Activity Report 2017

Section Software

CAMUS Team

6. New Software and Platforms

6.1. APOLLO

Automatic speculative POLyhedral Loop Optimizer
KEYWORD: Automatic parallelization
FUNCTIONAL DESCRIPTION: APOLLO is dedicated to automatic, dynamic and speculative parallelization of loop nests that cannot be handled efficiently at compile-time. It is composed of a static part consisting of specific passes in the LLVM compiler suite, plus a modified Clang frontend, and a dynamic part consisting of a runtime system. It can apply on-the-fly any kind of polyhedral transformations, including tiling, and can handle nonlinear loops, as while-loops referencing memory through pointers and indirections.

- Participants: Aravind Sukumaran-Rajam, Juan Manuel Martinez Caamaño, Manuel Selva and Philippe Clauss
- Contact: Philippe Clauss
- URL: http://apollo.gforge.inria.fr

6.2. Clan

A Polyhedral Representation Extraction Tool for C-Based High Level Languages
KEYWORD: Polyhedral compilation
FUNCTIONAL DESCRIPTION: Clan is a free software and library which translates some particular parts of high level programs written in C, C++ or Java into a polyhedral representation called OpenScop. This representation may be manipulated by other tools to, e.g., achieve complex analyses or program restructurations (for optimization, parallelization or any other kind of manipulation). It has been created to avoid tedious and error-prone input file writing for polyhedral tools (such as CLooG, LeTSeE, Candl etc.). Using Clan, the user has to deal with source codes based on C grammar only (as C, C++ or Java). Clan is notably the frontend of the two major high-level compilers Pluto and PoCC.

- Participants: Cédric Bastoul and Imèn Fassi
- Contact: Cédric Bastoul
- URL: http://icps.u-strasbg.fr/people/bastoul/public_html/development/clan/

6.3. Clay

Chunky Loop Alteration wizardrY
FUNCTIONAL DESCRIPTION: Clay is a free software and library devoted to semi-automatic optimization using the polyhedral model. It can input a high-level program or its polyhedral representation and transform it according to a transformation script. Classic loop transformations primitives are provided. Clay is able to check for the legality of the complete sequence of transformation and to suggest corrections to the user if the original semantics is not preserved.

- Participant: Cédric Bastoul
- Contact: Cédric Bastoul
- URL: http://icps.u-strasbg.fr/people/bastoul/public_html/development/clay/

6.4. CLooG

Code Generator in the Polyhedral Model

FUNCTIONAL DESCRIPTION: CLooG is a free software and library to generate code (or an abstract syntax tree of a code) for scanning Z-polyhedra. That is, it finds a code (e.g. in C, FORTRAN...) that reaches each integral point of one or more parameterized polyhedra. CLooG has been originally written to solve the code generation problem for optimizing compilers based on the polyhedral model. Nevertheless it is used now in various area e.g. to build control automata for high-level synthesis or to find the best polynomial approximation of a function. CLooG may help in any situation where scanning polyhedra matters. While the user has full control on generated code quality, CLooG is designed to avoid control overhead and to produce a very effective code. CLooG is widely used (including by GCC and LLVM compilers), disseminated (it is installed by default by the main Linux distributions) and considered as the state of the art in polyhedral code generation.

RELEASE FUNCTIONAL DESCRIPTION: It mostly solves building and offers a better OpenScop support.

- Participant: Cédric Bastoul
- Contact: Cédric Bastoul
- URL: http://www.cloog.org

6.5. IBB

Iterate-But-Better
FUNCTIONAL DESCRIPTION: IBB is a source-to-source xfor compiler which automatically translates any C source code containing xfor-loops into an equivalent source code where xfor-loops have been transformed into equivalent for-loops.

RELEASE FUNCTIONAL DESCRIPTION: The IBB compiler has been improved in some aspects in 2014: loop bounds can now be min and max functions, IBB uses the OpenScop format to encode statements and iteration domains.

- Participants: Cédric Bastoul, Imèn Fassi and Philippe Clauss
- Contact: Philippe Clauss
- URL: http://xfor.gforge.inria.fr

6.6. OpenScop

A Specification and a Library for Data Exchange in Polyhedral Compilation Tools
FUNCTIONAL DESCRIPTION: OpenScop is an open specification that defines a file format and a set of data structures to represent a static control part (SCoP for short), i.e., a program part that can be represented in the polyhedral model. The goal of OpenScop is to provide a common interface to the different polyhedral compilation tools in order to simplify their interaction. To help the tool developers to adopt this specification, OpenScop comes with an example library (under 3-clause BSD license) that provides an implementation of the most important functionalities necessary to work with OpenScop.

- Participant: Cédric Bastoul
- Contact: Cédric Bastoul
- URL: http://icps.u-strasbg.fr/people/bastoul/public_html/development/openscop/

6.7. PolyLib

The Polyhedral Library
KEYWORDS: Rational polyhedra - Library - Polyhedral compilation
SCIENTIFIC DESCRIPTION: A C library used in polyhedral compilation, as a basic tool used to analyze, transform, optimize polyhedral loop nests. Has been shipped in the polyhedral tools Cloog and Pluto.

FUNCTIONAL DESCRIPTION: PolyLib is a C library of polyhedral functions, that can manipulate unions of rational polyhedra of any dimension. It was the first to provide an implementation of the computation of parametric vertices of a parametric polyhedron, and the computation of an Ehrhart polynomial (expressing the number of integer points contained in a parametric polytope) based on an interpolation method. Vincent Loechner is the maintainer of this software.

- Participant: Vincent Loechner
- Contact: Vincent Loechner
- URL: http://icps.u-strasbg.fr/PolyLib/

6.8. ORWL

Ordered Read-Write Lock

KEYWORDS: Task scheduling - Deadlock detection

FUNCTIONAL DESCRIPTION: ORWL is a reference implementation of the Ordered Read-Write Lock tools. The macro definitions and tools for programming in C99 that have been implemented for ORWL have been separated out into a toolbox called P99.

- Participants: Jens Gustedt, Mariem Saied and Stéphane Vialle
- Contact: Jens Gustedt
- Publications: Iterative Computations with Ordered Read-Write Locks - Automatic, Abstracted and Portable Topology-Aware Thread Placement - Resource-Centered Distributed Processing of Large Histopathology Images - Automatic Code Generation for Iterative Multi-dimensional Stencil Computations

6.9. P99

KEYWORD: Macro programming

FUNCTIONAL DESCRIPTION: P99 is a suite of macro and function definitions that ease the programming in modern C, minimum C99. By using tools from C99 and C11 we implement default arguments for functions, scope bound resource management, transparent allocation and initialization.

- Participants: Jens Gustedt, Mariem Saied and Stéphane Vialle
- Contact: Jens Gustedt
- URL: https://gforge.inria.fr/projects/p99/

6.10. stdatomic

standard atomic library

KEYWORD: Atomic access

SCIENTIFIC DESCRIPTION: We present a new algorithm and implementation of a lock primitive that is based on Linux' native lock interface, the futex system call. It allows us to assemble compiler support for atomic data structures that can not be handled through specific hardware instructions. Such a tool is needed for C11's atomics interface because here an _Atomic qualification can be attached to almost any data type. Our lock data structure for that purpose meets very specific criteria concerning its field of operation and its performance. By that we are able to outperform gcc's libatomic library by around 60%.

FUNCTIONAL DESCRIPTION: This implementation builds entirely on the two gcc ABIs for atomics. It doesn't even attempt to go down to assembly level by itself. We provide all function interfaces that the two gcc ABIs and the C standard need. For compilers that don't offer the direct language support for atomics this provides a syntactically reduced but fully functional approach to atomic operations.

- Author: Jens Gustedt
- Contact: Jens Gustedt
- Publications: Futex based locks for C11's generic atomics - Futex based locks for C11's generic atomics (extended abstract)
- URL: http://stdatomic.gforge.inria.fr/

6.11. musl

KEYWORDS: Standards - Library

SCIENTIFIC DESCRIPTION: musl provides consistent quality and implementation behavior from tiny embedded systems to full-fledged servers. Minimal machine-specific code means less chance of breakage on minority architectures and better success with "write once run everywhere" C development.

musl's efficiency is unparalleled in Linux libc implementations. Designed from the ground up for static linking, musl carefully avoids pulling in large amounts of code or data that the application will not use. Dynamic linking is also efficient, by integrating the entire standard library implementation, including threads, math, and even the dynamic linker itself into a single shared object, most of the startup time and memory overhead of dynamic linking have been eliminated.

