



Universidade Nova de Lisboa  
Faculdade de Ciências e Tecnologia

## MovieGene

A multimedia production system using Evolutionary Computation

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# Agenda

## Objectives

A new multimedia authoring paradigm based on evolutionary computation.

1. Research new ways of editing and producing multimedia documents.
2. Mixing evolutionary computation and cinematic rules.
3. Different aesthetics, new rules, future cinema.

# Agenda

# Evolutionary algorithms

- Nature concepts
  - Population
  - Fitness (individual's adaptation)
- Genetic operators
  - Selection (w/ Elitism)
  - Mating
  - Mutation
  - Elimination

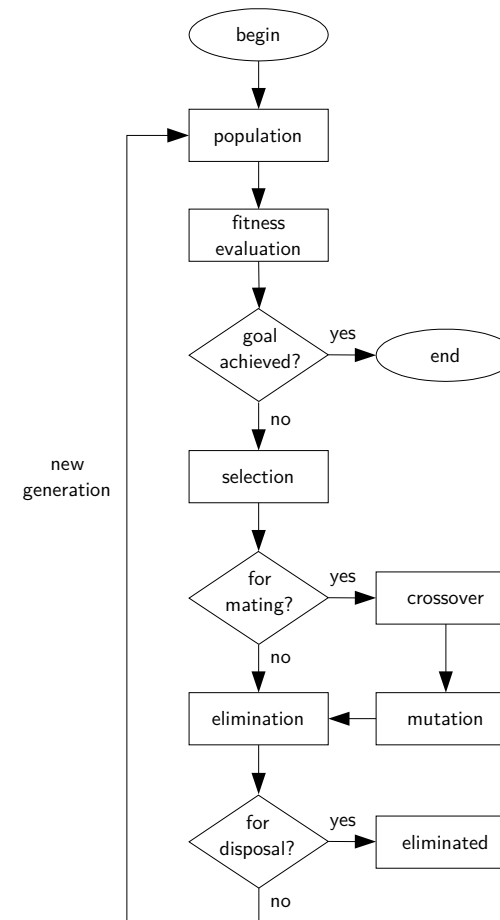


Figure 1: Work flow diagram

# Agenda

## Cinema and video editing and annotation

**Annotation metadata** Using MPEG-7 standard descriptors.

XML (standard 1.0) file format. Annotation file separated from video file.

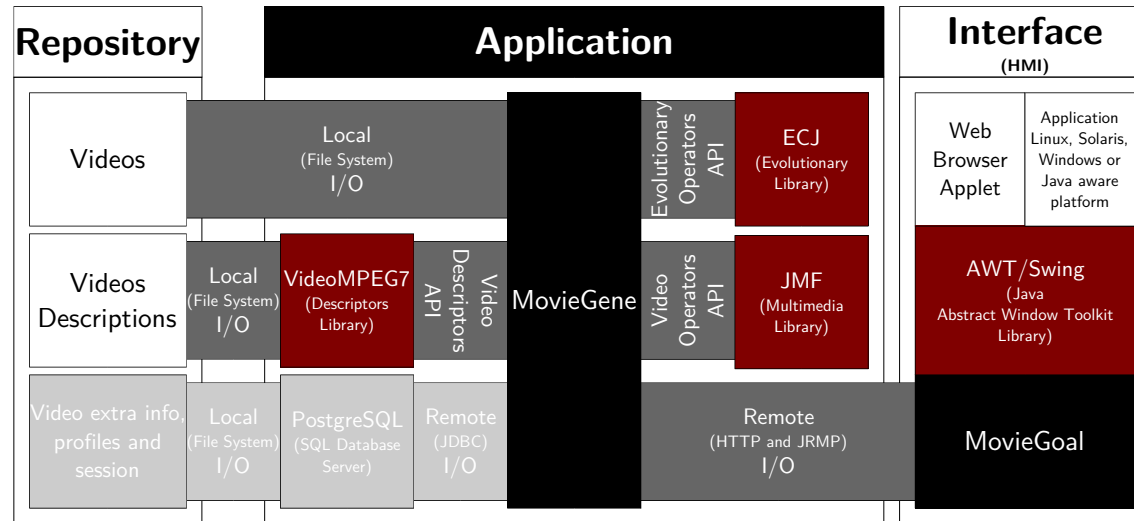
**Editing** using the simple Cut to join segments. This Cut means an abrupt transition between segments, and segments cuted from clips.

