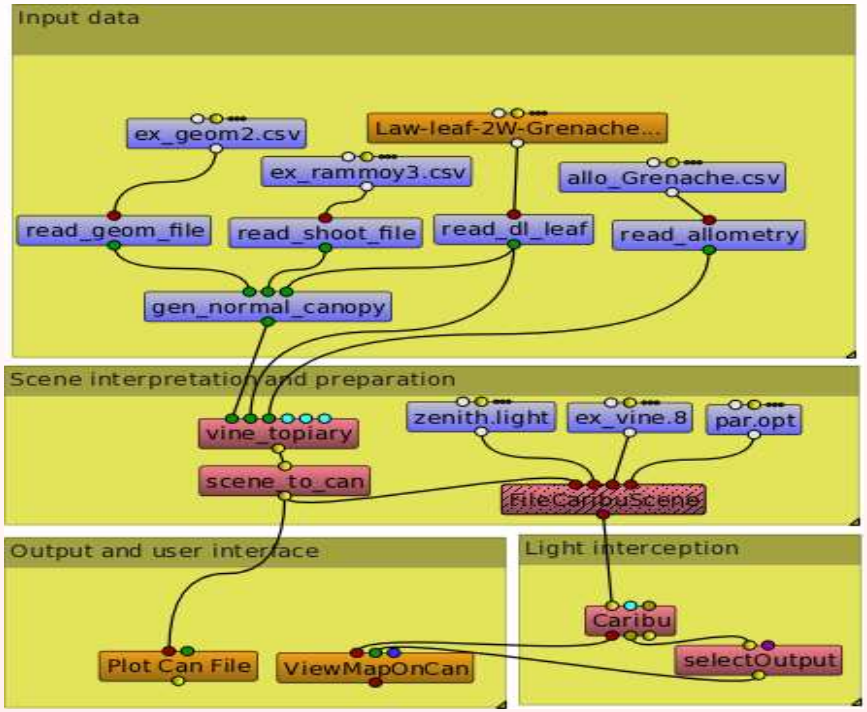
Topvine: vine grape data

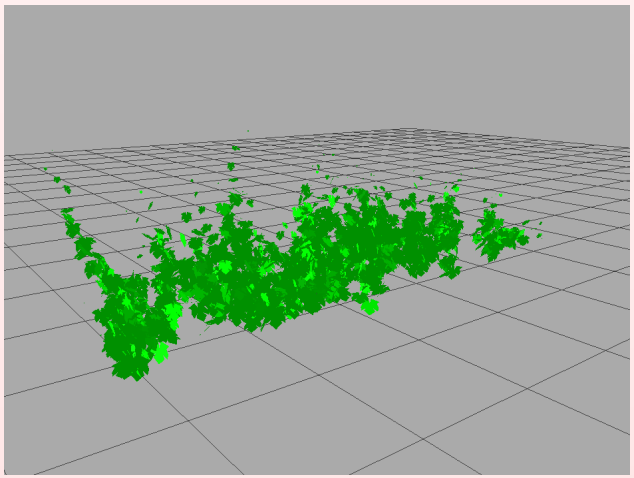
vine grape model

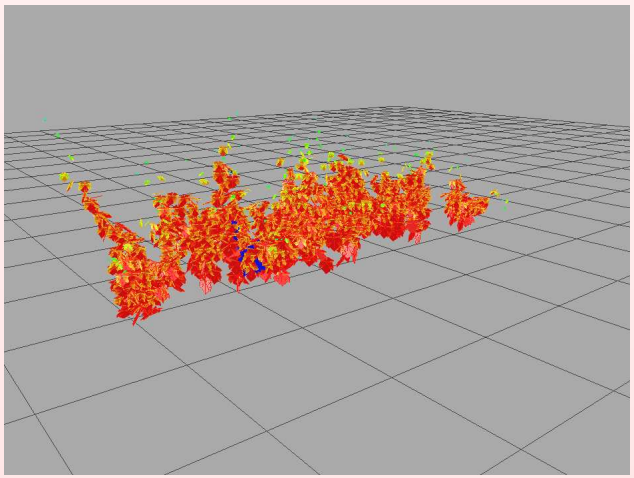
- Dataflows implemented in VisuAlea combined with PlantGL and Caribu packages
- Interactive selection of the output

reference

Louarn, G; Lecoeur, J; Lebon, E, AOB (101) 8, 2008







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Conclusions

OpenAlea and VisuAlea

- OpenAlea is an open source project.
- OpenAlea provides a visual programming environment called VisuAlea
- VisuAlea allows to compose scientific models in a GUI
- Foster components/widgets reuse between labs
- Many packages from co-developers are available: Biophysics models, image processing, statistical analysis, Lsystems

Modelling and coding sprints

- Sprints are organised so that people from different teams can meet up to work on a common model.

Documentation

- OpenAlea web site gather technical and scientific information
- Each package has its own web site to provide user and developer documentations

Thank You!



http://openalea.gforge.inria.fr

- +120 000 viewed pages a year
- 160 000 downloads (since 2007)
- 1 200 unique visitors a month
- 20 active developers
- 20 integrates components
- 16 teams involved
- 10 coding and modelling sprints (since 2007)

