Dagli script a linguaggio di programmazione

Una GUI per il team di produzione

Marco Basilico, Xavier Balague
Milano, 24 Giugno 2019
<table>
<thead>
<tr>
<th>Table Of Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introducing TRE ALTAMIRA</td>
</tr>
<tr>
<td>TRE ALTAMIRA products</td>
</tr>
<tr>
<td>Why MATLAB?</td>
</tr>
<tr>
<td>MATLAB (a long journey)</td>
</tr>
<tr>
<td>• MATLAB as a script for R&amp;D</td>
</tr>
<tr>
<td>• MATLAB as a tool for production</td>
</tr>
<tr>
<td>• MATLAB as a programming language</td>
</tr>
<tr>
<td>A GUI/application for production</td>
</tr>
<tr>
<td>Conclusions and next steps</td>
</tr>
</tbody>
</table>
Introduction to TRE ALTAMIRA
TRE ALTAMIRA

The global leader in satellite radar data processing for the measurement of ground and structural movements
**TRE and ALTAMIRA** have joined forces to become the largest InSAR group worldwide, as part of the CLS Group company.

Our History

<table>
<thead>
<tr>
<th>1999</th>
<th>2000</th>
<th>2015</th>
<th>2016</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRE</td>
<td>ALTA</td>
<td>New subsidiaries</td>
<td>TRE</td>
<td>TRE</td>
</tr>
<tr>
<td>2008</td>
<td>2009</td>
<td>2010</td>
<td>2015</td>
<td>2018</td>
</tr>
<tr>
<td>Vancouver</td>
<td>Calgary</td>
<td>TRE launches SqueeSAR as the new industry standard of advanced InSAR techniques.</td>
<td>Joining the CLS Group company.</td>
<td>TRE ALTAMIRA is a routine provider of nation-wide databases of InSAR measurements using Sentinel-1 imagery.</td>
</tr>
</tbody>
</table>

is a global company and pioneer provider of space-based solutions. It works in six strategic areas of activity: from sustainable fisheries management, maritime surveillance, fleet management, to environmental monitoring, energy & mining and space & ground systems.
Facts

19 YEARS' EXPERIENCE

120,000 Satellite Radar IMAGES PROCESSED

\(~5,000,000\) km\(^2\), analysed everywhere in the world

1 mm PRECISION on single displacement measurements

600+ InSAR PROJECTS
in different market sectors

International PATENTS
on radar data processing

SqueeSAR\(^\text{®}\) DespecKS\(^\text{®}\)
Double-Geometry Corner Reflectors

SAR satellites PAST AND PRESENT
Ready for future platforms
TRE ALTAMIRA PRODUCTS
We provide deformation maps with millimetric precision using a technique called SqueeSAR®.

Deliverables are in shapefiles format.

Generally shapefile contains millions of points with hundreds of attributes.
For every measurement we provide: geolocalization (lat, lon, height), annual deformation rate, acceleration, standard deviations and all the displacement.

→ This huge amount of data must be displayed and edited in MATLAB ←
WHY MATLAB?
Most of the employees learnt MATLAB at university (a well known tool)

We need high computational performances.

We need to easily display/interact data while process them

We need to develop complex tool; we need a programming language

Mathworks customer care

A large community of developers (also important events such as: MATLAB expo, Advisory Board)

Many online how2/training resources
MATLAB ... A LONG JOURNEY
All users initially developed independently its own tool and set of MATLAB functions.

No standardization, no proper comments into functions, no documentation, no common best practices

Many functions for the same action with slightly different results

Reinvent the wheel
moving toward ... a tool for production

» Remove duplicated functions
» Organize code in an homogenous way
  • Set up a repository with proper guidelines for users
  • Organize function in modules with a version
  • Create collection of modules into releases

» Oblige data scientist to use a code repository (CVS, git)
» It is forbidden to edit production code
» Oblige data scientist to test the code in an extensive way
» Work in a team
Function are collected in module (libraries) with a proper version number. A release in production is a collection of modules version. Any release has a xml configuration file to specify the release modules. The MATLAB path is set automatically choosing the production release.
findFunction is a tool to retrieve function thanks to some keywords. The documentation is build automatically from some comments added to the code.
A web-app to drive the team into repository and versioning (CVS and git command suggestions, mail notifications, version numbers stored into database)

… a tool for production
Some MATLAB GUI were created to let code deploying automatic and easy.
switch_path and switch_stable are tools that lets the user change the release used in a MATLAB session; the MATLAB path is updated automatically.
using MATLAB ... as a programming language

» A powerful editor (even for GUI developing)
» Debugging tools
» Profiling tools
» Tests
» A large community of developers (also important events such as: MATLAB expo, Advisory Board)
» Easy to learn
» Mathworks customer care
» Training opportunities

→ We need a programming language to develop a challenging project as GUI factotum ←
From scripting to a professional user interface

- Users will not need to learn MATLAB scripting/developing
- Users are more focused on the quality of the products
- The need to see/inspect results during the processing
- Product creation is guided and for sure:
  - more standardized
  - actions are register/logged
Millions of points must be displayed and processed. The GUI must be optimized to guarantee good performances.
» Code must reflect this model
» Function naming follows a rigid schema
» No direct access to MODEL data (GET/SET)
» Unit and integrity tests
» Code must be re-used easily

GUI factotum

We must TEST the GUI!

Event → GUI callback → User input

- Turn off widgets
  - New events could be triggered during the execution
  - Users shouldn't interact with GUI while it is reacting to a user action
  - All the code necessary to execute the required action

- Turn on widgets
  - Now users can understand the required action is completed
MATLAB is the “tool” of the production team
MATLAB is a “programming language”
It is mandatory to set tools/procedures for development and deployment
Work always in team

Conclusions and Next steps
Next steps are usually driven by important events such as MATLAB expo or MAB

» Move to the cloud (AWS EC2 and S3)
» Use MATLAB Coder to improve performances
» Move to MATLAB OOP?
» Move to App Designer and/or Live Editor?
» Use MATLAB Compiler?