# Agenda



# Prototype

# Architecture



Level:

- Application core
- External library or Server
- Application Software Interface and Services (local and remote I/O)
- Human Machine Interface and Repository
- Future work (*not implemented*)

Figure 2: MovieGene's system architecture.

**Libraries used:** JMF, JFFMPEG, and ECJ.

**Libraries developed:** VideoMPEG7 and all the coding above JMF and ECJ (extending), on the MovieGoal and MovieGene layers.

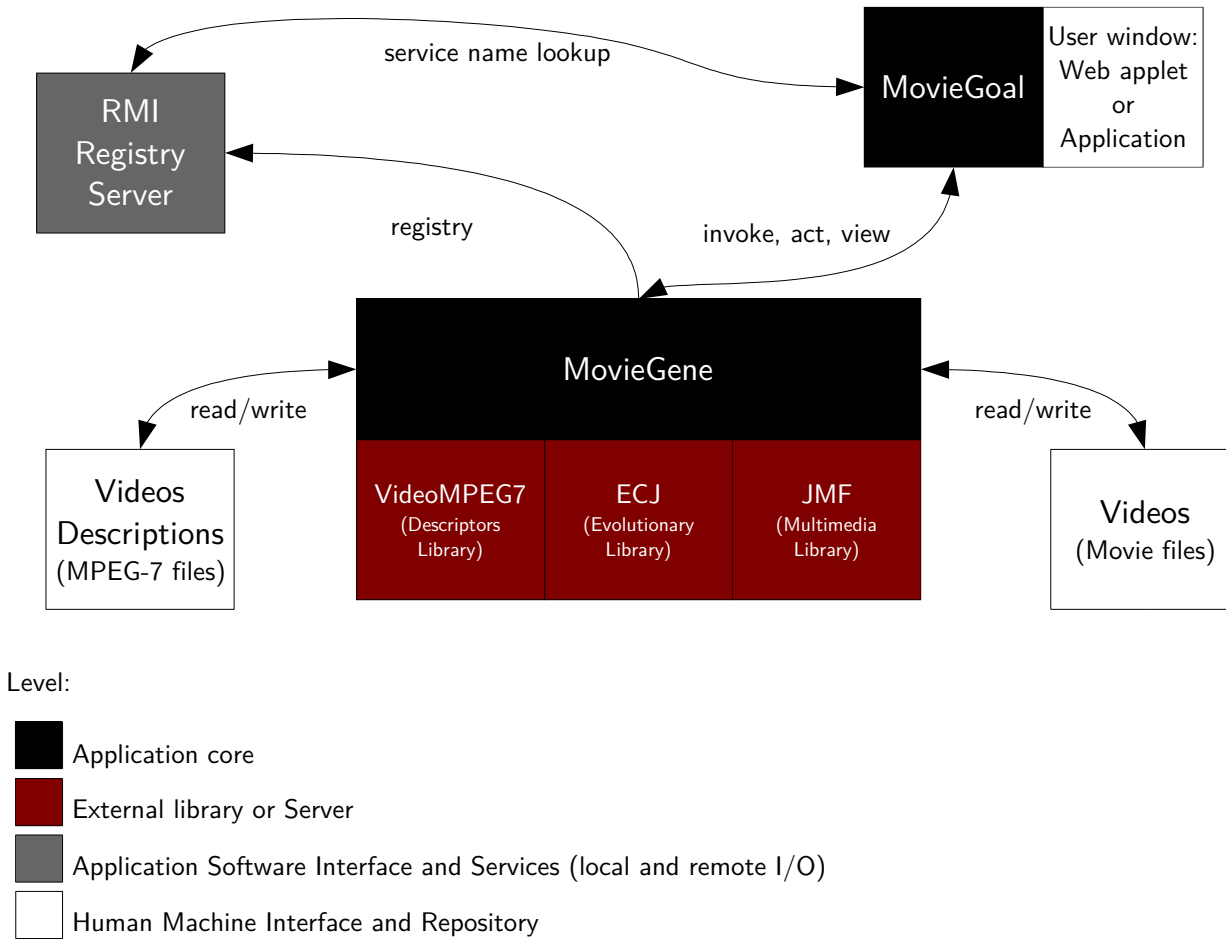


Figure 3: MovieGene's interaction architecture.