FUNCTIONAL DESCRIPTION: We participate in the development of musl, a re-implementation of the C library as it is described by the C and POSIX standards. It is lightweight, fast, simple, free, and strives to be correct in the sense of standards-conformance and safety. Musl is production quality code that is mainly used in the area of embedded device. It gains more market share also in other area, e.g. there are now Linux distributions that are based on musl instead of Gnu LibC.

- Participant: Jens Gustedt
- Contact: Jens Gustedt
- URL: http://www.musl-libc.org/

6.12. Modular C

KEYWORDS: Programming language - Modularity

FUNCTIONAL DESCRIPTION: The change to the C language is minimal since we only add one feature, composed identifiers, to the core language. Our modules can import other modules as long as the import relation remains acyclic and a module can refer to its own identifiers and those of the imported modules through freely chosen abbreviations. Other than traditional C include, our import directive ensures complete encapsulation between modules. The abbreviation scheme allows to seamlessly replace an imported module by another one with equivalent interface. In addition to the export of symbols, we provide parameterized code injection through the import of "snippets". This implements a mechanism that allows for code reuse, similar to X macros or templates. Additional features of our proposal are a simple dynamic module initialization scheme, a structured approach to the C library and a migration path for existing software projects.

- Author: Jens Gustedt
- Contact: Jens Gustedt
- Publications: Modular C - Arbogast: Higher order AD for special functions with Modular C - Futex based locks for C11's generic atomics
- URL: http://cmod.gforge.inria.fr/

6.13. arbogast

KEYWORD: Automatic differentiation

SCIENTIFIC DESCRIPTION: This high-level toolbox for the calculus with Taylor polynomials is named after L.F.A. Arbogast (1759-1803), a French mathematician from Strasbourg (Alsace), for his pioneering work in derivation calculus. Its modular structure ensures unmatched efficiency for computing higher order Taylor polynomials. In particular it permits compilers to apply sophisticated vector parallelization to the derivation of nearly unmodified application code.

FUNCTIONAL DESCRIPTION: Arbogast is based on a well-defined extension of the C programming language, Modular C, and places itself between tools that proceed by operator overloading on one side and by rewriting, on the other. The approach is best described as contextualization of C code because it permits the programmer to place his code in different contexts – usual math or AD – to reinterpret it as a usual C function or as a differential operator. Because of the type generic features of modern C, all specializations can be delegated to the compiler.

- Author: Jens Gustedt
- Contact: Jens Gustedt
- Publications: Arbogast: Higher order AD for special functions with Modular C - Arbogast – Origine d'un outil de dérivation automatique
- URL: https://gforge.inria.fr/projects/arbo

6.14. CFML

Interactive program verification using characteristic formulae
KEYWORDS: Coq - Software Verification - Deductive program verification - Separation Logic
FUNCTIONAL DESCRIPTION: The CFML tool supports the verification of OCaml programs through interactive Coq proofs. CFML proofs establish the full functional correctness of the code with respect to a specification. They may also be used to formally establish bounds on the asymptotic complexity of the code. The tool is made of two parts: on the one hand, a characteristic formula generator implemented as an OCaml program that parses OCaml code and produces Coq formulae, and, on the other hand, a Coq library that provides notation and tactics for manipulating characteristic formulae interactively in Coq.

- Participants: Arthur Charguéraud, Armaël Guéneau and François Pottier
- Contact: Arthur Charguéraud
- URL: http://www.chargueraud.org/softs/cfml/

6.15. TLC

TLC Coq library
KEYWORDS: Coq - Library
FUNCTIONAL DESCRIPTION: TLC is a general purpose Coq library that provides an alternative to Coq's standard library. TLC takes as axiom extensionality, classical logic and indefinite description (Hilbert's epsilon). These axioms allow for significantly simpler formal definitions in many cases. TLC takes advantage of the type class mechanism. In particular, this allows for common operators and lemma names for all container data structures and all order relations. TLC includes the optimal fixed point combinator, which can be used for building arbitrarily-complex recursive and co-recursive definitions. Last, TLC provides a collection of tactics that enhance the default tactics provided by Coq. These tactics help constructing more concise and more robust proof scripts.

- Contact: Arthur Charguéraud
- URL: http://www.chargueraud.org/softs/tlc/

<p align="center" style="color:red">**CARAMBA Project-Team**</p>

6. New Software and Platforms

6.1. Belenios

Belenios - Verifiable online voting system
KEYWORD: E-voting
FUNCTIONAL DESCRIPTION: Belenios is an online voting system that provides confidentiality and verifiability. End-to-end verifiablity relies on the fact that the ballot box is public (voters can check that their ballots have been received) and on the fact that the tally is publicly verifiable (anyone can recount the votes). Confidentiality relies on the encryption of the votes and the distribution of the decryption key.

Belenios builds upon Helios, a voting protocol used in several elections. The main design enhancement of Belenios vs Helios is that the ballot box can no longer add (fake) ballots, due to the use of credentials.

- Participants: Pierrick Gaudry, Stéphane Glondu and Véronique Cortier
- Partners: CNRS - Inria
- Contact: Stéphane Glondu
- URL: http://belenios.gforge.inria.fr/

6.2. tinygb

KEYWORD: Gröbner bases
FUNCTIONAL DESCRIPTION: Tinygb is a free software which implements tools for computing Gröbner bases with Faugère's F4 algorithm.
NEWS OF THE YEAR: The code has been largely rewritten and optimized. A new release is planned for the beginning of 2018.

- Author: Pierre-Jean Spaenlehauer
- Contact: Pierre-Jean Spaenlehauer
- URL: https://gforge.inria.fr/projects/tinygb/

6.3. CADO-NFS

Crible Algébrique: Distribution, Optimisation - Number Field Sieve
KEYWORDS: Cryptography - Number theory
FUNCTIONAL DESCRIPTION: CADO-NFS is a complete implementation in C/C++ of the Number Field Sieve (NFS) algorithm for factoring integers and computing discrete logarithms in finite fields. It consists in various programs corresponding to all the phases of the algorithm, and a general script that runs them, possibly in parallel over a network of computers.

- Participants: Pierrick Gaudry, Emmanuel Thomé and Paul Zimmermann
- Contact: Emmanuel Thomé
- URL: http://cado-nfs.gforge.inria.fr/

CARTE Team

6. New Software and Platforms

6.1. Software

6.1.1. FiatLux

FiatLux is a simulation program for cellular automata developed by Nazim Fatès. The project is currently available at the Inria GForge. It is under the CeCILL license.

GAMBLE Project-Team

6. New Software and Platforms

6.1. ISOTOP

Topology and geometry of planar algebraic curves

KEYWORDS: Topology - Curve plotting - Geometric computing

FUNCTIONAL DESCRIPTION: Isotop is a Maple software for computing the topology of an algebraic plane curve, that is, for computing an arrangement of polylines isotopic to the input curve. This problem is a necessary key step for computing arrangements of algebraic curves and has also applications for curve plotting. This software has been developed since 2007 in collaboration with F. Rouillier from Inria Paris - Rocquencourt. It is based on the method described in [Cheng, J., Lazard, S., Pe

NEWS OF THE YEAR: In 2017, an ADT FastTrack funded a 6 months engineer contract to port the Maple code to C code. In addition, another local engineer from Inria Nancy (Benjamin Dexheimer) implemented a web server to improve the diffusion of our software.

- Participants: Elias Tsigaridas, Jinsan Cheng, Luis Penaranda, Marc Pouget and Sylvain Lazard
- Contact: Sylvain Lazard
- URL: http://vegas.loria.fr/isotop/

6.2. CGAL Package : 3D periodic regular triangulations

KEYWORDS: Flat torus - CGAL - Geometry - Geometric computing - Voronoi diagram - Delaunay triangulation - Triangulation

FUNCTIONAL DESCRIPTION: This class of CGAL (Computational Geometry Algorithms Library http://www.cgal.org) allows to build and handle periodic regular triangulations whose fundamental domain is a cube in 3D. Triangulations are built incrementally and can be modified by insertion of weighted points or removal of vertices. They offer location facilities for weighted points. The class offers nearest neighbor queries for the additively weighted distance and primitives to build the dual weighted Voronoi diagrams.

- Participants: Aymeric Pellé, Mael Rouxel-Labbe and Monique Teillaud
- Contact: Monique Teillaud
- URL: https://doc.cgal.org/latest/Manual/packages.html#PkgPeriodic3Triangulation3Summary

6.3. CGAL Package : 2D hyperbolic triangulations

KEYWORDS: Geometry - Delaunay triangulation - Hyperbolic space

FUNCTIONAL DESCRIPTION: This package implements the construction of Delaunay triangulations in the Poincaré disk model.

