



## ETHOM: Evolutionary algoriTHm for Optimized feature Models

Sergio Segura<sup>(1)</sup>, José A. Parejo<sup>(1)</sup>, Robert M. Hierons<sup>(2)</sup>, David Benavides<sup>(1)</sup>, José A. Galindo<sup>(1)</sup>, Roberto E. Lopez-Herrejón<sup>(3)</sup>, Lukas Linsbauer<sup>(3)</sup>, Alexander Egyed<sup>(3)</sup> and Antonio Ruiz-Cortés<sup>(1)</sup>

(1) Grupo de Ingeniería del Software Aplicada, Universidad de Sevilla, Spain  
(2) School of Information Systems, Computing and Mathematics, Brunel University, UK  
(3) Institute for Software Systems Engineering, Johannes Kepler University, Austria



JISBD 2015 - Santander



Introduction



Evolutionary algorithm



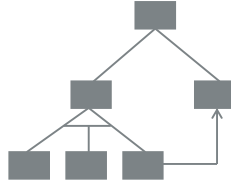
Applications



Future work

## Introduction

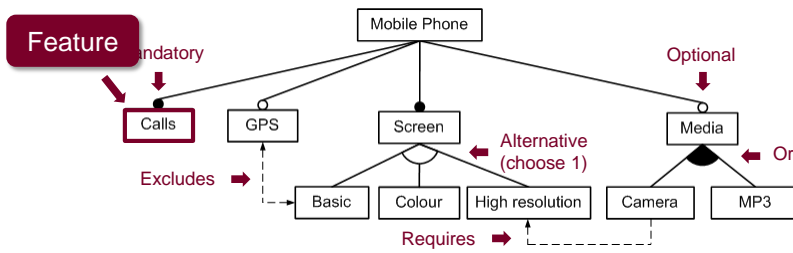
### Feature model



Visual and compact representation of all the products of a Software Product Line (SPL) in terms of features and relationships among them.