## Gene/video segment descriptors

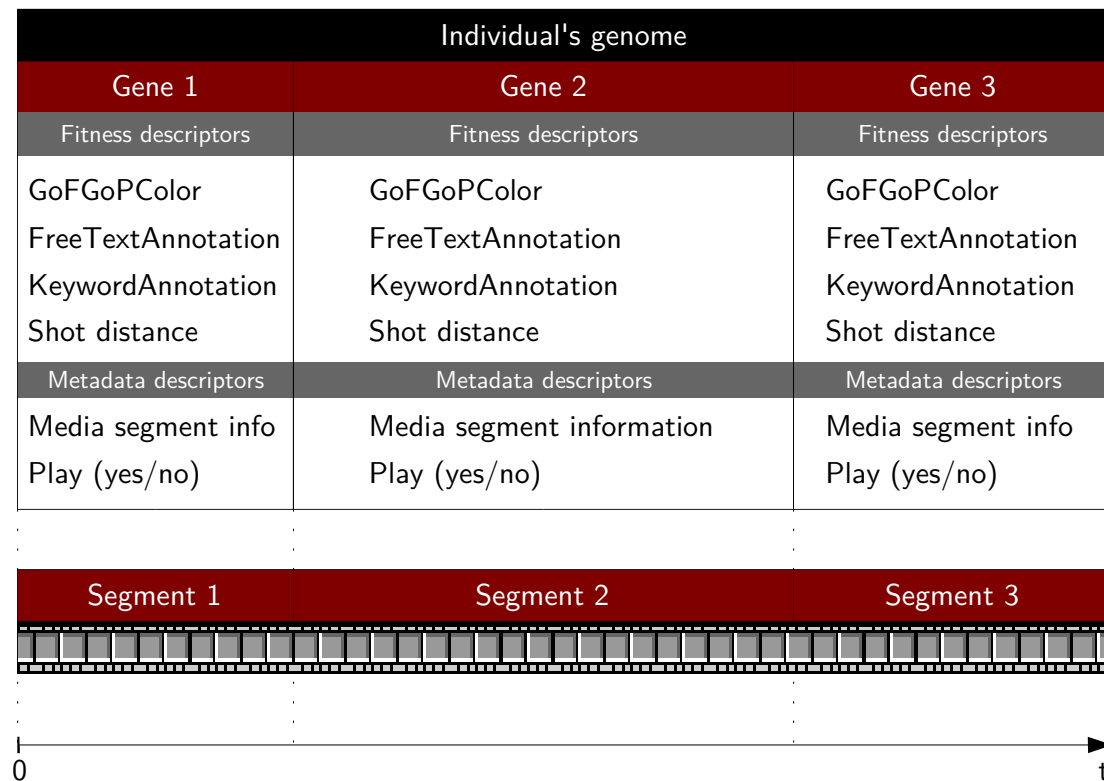


Figure 4: Three atomic segments (genes).

## Fitness function

$$f_i(V_i) = \sum_{v \in V_i} \frac{1}{g} (w_C C(v) + w_K K(v) + w_F F(v) + w_S S(v)), \quad i \in I \quad (1)$$

- $f : I \rightarrow [0, 1]$
- $I$ : individual  $i$  of the current generation.
- $V_i$ : individual's video described segments.
- $g$ : individual's number of genes/segments.
- $w_d$ : weight (sets relevance) for specific descriptor  $d$ .

$$w_K \gg w_F > w_C = w_S$$

$$\sum_{d \in D_i} w_d = 1$$

# Genetic algorithm operators

## Crossover

**Selection** Tournament with size 7. Probability range  $[0, 1]$ , typical  $[0.5, 1.0]$ . Elitism. Probability range  $[0, 1]$ , typical  $[0.0, 0.1]$ .

**Mating** one point crossover (better for testing than two point).

## Mutation

Gene descriptor “Play” is changed to `false`, video segment does not play. Probability range  $[0, 1]$ , typical  $[0.0, 0.1]$ .