- Authors: Mikhail Bogdanov, Olivier Devillers and Monique Teillaud
- Contact: Monique Teillaud
- Publication: Hyperbolic Delaunay Complexes and Voronoi Diagrams Made Practical
- URL: https://github.com/CGAL/cgal-public-dev/tree/Hyperbolic_triangulation_2-MBogdanov

6.4. CGAL Package : 2D periodic hyperbolic triangulations

KEYWORDS: Geometry - Delaunay triangulation - Hyperbolic space

FUNCTIONAL DESCRIPTION: This module implements the computation of Delaunay triangulations of the Bolza surface.

- Authors: Iordan Iordanov and Monique Teillaud
- Contact: Monique Teillaud
- Publication: Implementing Delaunay Triangulations of the Bolza Surface
- URL: https://github.com/CGAL/cgal-public-dev/tree/Periodic_4_hyperbolic_triangulation_2-IIordanov

<p align="center" style="color:red">PESTO Project-Team</p>

6. New Software and Platforms

6.1. Akiss

AKISS: Active Knowledge in Security Protocols
KEYWORDS: Security - Verification
FUNCTIONAL DESCRIPTION: Akiss (Active Knowledge in Security Protocols) is a tool for verifying indistinguishability properties in cryptographic protocols, modelled as trace equivalence in a process calculus. Indistinguishability is used to model a variety of properties including anonymity properties, strong versions of confidentiality and resistance against offline guessing attacks, etc. Akiss implements a procedure to verify equivalence properties for a bounded number of sessions based on a fully abstract modelling of the traces of a bounded number of sessions of the protocols into first-order Horn clauses and a dedicated resolution procedure. The procedure can handle a large set of cryptographic primitives, namely those that can be modeled by an optimally reducing convergent rewrite system.

- Contact: Steve Kremer
- URL: https://github.com/akiss

6.2. Belenios

Belenios - Verifiable online voting system
KEYWORD: E-voting
FUNCTIONAL DESCRIPTION: Belenios is an online voting system that provides confidentiality and verifiability. End-to-end verifiablity relies on the fact that the ballot box is public (voters can check that their ballots have been received) and on the fact that the tally is publicly verifiable (anyone can recount the votes). Confidentiality relies on the encryption of the votes and the distribution of the decryption key.

Belenios builds upon Helios, a voting protocol used in several elections. The main design enhancement of Belenios vs Helios is that the ballot box can no longer add (fake) ballots, due to the use of credentials.

- Participants: Pierrick Gaudry, Stéphane Glondu and Véronique Cortier
- Partners: CNRS - Inria
- Contact: Stéphane Glondu
- URL: http://belenios.gforge.inria.fr/

6.3. CL-AtSe

Constraint Logic based Attack Searcher
KEYWORDS: Security - Verification - Web Services
FUNCTIONAL DESCRIPTION: CL-AtSe is a Constraint Logic based Attack Searcher for security protocols and services. The main idea in CL-AtSe consists in running the protocol or set of services in all possible ways by representing families of traces with positive or negative constraints on the intruder knowledge, on variable values, on sets, etc. Thus, each run of a service step consists in adding new constraints on the current intruder and environment state, reducing these constraints down to a normalized form for which satisfiability is easily decidable, and decide whether some security property has been violated up to this point.

- Participants: Mathieu Turuani and Tigran Avanesov
- Contact: Mathieu Turuani
- URL: https://cassis.loria.fr/wiki/Wiki.jsp?page=Cl-Atse

6.4. Deepsec

DEciding Equivalence Properties in SECurity protocols
KEYWORDS: Security - Verification
FUNCTIONAL DESCRIPTION: DeepSec (DEciding Equivalence Properties in SECurity protocols) is a tool
for verifying indistinguishability properties in cryptographic protocols, modelled as trace equivalence in a
process calculus. Indistinguishability is used to model a variety of properties including anonymity properties,
strong versions of confidentiality and resistance against offline guessing attacks, etc. DeepSec implements a
decision procedure to verify trace equivalence for a bounded number of sessions and cryptographic primitives
modeled by a subterm convergent destructor rewrite system. The procedure is based on constraint solving
techniques. Several new features are currently being developed including the possibility to verify labelled
bisimilarity and session equivalence. Optimizations to improve efficiency and interface improvements are also
under development.

- Contact: Vincent Cheval
- URL: https://github.com/DeepSec-prover/deepsec

6.5. Tamarin

TAMARIN prover
KEYWORDS: Security - Verification
FUNCTIONAL DESCRIPTION: The TAMARIN prover is a security protocol verification tool that supports
both falsification and unbounded verification of security protocols specified as multiset rewriting systems with
respect to (temporal) first-order properties and a message theory that models Diffie-Hellman exponentiation,
bilinear pairing, multisets, and exclusive-or (XOR), combined with a user-defined convergent rewriting theory.
Its main advantages are its ability to handle stateful protocols and its interactive proof mode. Moreover, it has
recently been extended to verify equivalence properties. The tool is developed jointly by the PESTO team, the
Institute of Information Security at ETH Zurich, and the University of Oxford. In a joint effort, the partners
wrote and published a user manual in 2016, available from the Tamarin website.

- Contact: Jannik Dreier
- URL: http://tamarin-prover.github.io/

6.6. SAPIC

SAPIC: Stateful Applied Pi Calculus
KEYWORDS: Security - Verification
FUNCTIONAL DESCRIPTION: SAPIC is a tool that translates protocols from a high-level protocol description
language akin to the applied pi-calculus into multiset rewrite rules, that can then be analysed using the
TAMARIN prover. TAMARIN has also been extended with dedicated heuristics that exploit the form of
translated rules and favor termination.

SAPIC offers support for the analysis of protocols that include states, for example Hardware Security Tokens
communicating with a possibly malicious user, or protocols that rely on databases. It also allows us to
verify liveness properties and a recent extension adds a notion of location and reporting used for modelling
trusted execution environments. It has been successfully applied on several case studies including the Yubikey
authentication protocol, and extensions of the PKCS#11 standard. SAPIC also includes support for verifying
liveness properties, which are for instance important in fair exchange and contract signing protocols, as well
as support for constructions useful when modelling isolated execution environments.

SAPIC has been integrated as a plugin in TAMARIN and is now part of the TAMARIN distribution.

- Contact: Steve Kremer
- URL: http://sapic.gforge.inria.fr/

6.7. TypeEquiv

A type checker for privacy properties

KEYWORDS: Security - Cryptographic protocol - Privacy

FUNCTIONAL DESCRIPTION: TypeEquiv takes as input the specification of a pair of security protocols, written in a dialect of the applied-pi calculus, together with some type annotations. It checks whether the two protocols are in equivalence or not.

- Partner: Technische Universität Wien
- Contact: Véronique Cortier

VERIDIS Project-Team

6. New Software and Platforms

6.1. Redlog

Reduce Logic System

KEYWORDS: Computer algebra system (CAS) - First-order logic - Constraint solving

SCIENTIFIC DESCRIPTION: Redlog is an integral part of the interactive computer algebra system Reduce. It supplements Reduce's comprehensive collection of powerful methods from symbolic computation by supplying more than 100 functions on first-order formulas.

Redlog generally works with interpreted first-order logic in contrast to free first-order logic. Each first-order formula in Redlog must exclusively contain atoms from one particular Redlog-supported theory, which corresponds to a choice of admissible functions and relations with fixed semantics. Redlog-supported theories include Nonlinear Real Arithmetic (Real Closed Fields), Presburger Arithmetic, Parametric QSAT, and many more.

NEWS OF THE YEAR: In 2017, there was a strong focus on applications of Redlog. With the final phase of the ANR-DFG Project SMArT, Redlog was integrated with the SMT solver veriT. That combination, as well as a stand-alone version of Redlog, participated in the SMT competition SMTCOMP 2017. All configurations performed very well, the stand-alone version won the category NRA (nonlinear real arithmetic).

On the scientific side, we made significant progress with the symbolic bifurcation analysis for biological networks.

Redlog technology for biological network analysis from last year, viz. subtropical solving, has raised considerable attention in the SMT community, where it has been adopted and triggered new research.