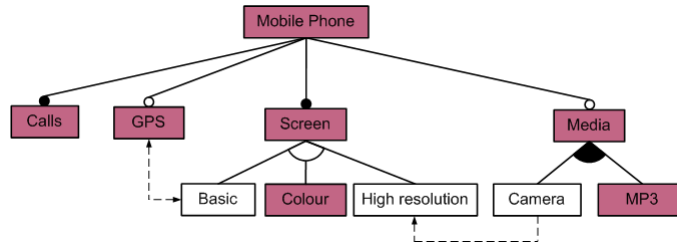
## Introduction

### Feature models



## Introduction

Feature models



= {MobilePhone, Calls, GPS, Screen, Colour, Media, MP3}



Introduction



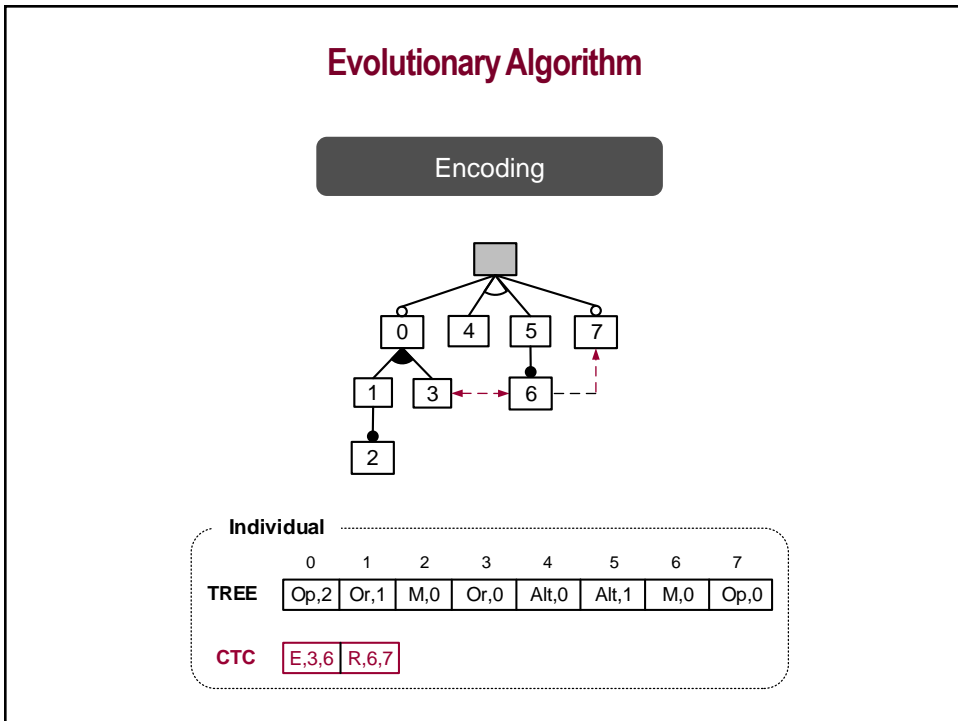
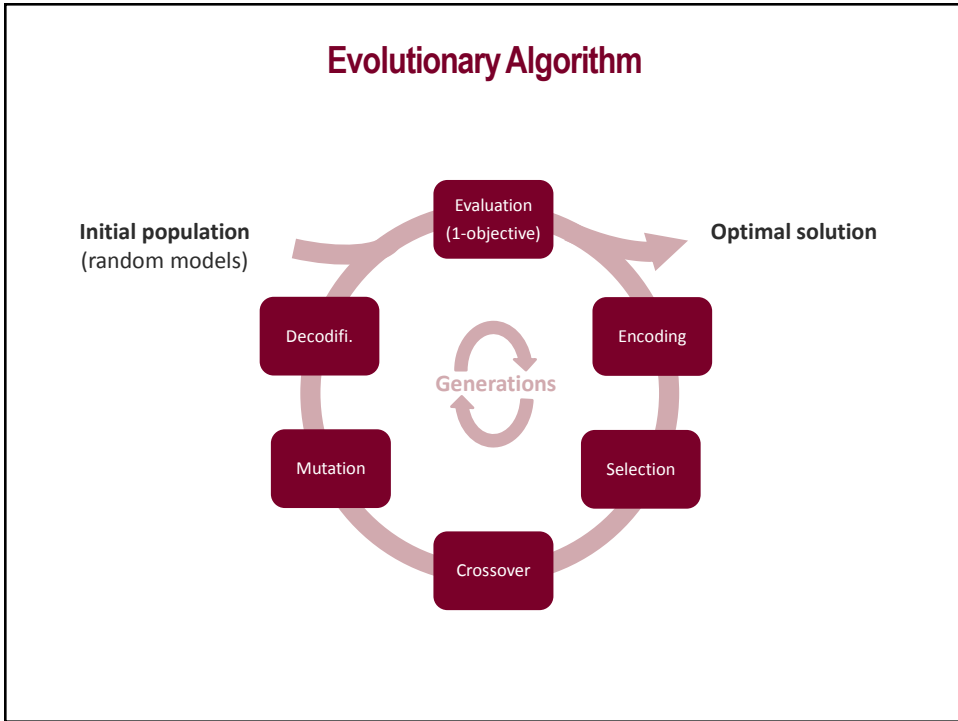
Evolutionary algorithm

