Introduction to OpenAlea, a platform for plant modelling

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on behalf of the OpenAlea project

INRIA cirad

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Background: plant modelling at a glance

- Different scales:
  - cell
  - branch
  - tree
  - forest

- Heterogeneous data:
  - raw data
  - digitized data
  - tree databases
  - 3D images

- Many tools required:
  - topology
  - Geometry
  - simulation

- Many models possible:
  - theoretical
  - 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 + reproductibility

- Reuse existing software and tools
- Enhance accessibility to data and software (via common web sites)
- Set quality rules
OpenAlea in a nutshell

Applications

Conclusions

Goals

Architecture

VisuAlea: a Visual Programming Environment

Packages

Community

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, cpf, ...
- 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

**Stats (Guedon et al.)**
Statistical Analysis, data exploration.

**Lpy (Boudon)**
Lsystem in Python run within VisuAlea

**MTG (Godin et al.)**
Multiscale Tree graph library (MTG).

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

**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 scenarios 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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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**
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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OpenAlea in a nutshell

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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)