- Participant: Thomas Sturm
- Contact: Thomas Sturm
- URL: http://www.redlog.eu/

6.2. SPASS

KEYWORD: First-order logic

SCIENTIFIC DESCRIPTION: The classic SPASS is an automated theorem prover based on superposition that handles first-order logic with equality and several extensions for particular classes of theories. With version SPASS 3.9 we have stopped the development of the classic prover and have started the bottom-up development of SPASS 4.0 that will actually be a workbench of automated reasoning tools. Furthermore, we use SPASS 3.9 as a test bed for the development of new calculi.

Meanwhile we have released the second version of SPASS-IQ, our solver for linear integer arithmetic that we are currently extending to real and mixed real-integer arithmetic. We didn't release SPASS-SATT yet, instead we further investigated the use of redundancy elimination in SAT solving and underlying implementation techniques. Our aim is a new approach to SAT solving that needs fewer conflicts (on average) *and* is faster than the current state-of-the art solvers. Furthermore, we have developed a new calculus and first prototypical implementation of a SAT solver with mixed OR/XOR clauses.

SPASS 3.9 has been used as the basis for SPASS-AR, an new approximation refinement theorem proving approach.

FUNCTIONAL DESCRIPTION: SPASS is an automated theorem prover based on superposition that handles first-order logic with equality and several extensions for particular classes of theories.

- Contact: Christoph Weidenbach
- URL: http://www.spass-prover.org/

6.3. TLAPS

TLA+ proof system

KEYWORD: Proof assistant

FUNCTIONAL DESCRIPTION: TLAPS is a platform for developing and mechanically verifying proofs about TLA+ specifications. The TLA+ proof language is hierarchical and explicit, allowing a user to decompose the overall proof into proof steps that can be checked independently. TLAPS consists of a proof manager that interprets the proof language and generates a collection of proof obligations that are sent to backend verifiers. The current backends include the tableau-based prover Zenon for first-order logic, Isabelle/TLA+, an encoding of TLA+ set theory as an object logic in the logical framework Isabelle, an SMT backend designed for use with any SMT-lib compatible solver, and an interface to a decision procedure for propositional temporal logic.

NEWS OF THE YEAR: In 2017, we have continued to work on a complete reimplementation of the proof manager. Its objectives are a cleaner interaction with the TLA$^+$ front-ends, in particular SANY, the standard parser and semantic analyzer. The reimplementation is also necessary for extending the scope of the fragment of TLA$^+$ that is handled by TLAPS, in particular full temporal logic and module instantiation.

- Participants: Damien Doligez, Stephan Merz and Martin Riener
- Contact: Stephan Merz
- URL: https://tla.msr-inria.inria.fr/tlaps/content/Home.html

6.4. veriT

KEYWORDS: Automated deduction - Formula solving - Verification

SCIENTIFIC DESCRIPTION: veriT comprises a SAT solver, a decision procedure for uninterpreted symbols based on congruence closure, a simplex-based decision procedure for linear arithmetic, and instantiation-based quantifier handling.

FUNCTIONAL DESCRIPTION: VeriT is an open, trustable and efficient SMT (Satisfiability Modulo Theories) solver, featuring efficient decision procedure for uninterpreted symbols and linear arithmetic, and quantifier reasoning.

NEWS OF THE YEAR: Efforts in 2017 have been focused on non-linear arithmetic reasoning and quantifier handling. The reasoning capabilities of veriT have been significantly improved along those two axes.

The veriT solver participated in the SMT competition SMT-COMP 2017 with good results.

We target applications where validation of formulas is crucial, such as the validation of TLA$^+$ and B specifications, and work together with the developers of the respective verification platforms to make veriT even more useful in practice. The solver is available as a plugin for the Rodin platform, it is integrated within the Atelier B.

- Participants: Haniel Barbosa, Daniel El Ouraoui, Pascal Fontaine and Hans-Jörg Schurr
- Partner: Université de Lorraine
- Contact: Pascal Fontaine
- URL: http://www.veriT-solver.org

6.5. Nunchaku

The Nunchaku Higher-Order Model Finder

KEYWORDS: Proof - Higher-order logic

SCIENTIFIC DESCRIPTION: Nunchaku is a model finder for higher-order logic, with dedicated support for various definitional principles. It is designed to work as a backend for various proof assistants (notably Isabelle/HOL and Coq) and to use state-of-the-art model finders and other solvers as backends.

FUNCTIONAL DESCRIPTION: Nunchaku is a model finder (counterexample generator) for higher-order logic.

NEWS OF THE YEAR: A noteworthy development this year is the creation of a backend called SMBC, based on new ideas by Cruanes about how to combine SAT solving and narrowing.

- Participants: Jasmin Christian Blanchette and Simon Cruanes
- Contact: Jasmin Christian Blanchette
- URL: https://github.com/nunchaku-inria

<p align="center">**SPHINX Project-Team**</p>

6. New Software and Platforms

6.1. GetDDM

KEYWORDS: Large scale - 3D - Domain decomposition - Numerical solver
FUNCTIONAL DESCRIPTION: GetDDM combines GetDP and Gmsh to solve large scale finite element problems using optimized Schwarz domain decomposition methods.

- Contact: Xavier Antoine
- URL: http://onelab.info/wiki/GetDDM

6.2. GPELab

Gross-Pitaevskii equations Matlab toolbox
KEYWORDS: 3D - Quantum chemistry - 2D
FUNCTIONAL DESCRIPTION: GPELab is a Matlab toolbox developed to help physicists for computing ground states or dynamics of quantum systems modeled by Gross-Pitaevskii equations. This toolbox allows the user to define a large range of physical problems (1d-2d-3d equations, general nonlinearities, rotation term, multi-components problems...) and proposes numerical methods that are robust and efficient.

- Contact: Xavier Antoine
- URL: http://gpelab.math.cnrs.fr/

TOSCA Project-Team

6. New Software and Platforms

6.1. MOC

Models Of Chemostat
KEYWORD: Simulator
FUNCTIONAL DESCRIPTION: MOC (for Models of Chemostat) is a Python simulator of four chemostat models: a mass-structured stochastic individual based model, a mass-structured integro-differential model, the Crump-Young model and a system of ordinary differential equations. This software allows to simulate one or several of those models with different parameters, to plot graphics of evolution of biomass concentration, number of bacteria and substrate concentration as well as the phase portrait, to determine the law of the extinction time of the bacterial population in case of population extinction.

- Participants: Coralie Fritsch and Fabien Campillo
- Contact: Coralie Fritsch
- URL: https://github.com/coraliefritsch/modelsOfChemostat

6.2. AWFController

Acoustic Wind Farm Controller
KEYWORDS: Matlab - Noise - Control
SCIENTIFIC DESCRIPTION: AWFController is a matlab module dedicated to a real time application that performs acoustic control of wind farms based on microphones set near surrounding housings. It computes the optimal command for each wind turbine at each time-step to fullfil the law criteria of acoustic annoyance while maximizing the electric production. It uses local weather measurements (wind speeds and directions) and wind turbines noise estimates computed by an audio source separation algorithm on the acoustic measurements.
FUNCTIONAL DESCRIPTION: Nowadays, wind farm owners have to reduce the velocity of their wind turbines to comply with the regulation on acoustic annoyance. However, the variability of perceived noise due to weather variations makes optimization hard to achieve. AWFController is developed along with an industrial project in order to improve the optimization by adapting wind turbines speeds in regards to acoustic measurements of permanent sensors. It computes optimal command from acoustic measurements and meteo data.

- Participants: Baldwin Dumortier, Emmanuel Vincent and Madalina Deaconu
- Contact: Baldwin Dumortier

BIGS Project-Team

5. New Software and Platforms

5.1. Angio-Analytics

KEYWORDS: Health - Cancer - Biomedical imaging
SCIENTIFIC DESCRIPTION: This tool allows the pharmacodynamic characterization of anti-vascular effects in anti-cancer treatments. It uses time series of in vivo images provided by intra-vital microscopy. Such in vivo images are obtained owing to skinfold chambers placed on mice skin. The automatized analysis is split up into two steps that were completely performed separately and manually before. The first steps corresponds to image processing to identify characteristics of the vascular network. The last step is the system identification of the pharmacodynamic response and the statistical analysis of the model parameters.
FUNCTIONAL DESCRIPTION: Angio-Analytics allows the pharmacodynamic characterization of anti-vascular effects in anti-cancer treatments.