## Elimination

The user may act as an extra Selection operator, choosing and eliminating clips from the population.

## Interface

- For the user: simple.  
Currently it is rather technical for testing purposes.  
It will be improved in future work.
- Anywhere in the Web: Java Applet and Application.
- Complete: anything changeable should be in it.  
Goal parameters.  
Genetic (engine) parameters.  
Video clips subset removal from the repository.  
Go step by step or unattended run for the best.  
Store the final result in a local file.  
...



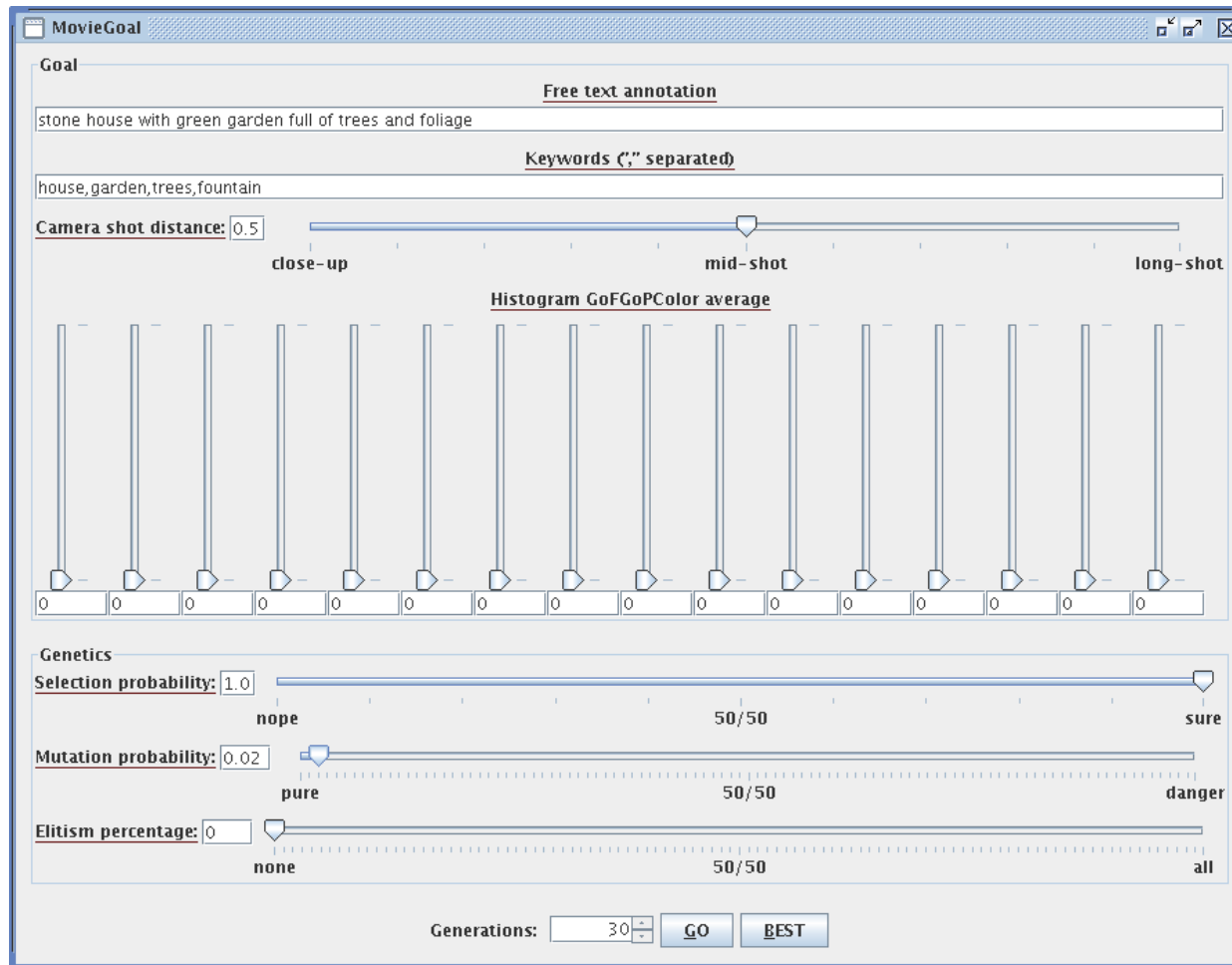


Figure 5: Goal and genetics screen.