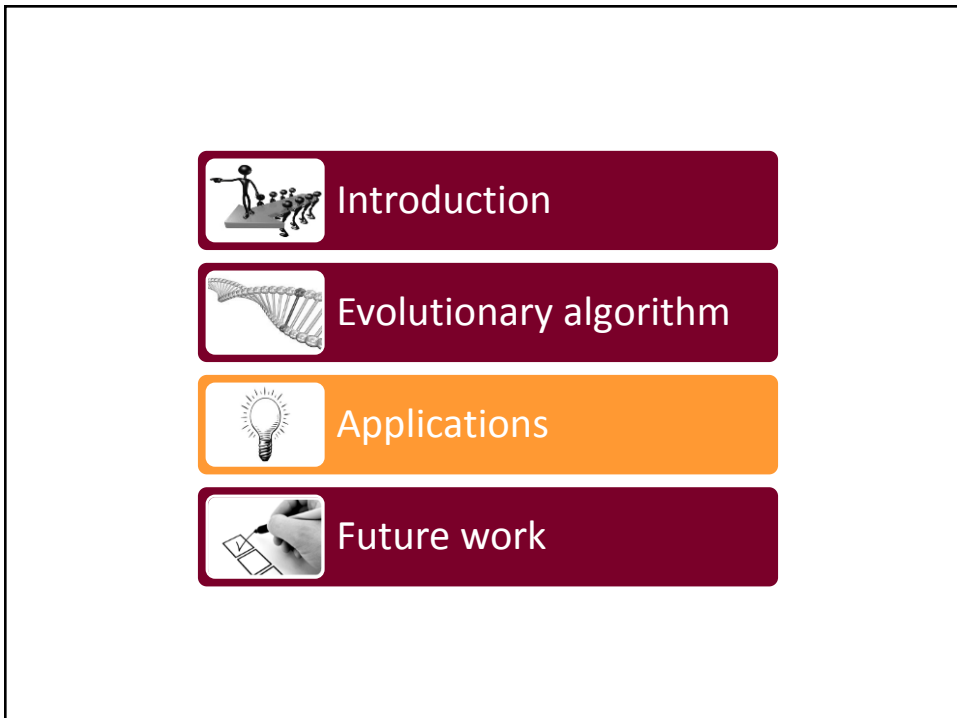
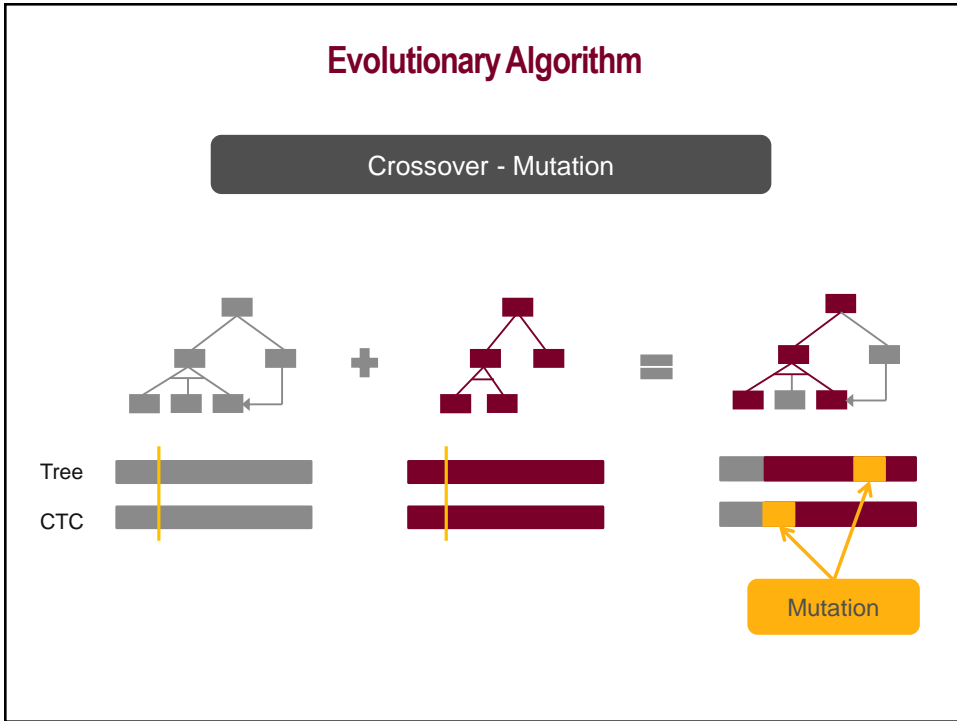


Applications



Future work





**CONTRIBUTION**

### Applications

Generation of computationally-hard feature models

**Performance Testing**  
How to know the performance of FM analysis tools in pessimistic cases?

Execution time  
Memory consumption  
...

Feature Model Analysis Tool

Sergio Segura, José A. Parejo, Robert M. Hierons, David Benavides, and Antonio Ruiz-Cortés. 2014. Automated generation of computationally hard feature models using evolutionary algorithms. *Expert Syst. Appl.* 41, 8 (June 2014), 3975-3992.