- Participant: Thierry Bastogne
- Contact: Thierry Bastogne

5.2. In silico

In silico design of nanoparticles for the treatment of cancers by enhanced radiotherapy
KEYWORDS: Bioinformatics - Cancer - Drug development
FUNCTIONAL DESCRIPTION: To speed up the preclinical development of medical engineered nanomaterials, we have designed an integrated computing platform dedicated to the virtual screening of nanostructured materials activated by X-ray making it possible to select nano-objects presenting interesting medical properties faster. The main advantage of this in silico design approach is to virtually screen a lot of possible formulations and to rapidly select the most promising ones. The platform can currently handle the accelerated design of radiation therapy enhancing nanoparticles and medical imaging nano-sized contrast agents as well as the comparison between nano-objects and the optimization of existing materials.

- Participant: Thierry Bastogne
- Contact: Thierry Bastogne

5.3. SesIndexCreatoR

FUNCTIONAL DESCRIPTION: This package allows computing and visualizing socioeconomic indices and categories distributions from datasets of socioeconomic variables (These tools were developed as part of the EquitArea Project, a public health program).

- Participants: Benoît Lalloué, Jean-Marie Monnez, Nolwenn Le Meur and Severine Deguen
- Contact: Benoît Lalloué
- URL: http://www.equitarea.org/documents/packages_1.0-0/

<p style="text-align:center;color:red;font-weight:bold;">CAPSID Project-Team</p>

6. New Software and Platforms

6.1. Hex

KEYWORDS: 3D rendering - Bioinformatics - 3D interaction - Structural Biology

SCIENTIFIC DESCRIPTION: Hex is an interactive protein docking and molecular superposition program for Linux Mac-OS and Windows-XP. Hex understands protein and DNA structures in PDB format, and it can also read small-molecule SDF files. The recent versions now include CUDA support for Nvidia GPUs. On a modern workstation, docking times range from a few minutes or less when the search is constrained to known binding sites, to about half an hour for a blind global search (or just a few seconds with CUDA).

FUNCTIONAL DESCRIPTION: The underlying algorithm uses a novel polar Fourier correlation technique to accelerate the search for close-fitting orientations of the two molecules.

- Participant: David Ritchie
- Contact: David Ritchie
- URL: http://hex.loria.fr

6.2. Kbdock

KEYWORD: 3D interaction

SCIENTIFIC DESCRIPTION: Kbdock is a database of 3D protein domain-domain interactions with a web interface.

FUNCTIONAL DESCRIPTION: The Kbdock database is built from a snapshot of the Protein Databank (PDB) in which all 3D structures are cut into domains according to the Pfam domain description. A web interface allows 3D domain-domain interactions to be compared by Pfam family.

- Authors: Anisah Ghoorah, Anisah Ghoorah, David Ritchie and Marie-Dominique Devignes
- Contact: David Ritchie
- URL: http://kbdock.loria.fr

6.3. Kpax

KEYWORDS: Bioinformatics - Structural Biology

SCIENTIFIC DESCRIPTION: Kpax is a program for aligning and superposing the 3D structures of protein molecules.

FUNCTIONAL DESCRIPTION: The algorithm uses a Gaussian representation of the protein backbone in order to construct a similarity score based on the 3D overlap of the Gaussians of the proteins to be superposed. Multiple proteins may be aligned together (multiple structural alignment) and databases of protein structures may be searched rapidly.

- Participant: David Ritchie
- Contact: David Ritchie

6.4. Sam

Protein Symmetry Assembler

KEYWORDS: Proteins - Structural Biology

SCIENTIFIC DESCRIPTION: Sam is a program for making symmetrical protein complexes, starting from a single monomer.

FUNCTIONAL DESCRIPTION: The algorithm searches for good docking solutions between protein monomers using a spherical polar Fast Fourier transform correlation in which symmetry restraints are built into the calculation. Thus every candidate solution is guaranteed to have the desired symmetry.

- Authors: David Ritchie and Sergey Grudinin
- Partner: CNRS
- Contact: David Ritchie
- URL: http://sam.loria.fr

6.5. gEMfitter

KEYWORDS: 3D reconstruction - Cryo-electron microscopy - Fitting
SCIENTIFIC DESCRIPTION: A program for fitting high resolution 3D protein structures into low resolution cryo-EM density maps.
FUNCTIONAL DESCRIPTION: A highly parallel fast Fourier transform (FFT) EM density fitting program which can exploit the special hardware properties of modern graphics processor units (GPUs) to accelerate both the translationnal and rotational parts of the correlation search.

- Authors: Van-Thai Hoang and David Ritchie
- Contact: David Ritchie
- URL: http://gem.loria.fr/gEMfitter/

6.6. ECDM

ECDomainMiner
KEYWORD: Functional annotation
SCIENTIFIC DESCRIPTION: EC-DomainMiner uses a recommender-based approach for associating EC (Enzyme Commission) numbers with protein Pfam domains from EC-sequence relationships that have been annotated previously in the SIFTS and Uniprot databases.
FUNCTIONAL DESCRIPTION: A program to associate protein Enzyme Commission numbers with Pfam domains

- Contact: David Ritchie
- URL: http://ecdm.loria.fr

6.7. GODM

GO-DomainMiner
KEYWORD: Functional annotation
FUNCTIONAL DESCRIPTION: GO-DomainMiner is is a graph-based approach for associating GO (gene ontology) terms with protein Pfam domains.

- Contact: David Ritchie
- URL: http://godm.loria.fr

6.8. BLADYG

A Block-centric graph processing framework for LArge Dynamic Graphs
KEYWORDS: Distributed computing - Dynamic graph processing

FUNCTIONAL DESCRIPTION: BLADYG is a block-centric framework that addresses the issue of dynamism in large-scale graphs. BLADYG starts its computation by collecting the graph data from various data sources. After collecting the graph data, BLADYG partitions the input graph into multiple partitions. Each BLADYG worker loads its block/partition and performs both local and remote computations, after which the status of the blocks is updated. The BLADYG coordinator orchestrates the execution of the considered graph operation in order to deal with graph updates.

- Partner: University of Trento
- Contact: Sabeur Aridhi

6.9. Platforms

6.9.1. The MBI Platform

The MBI (Modeling Biomolecular Interactions) platform (http://bioinfo.loria.fr) was established to support collaborations between Inria Nancy – Grand Est and other research teams associated with the University of Lorraine. The platform is a research node of the Institut Français de Bioinformatique (IFB), which is the French national network of bioinformatics platforms (http://www.france-bioinformatique.fr). In 2017, a Galaxy portal (https://galaxyproject.org/) for structural bioinformatics software was added to the platform thanks to funding for an engineer (Antoine Chemardin) from the IFB.

- Contact: Marie-Dominique Devignes

<p align="center" style="color:red">**MIMESIS Team**</p>

6. New Software and Platforms

6.1. SOFA

Simulation Open Framework Architecture

KEYWORDS: Real time - Multi-physics simulation - Medical applications

FUNCTIONAL DESCRIPTION: SOFA is an Open Source framework primarily targeted at real-time simulation, with an emphasis on medical simulation. It is mostly intended for the research community to help develop new algorithms, but can also be used as an efficient prototyping tool. Based on an advanced software architecture, it allows : the creation of complex and evolving simulations by combining new algorithms with algorithms already included in SOFA, the modification of most parameters of the simulation (deformable behavior, surface representation, solver, constraints, collision algorithm, etc.) by simply editing an XML file, the building of complex models from simpler ones using a scene-graph description, the efficient simulation of the dynamics of interacting objects using abstract equation solvers, the reuse and easy comparison of a variety of available methods.

- Participants: Christian Duriez, François Faure, Hervé Delingette and Stéphane Cotin
- Partner: IGG
- Contact: Stéphane Cotin
- URL: http://www.sofa-framework.org

6.2. SofaPardisoSolver

KEYWORDS: Simulation - Linear Systems Solver - Direct solvers - Collision - Numerical simulations

SCIENTIFIC DESCRIPTION: The SofaPardisoSolver allows for fast direct solution of sparse systems of linear equations, using a decomposition (such as LU, LDL and Cholesky) according to the type of the matrix. Moreover, the wrapper allows for employing a partial factorization which brings a significant improvement when solving augmented systems, usually resulting in problems involving collisions and/or domain decomposition.

FUNCTIONAL DESCRIPTION: The SofaPardisoSolver plugin contains a wrapper allowing for an efficient direct solution of a system of linear equations. It also contains an advanced feature which exploits an algorithm of partial decomposition available in Pardiso. This feature significantly accelerates the computation of Schur complement, typically needed to solve linear complementarity problems (LCP). Example of use: collision and contacts.