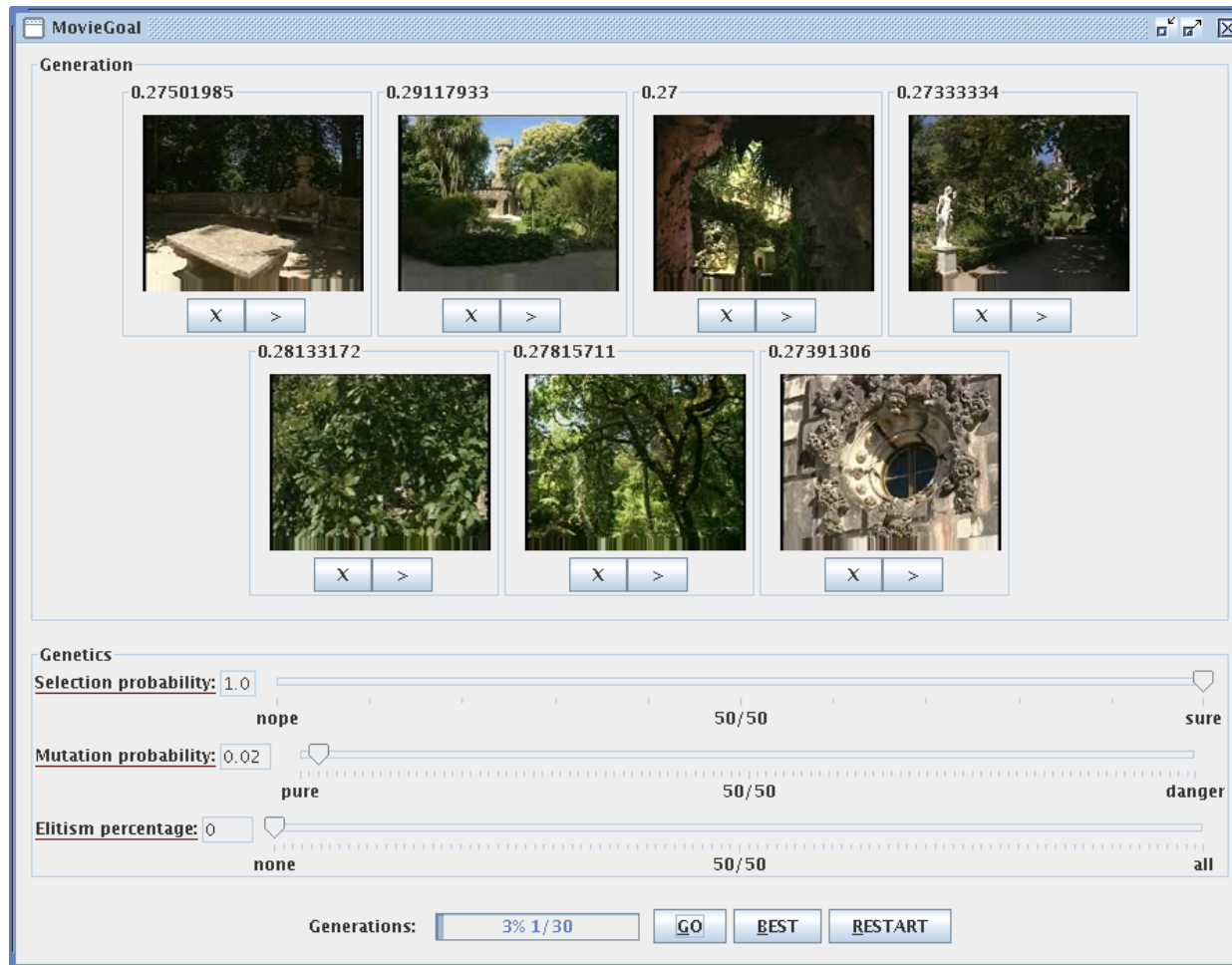


Figure 6: Evolutionary step screen.