### Applications

Generation of computationally-hard feature models

27.5 minutes

0.2 seconds

22.2x10<sup>6</sup> nodes

14.8x10<sup>6</sup> nodes

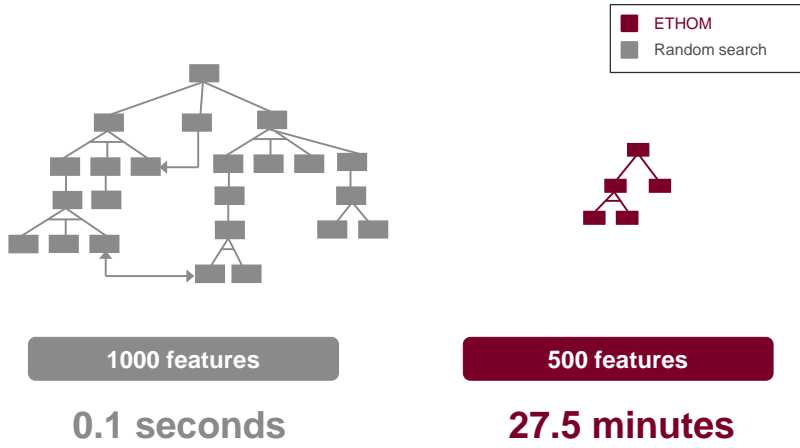
Execution time (CSP)

Memory consumption (BDD)

Legend: ■ ETHOM, ■ Random search

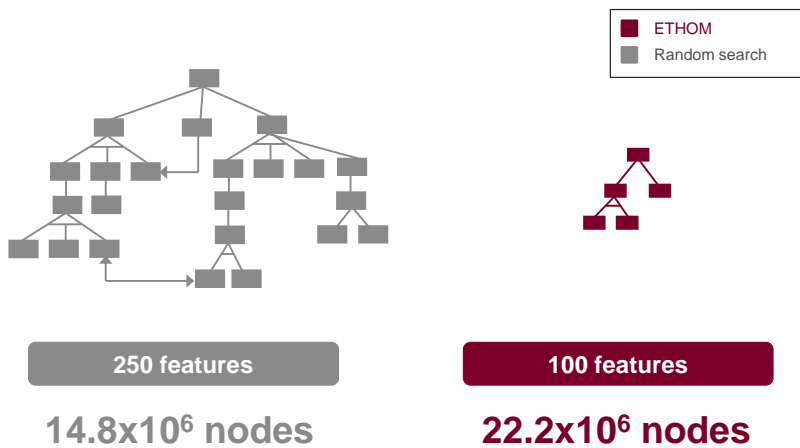
## Applications

Generation of computationally-hard feature models



## Applications

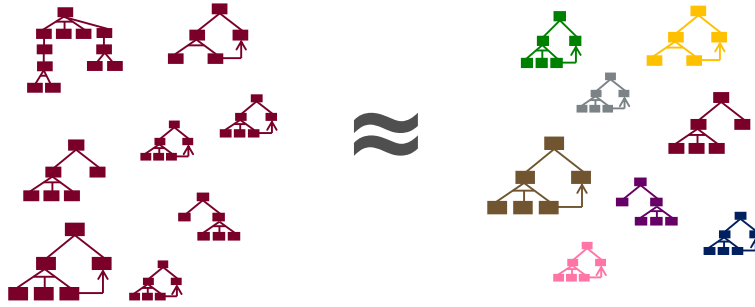
Generation of computationally-hard feature models



## Applications

Generation of computationally-hard feature models

Are the generated models realistic?



Hard feature models

Real feature models

## Applications

Reverse engineering of feature models

Given a set of products,  
how to generate a feature model that represents them?

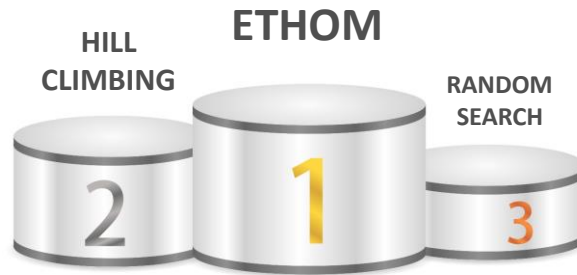


Roberto E. Lopez-Herrejon, Lukas Linsbauer, José A. Galindo, José A. Parejo, David Benavides, Sergio Segura, Alexander Egyed, An assessment of search-based techniques for reverse engineering feature models, Journal of Systems and Software, Volume 103, May 2015, Pages 353-369.



## Applications

Reverse engineering of feature models



Introduction



Evolutionary algorithm



Applications



Future work

## Future work



Improvements in the algorithm



New applications (e.g. energy consumption)

# Thanks!



[www.isa.us.es](http://www.isa.us.es)



[sergiosegura@us.es](mailto:sergiosegura@us.es)



[www.isa.us.es/betty](http://www.isa.us.es/betty)