- Author: Igor Peterlik
- Contact: Igor Peterlik

6.3. SOFA Xray rendering

KEYWORDS: Simulation - Realistic rendering - Real-time rendering - Medical imaging - Medical applications

FUNCTIONAL DESCRIPTION: This work allows to emulate a X-ray scan image within the simulation platform SOFA. By defining the position of an emitter and receptor in the 3D space, an image is rendered. A realistic medical image of organs can thus be obtained from surface meshes (triangulated or quadrangulated) in real-time.

Version compatible with SOFA v17.06

- Authors: Stéphane Cotin and Frédérick Roy
- Contact: Stéphane Cotin

NEUROSYS Project-Team

6. New Software and Platforms

6.1. BrianModel

Library of Brian Neuron Models
KEYWORDS: Spiking neural networks - Neurosciences - Numerical simulations
FUNCTIONAL DESCRIPTION: BrianModel is a library of neuron models and ionic currents for the BRIAN simulator. The purpose of BrianModel is to speed up simulation set-up and reduce code duplication across simulation scripts. Template neurons are defined by the ionic currents that flow through their membrane. Implemented templates include: Hodgkin-Huxley pyramidal neuron, Hodgkin-Huxley pyramidal neuron with CAN receptors, Hodgkin-Huxley fast-spiking inhibitory hippocampal. The current library is easily extensible by third-party users due to its hierarchical design. The template neurons and their currents are defined as YAML files, which are conveniently parsed by a Python library which acts as an interface to the BRIAN simulator API's.

- Contact: Francesco Giovannini
- URL: https://github.com/JoErNanO/brianmodel

6.2. OpenVIBE

KEYWORDS: Neurosciences - Interaction - Virtual reality - Health - Real time - Neurofeedback - Brain-Computer Interface - EEG - 3D interaction
FUNCTIONAL DESCRIPTION: OpenViBE is a free and open-source software platform devoted to the design, test and use of Brain-Computer Interfaces (BCI). The platform consists of a set of software modules that can be integrated easily and efficiently to design BCI applications. The key features of OpenViBE software are its modularity, its high-performance, its portability, its multiple-users facilities and its connection with high-end/VR displays. The designer of the platform enables to build complete scenarios based on existing software modules using a dedicated graphical language and a simple Graphical User Interface (GUI). This software is available on the Inria Forge under the terms of the AGPL licence, and it was officially released in June 2009. Since then, the OpenViBE software has already been downloaded more than 40000 times, and it is used by numerous laboratories, projects, or individuals worldwide. More information, downloads, tutorials, videos, documentations are available on the OpenViBE website.

- Participants: Cédric Riou, Thierry Gaugry, Anatole Lécuyer, Fabien Lotte, Jussi Tapio Lindgren, Laurent Bougrain, Maureen Clerc Gallagher and Théodore Papadopoulo
- Partners: INSERM - CEA-List - GIPSA-Lab
- Contact: Anatole Lécuyer
- URL: http://openvibe.inria.fr

6.3. Platforms

6.3.1. EEG experimental room

A room at Inria Nancy - Grand Est is dedicated to electroencephalographic recordings. An umbrella agreement and several additional experiment descriptions have been approved by the Inria Operational Legal and Ethical Risk Assessment Committee (COERLE). Our Biosemi EEG amplifier has been extended this year to record 128 channels (Regional initiative *Contrat de Projet État Région (CPER) IT2MP* see section 8.1).

Figure 1. Electroencephalographic Experimental room at Inria Nancy-Grand Est

<p align="center" style="color:red">TONUS Team</p>

6. New Software and Platforms

6.1. CLAC

Conservation Laws Approximation on many Cores

SCIENTIFIC DESCRIPTION: It is clear now that future computers will be made of a collection of thousands of interconnected multicore processors. Globally it appears as a classical distributed memory MIMD machine. But at a lower level, each of the multicore processors is itself made of a shared memory MIMD unit (a few classical CPU cores) and a SIMD unit (a GPU). When designing new algorithms, it is important to adapt them to this kind of architecture. Our philosophy will be to program our algorithms in such a way that they can be run efficiently on this kind of computers. Practically, we will use the MPI library for managing the coarse grain parallelism, while the OpenCL library will efficiently operate the fine grain parallelism.

We have invested for several years until now into scientific computing on GPUs, using the open standard OpenCL (Open Computing Language). We were recently awarded a prize in the international AMD OpenCL innovation challenge thanks to an OpenCL two-dimensional Vlasov-Maxwell solver that fully runs on a GPU. OpenCL is a very interesting tool because it is an open standard now available on almost all brands of multicore processors and GPUs. The same parallel program can run on a GPU or a multicore processor without modification.

Because of the envisaged applications of CLAC, which may be either academic or commercial, it is necessary to conceive a modular framework. The heart of the library is made of generic parallel algorithms for solving conservation laws. The parallelism can be both fine-grained (oriented towards GPUs and multicore processors) and coarse-grained (oriented towards GPU clusters). The separate modules allow managing the meshes and some specific applications. In this way, it is possible to isolate parts that should be protected for trade secret reasons.

FUNCTIONAL DESCRIPTION: CLAC is a generic Discontinuous Galerkin solver, written in C/C++, based on the OpenCL and MPI frameworks.

- Partner: AxesSim
- Contact: Philippe Helluy
- URL: http://clac.gforge.inria.fr/

6.2. Selalib

SEmi-LAgrangian LIBrary

KEYWORDS: Plasma physics - Semilagrangian method - Parallel computing - Plasma turbulence

SCIENTIFIC DESCRIPTION: The objective of the Selalib project (SEmi-LAgrangian LIBrary) is to develop a well-designed, organized and documented library implementing several numerical methods for kinetic models of plasma physics. Its ultimate goal is to produce gyrokinetic simulations.

Another objective of the library is to provide to physicists easy-to-use gyrokinetic solvers, based on the semi-lagrangian techniques developed by Eric Sonnendrücker and his collaborators in the past CALVI project. The new models and schemes from TONUS are also intended to be incorporated into Selalib.

FUNCTIONAL DESCRIPTION: Selalib is a collection of modules conceived to aid in the development of plasma physics simulations, particularly in the study of turbulence in fusion plasmas. Selalib offers basic capabilities from general and mathematical utilities and modules to aid in parallelization, up to pre-packaged simulations.

- Partners: Max Planck Insitute - Garching - Université de Strasbourg
- Contact: Philippe Helluy
- URL: http://selalib.gforge.inria.fr/

6.3. SCHNAPS

Solver for Conservative Hyperbolic Nonlinear Applications for PlasmaS

KEYWORDS: Discontinuous Galerkin - StarPU - Kinetic scheme

FUNCTIONAL DESCRIPTION: Generic systems of conservation laws. Specific models: fluids, Maxwell, Vlasov, acoustics (with kinetic representation). Multitasking with StarPU. Explicit solvers (RK2, RK3, RK4): accelerated with OpenCL Implicit solvers: through kinetic representations and palindromic time integration.

- Contact: Philippe Helluy
- URL: http://schnaps.gforge.inria.fr/

<h1 style="color:red; text-align:center">COAST Project-Team</h1>

4. New Software and Platforms

4.1. BeGoood

FUNCTIONAL DESCRIPTION: BeGoood is a generic system for managing non-regression tests on knowledge bases. BeGoood allows to define test plans in order to monitor the evolution of knowledge-bases. Any system answering queries by providing results in the form of set of strings can be tested with BeGoood. BeGoood has been developed following a REST architecture and is independent of any application domain. BeGoood is a part of the Kolflow infrastructure.

- Participant: Gérôme Canals
- Contact: Gérôme Canals
- URL: https://github.com/kolflow/begoood

4.2. MUTE

Multi-User Text Editor

FUNCTIONAL DESCRIPTION: MUTE (Multi-User Text Editor) is a web-based text editing tool that allows to edit documents collaboratively in real-time. It implements our recent work on collaborative editing algorithms and more specifically the LogootSplit+ approach. Compared to existing web-based collaborative text editing tool this editor does not require a powerful central server since the server is not performing any computation and acts as a simple broadcast server. Our editor offers support for working offline while still being able to reconnect at a later time.