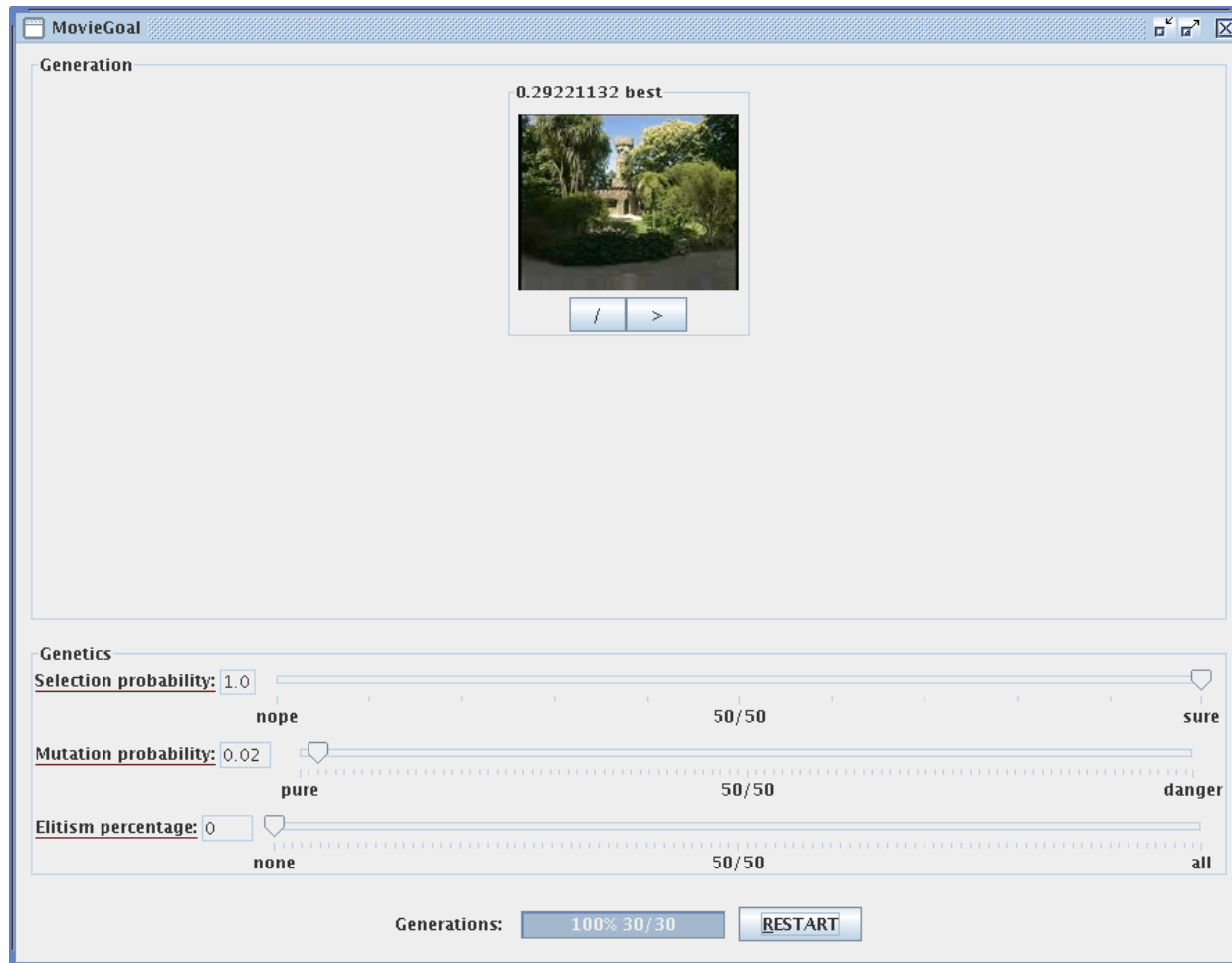


Figure 7: Best result screen.

# Agenda

## Conclusions and future work

- Prototype coding and algorithms need optimisation.
- Tests have shown the need for fine tuned descriptors.  
New descriptors should be added.  
Relevance weights needs fine tuning.
- New interface for the creative user.  
Without technical details.  
New graphical environment to better express the intended results.  
Several optional cinematic rules for the clips edition.