- Participants: Claudia-Lavinia Ignat, François Charoy, Gérald Oster and Luc André
- Contact: Gérald Oster
- URL: https://github.com/coast-team/mute-demo/

4.3. Replication Benchmarker

FUNCTIONAL DESCRIPTION: The Replication Benchmarker is a performance evaluation framework for optimistic replication mechanisms used in collaborative applications. It contains a library of implementation of several CRDT (Commutative Replicated Data Type) and OT (Operational Transformation) algorithms for different data types: text, set, trees. The framework is able to evaluate the performance of comparable algorithms on different corpus of events traces. These events traces can be produced randomly according to different parameters, can be extracted from real real-time editing session that have been recorded, or can be automatically extracted from distributed version control repositories such as the one produced with Git. Performances of the algorithms are measured in term of execution time, memory footprint and merge result quality (compared to manual merge history stored in git repositories).

- Participants: Gérald Oster, Mehdi Ahmed-Nacer and Pascal Urso
- Contact: Pascal Urso
- URL: https://github.com/score-team/replication-benchmarker/

4.4. Rivage

Real-tIme Vector grAphic Group Editor

FUNCTIONAL DESCRIPTION: Rivage is a real-time collaborative graphical editor. Several users can edit at the same time and in real-time a graphical document, user changes being immediately seen by the other users. The editor relies on a peer-to-peer architecture where users can join and leave the group at any time. Each user has a copy of the shared document and user changes on the document copies are merged in real-time by using a CRDT (Commutative Replicated Data Type) algorithm.

- Participant: Claudia-Lavinia Ignat
- Contact: Claudia-Lavinia Ignat
- URL: https://github.com/stephanemartin/rivage/

MADYNES Team

6. New Software and Platforms

6.1. Distem

KEYWORDS: Large scale - Experimentation - Virtualization - Emulation

FUNCTIONAL DESCRIPTION: Distem is a distributed systems emulator. When doing research on Cloud, P2P, High Performance Computing or Grid systems, it can be used to transform an homogenenous cluster (composed of identical nodes) into an experimental platform where nodes have different performance, and are linked together through a complex network topology, making it the ideal tool to benchmark applications targetting such environments, or aiming at tolerating performance degradations or variations which are frequent in the Cloud or in other applications distributed at large scale (P2P for example).

- Participants: Luc Sarzyniec, Lucas Nussbaum and Tomasz Buchert
- Partners: CNRS - Université de Lorraine - Loria - Grid'5000 - Inria
- Contact: Lucas Nussbaum
- URL: http://distem.gforge.inria.fr

6.2. Grid'5000 testbed

FUNCTIONAL DESCRIPTION: Grid'5000 is a scientific instrument designed to support experiment-driven research in all areas of computer science related to parallel, large-scale or distributed computing and networking. It gathers 10 sites, 25 clusters, 1200 nodes, for a total of 8000 cores. It provides its users with a fully reconfigurable environment (bare metal OS deployment with Kadeploy, network isolation with KaVLAN) and a strong focus on enabling high-quality, reproducible experiments.

- Participants: Arthur Garnier, Clement Parisot, Émile Morel, Emmanuel Jeanvoine, Jérémie Gaidamour, Luc Sarzyniec and Lucas Nussbaum
- Contact: Lucas Nussbaum
- URL: https://www.grid5000.fr/

6.3. Kadeploy

KEYWORD: Operating system provisioning

FUNCTIONAL DESCRIPTION: Kadeploy is a scalable, efficient and reliable deployment (provisioning) system for clusters and grids. It provides a set of tools for cloning, configuring (post installation) and managing cluster nodes. It can deploy a 300-nodes cluster in a few minutes, without intervention from the system administrator. It plays a key role on the Grid'5000 testbed, where it allows users to reconfigure the software environment on the nodes, and is also used on a dozen of production clusters both inside and outside Inria.

- Participants: Emmanuel Jeanvoine, Luc Sarzyniec and Lucas Nussbaum
- Partners: CNRS - Université de Lorraine - Loria - Grid'5000 - Inria
- Contact: Lucas Nussbaum
- URL: http://kadeploy3.gforge.inria.fr

6.4. MECSYCO-RE-C++

en Multi-agent Environment for Complex SYstems COsimulation. Coeur C++

KEYWORDS: Agent - Multi-agent - Multi-model - Simulator - Simulation - Modeling - Artefact

FUNCTIONAL DESCRIPTION: MECSYCO is a project aiming at the modeling and simulation of complex systems. It provides concepts and tools to describe and then simulate a system as a set of heterogeneous models (namely a multi-model). MECSYCO-RE-C++ is the C++ implementation of the central part (core) of MECSYCO. It can be complimente by mecsyco-com (a communication package for distributed exécution) and mecsyco-visu (a set of tools for vizualizaing simulations).

- Participants: Benjamin Camus, Benjamin Segault, Julien Vaubourg, Laurent Ciarletta, Nicolas Kirchner, Victorien Elvinger, Vincent Chevrier and Yannick Presse
- Partners: Université de Lorraine - Inria
- Contact: Vincent Chevrier

6.5. MECSYCO-RE-java

Multi-agent Environment for Complex SYstems COsimulation. Coeur java

KEYWORDS: Agent - Multi-agent - Co-simulation - Multi-model - Simulator - Simulation - Modeling - Artefact

FUNCTIONAL DESCRIPTION: MECSYCO is a project aiming at the modeling and simulation of complex systems. It provides concepts and tools to describe and then simulate a system as a set of heterogeneous models (namely a multi-model). MECSYCO-RE-java is the Java implementation of the central part (core) of MECSYCO. It can be complemented by mecsyco-com (a communication package for distributed exécution) and mecsyco-visu (a set of tools for vizualizaing simulations).

- Participants: Benjamin Camus, Christine Bourjot, Julien Siebert, Julien Vaubourg, Laurent Ciarletta, Victorien Elvinger, Vincent Chevrier and Yannick Presse
- Partners: Université de Lorraine - Inria
- Contact: Vincent Chevrier
- URL: http://www.mecsyco.com

6.6. Ruby-cute

KEYWORDS: Experimentation - HPC - Cloud

FUNCTIONAL DESCRIPTION: Ruby-Cute is a set of Commonly Used Tools for Experiments, or Critically Useful Tools for Experiments, depending on who you ask. It is a library aggregating various Ruby snippets useful in the context of (but not limited to) development of experiment software on distributed systems testbeds such as Grid'5000.

- Contact: Lucas Nussbaum
- URL: http://ruby-cute.github.io/

6.7. Platforms

6.7.1. CPS Security Assessment Platform

This year, we have extended our Cyber-Physical systems security assessment platform with new hardware components including multiple types of Programmable Logic Controllers (PLS) and a small scale distribution and sorting testbed. The physical platform is also extended with several IoT devices dedicated to residential networks (heating control, lightning system, home gateways, etc). The platform will be mainly used for building security assessmenet and evaluation experimentation on the available devices to identify and validate their associated attack patterns and discover new vulnerabilities.

ALICE Project-Team

6. New Software and Platforms

6.1. Graphite

Graphite: The Numerical Geometry Workbench

KEYWORDS: 3D modeling - Numerical Geometry - Texturing - Lighting - CAD - Visualization

SCIENTIFIC DESCRIPTION: Graphite is an experimental 3D modeler, built in top of the Geogram programming library. It has data structures and efficient OpenGL visualization for pointsets, surfacic meshes (triangles and polygons), volumetric meshes (tetrahedra and hybrid meshes). It has state-of-the-art mesh repair, remeshing, reconstruction algorithms. It also has an interface to the Tetgen tetrahedral mesh generator (by Hang Si). This year, Graphite3 was released. It is a major rewrite, based on Geogram, with increased software quality standards (zero warnings on all platforms, systematic documentation of all classes / all functions / all parameters, dramatically improved performances). It embeds Geogram (and optionally Vorpaline) with an easy-to-use Graphic User Interface.

FUNCTIONAL DESCRIPTION: Graphite is a dedicated software platform in numerical geometry that enables, among other things, 3D modelling and texture baking.

- Participants: Bruno Lévy, David Lopez, Dobrina Boltcheva, Jeanne Pellerin, Nicolas Ray and Samuel Hornus
- Contact: Bruno Lévy
- URL: http://alice.loria.fr/software/graphite

6.2. GEOGRAM

GEOGRAM : A functions library for geometric programming

KEYWORD: 3D modeling

FUNCTIONAL DESCRIPTION: GEOGRAM is a programming library with a set of basic geometric algorithms, such as search data structures (AABB tree, Kd tree), geometric predicates, triangulations (Delaunay triangulation, Regular triangulation), intersection between a simplicial mesh and a Voronoi diagram (restricted Voronoi diagram). GEOGRAM also includes a code generator for predicates (PCK: Predicate Construction Kit) and an efficient implementation of expansion arithmetics in arbitrary precision. GEOGRAM is shipped with WARP-DRIVE, the first program that computes semi-discrete optimal transport in 3D.

- Participant: Bruno Lévy
- Contact: Bruno Lévy
- URL: http://alice.loria.fr

6.3. OpenNL

Open Numerical Library

KEYWORDS: 3D modeling - Numerical algorithm

SCIENTIFIC DESCRIPTION: Open Numerical Library is a library for solving sparse linear systems, especially designed for the Computer Graphics community. The goal for OpenNL is to be as small as possible, while offering the subset of functionalities required by this application field. The Makefiles of OpenNL can generate a single .c + .h file, very easy to integrate in other projects. The distribution includes an implementation of the Least Squares Conformal Maps parameterization method.

FUNCTIONAL DESCRIPTION: Open Numerical Library is a library for solving sparse linear systems, especially designed for the Computer Graphics community. The goal for OpenNL is to be as small as possible, while offering the subset of functionalities required by this application field.

RELEASE FUNCTIONAL DESCRIPTION: * OpenMP parallel solver * more compact data structures, X2 acceleration * SuperLU weak coupling (dynamically loads SuperLU .so if available) (latest version available as part of geogram http://alice.loria.fr/software/geogram/doc/html/index.html)

- Participants: Bruno Lévy, Nicolas Ray and Rhaleb Zayer
- Contact: Bruno Lévy
- URL: http://alice.loria.fr/index.php/software/4-library/23-opennl.html

6.4. IceSL

KEYWORD: Additive manufacturing
FUNCTIONAL DESCRIPTION: IceSL allows to model complex shapes through CSG boolean operations. Objects can be directly prepared and sent to a 3d printer for fabrication, without the need to compute an intermediate 3D mesh.

- Participants: Frédéric Claux, Jean Hergel, Jérémie Dumas, Jonas Martinez-Bayona, Samuel Hornus and Sylvain Lefebvre
- Contact: Sylvain Lefebvre
- URL: http://shapeforge.loria.fr/icesl/

6.5. LibSL

Simple Library For Graphics
KEYWORDS: 3D - Graphics
FUNCTIONAL DESCRIPTION: LibSL is a toolbox for rapid prototyping of computer graphics algorithms, under both OpenGL, DirectX 9 - 10, Windows and Linux.

- Participant: Sylvain Lefebvre
- Contact: Sylvain Lefebvre

6.6. 3DPrintScaffoldings

KEYWORDS: 3D - 3D modeling - Additive manufacturing
FUNCTIONAL DESCRIPTION: Support generation for additive manufacturing. Optimizes scaffolding made of vertical pillars and horizontal bars that are optimized to use minimal material, be easily removed and support the part at all stages of the fabrication process.

- Participants: Jean Hergel, Jérémie Dumas and Sylvain Lefebvre
- Partner: Université de Lorraine
- Contact: Sylvain Lefebvre
- URL: http://shapeforge.loria.fr/icesl/

6.7. VORPALINE

VORPALINE mesh generator
KEYWORDS: 3D modeling - Unstructured heterogeneous meshes
FUNCTIONAL DESCRIPTION: VORPALINE is a surfacic and volumetric mesh generator, for simplicial meshes (triangles and tetrahedra), for quad-dominant and hex-dominant meshes.

- Participant: Bruno Lévy
- Contact: Bruno Lévy
- URL: http://alice.loria.fr/index.php/erc-vorpaline.html

LARSEN Project-Team

6. New Software and Platforms

6.1. ProMP_iCub

iCub Learning Trajectories with ProMP
KEYWORDS: Gaussian processes - Robotics
FUNCTIONAL DESCRIPTION: A set of matlab modules to learn, replay and infer the continuation of trajectories in robotics using Probabilistic Movement Primitives (ProMP).

- Contact: Serena Ivaldi

- Publication: Prediction of Intention during Interaction with iCub with Probabilistic Movement Primitives

- URL: https://github.com/inria-larsen/icubLearningTrajectories

6.2. Limbo

LIbrary for Model-based Bayesian Optimization
KEYWORDS: Black-box optimization - C++ - Global optimization - Machine learning - Policy Learning - Bayesian optimization - Gaussian processes
FUNCTIONAL DESCRIPTION: Limbo is an open-source C++11 library for Gaussian processes and Bayesian Optimization which is designed to be both highly flexible and very fast. It can be used to optimize functions for which the gradient is unknown, evaluations are expensive, and where runtime cost matters (e.g., on embedded systems or robots). Benchmarks on standard functions show that Limbo is about 2 times faster than BayesOpt (another C++ library) for a similar accuracy.
NEWS OF THE YEAR: Release 2.0 (2017) with: - serialization of Gaussian process models - new architecture for kernel and mean functions - automatic and extensive benchmarks for Gaussian processes regression and Bayesian optimization (generated weekly) - better random generator (thread-safe, c++11) - generation of the documentation for each release

- Partners: UPMC - Imperial College London

- Contact: Jean-Baptiste Mouret

- URL: http://www.resibots.eu/limbo

6.3. xsens_driver

KEYWORD: IMU driver
FUNCTIONAL DESCRIPTION: This is a driver for the third and fourth generation of Xsens IMU devices. The driver is in two parts, a small implementation of most of the MT protocol in Python and a ROS node. It works both on serial and USB interfaces.

These MT* devices can store their configuration and will retrieve it at each boot and then stream data according to this configuration. The node only forwards the data streamed onto ROS topics. In order to configure your device, you can use the mtdevice.py script (or the vendor tool on Windows).

RELEASE FUNCTIONAL DESCRIPTION: Support of fourth generation of devices. Support of ubuntu 16.04. Support of ROS Jade and ROS Kinetic.
NEWS OF THE YEAR: version 2.1.0 (2017-04-14) - several bugfixes and a new option.

- Contact: Francis Colas

- URL: https://github.com/ethz-asl/ethzasl_xsens_driver

6.4. sferes2

A lightweight generic C++ framework for evolutionary computation
FUNCTIONAL DESCRIPTION: Sferes2 is a high-performance, multi-core, lightweight, generic C++98 framework for evolutionary computation. It is intently kept small to stay reliable and understandable.

Sferes2 relies heavily on template-based meta-programming in C++ to get both abstraction and execution speed.

- Partner: UPMC
- Contact: Jean-Baptiste Mouret
- URL: http://github.com/sferes2/sferes2/

6.5. libdynamixel

KEYWORD: Robotics
FUNCTIONAL DESCRIPTION: The libdynamixel is a high-performance C++11 interface to the Dynamixel actuators (including the Dynamixel Pro range). It provides a high-level interface (designed to be easy to sue), a low-level interface (designed to add no overhead on top of the protocol), and a command-line tool for scripting and maintenance operations. The main emphasis is on performance and compatibility with modern C++.

- Contact: Jean-Baptiste Mouret
- URL: http://github.com/resibots/libdynamixel

<p style="text-align:center; color:red;">MAGRIT Project-Team</p>

6. New Software and Platforms

6.1. Ltrack

KEYWORDS: Augmented reality - Visual tracking

FUNCTIONAL DESCRIPTION: The Inria development action LTrack aims at developing an Android platform in order to facilitate the transfer of some of our algorithms onto mobile devices. For the moment, the tracking-by-synthesis algorithm has been implemented (up to our knowledge, for the first time on a mobile device) in order to rigidly track a real object in real time assuming that a CAD model of this object is available. The design and implementation of the platform have been guided by the need to enable easy integration of any tracking algorithm based on combining video data and other sensor information.

NEWS OF THE YEAR: A recovery procedure based on key-frames has been designed when the number of inliers tracked keypoints is too small.

- Contact: Marie-Odile Berger

6.2. PoLAR

Portable Library for Augmented Reality

FUNCTIONAL DESCRIPTION: PoLAR (Portable Library for Augmented Reality) is a framework which aims to help creating graphical applications for augmented reality, image visualization and medical imaging. PoLAR was designed to offer powerful visualization functionalities without the need to be a specialist in Computer Graphics. The framework provides an API to state-of-the-art libraries: Qt to build GUIs and OpenSceneGraph for high-end visualization, for researchers and engineers with a background in Computer Vision to be able to create beautiful AR applications, with little programming effort. The framework is written in C++ and published under the GNU GPL license

- Contact: Erwan Kerrien
- URL: http://polar.inria.fr

6.3. Fast>VP

KEYWORDS: Vanishing points - Image rectification

FUNCTIONAL DESCRIPTION: Fast>VP is a fast and effective tool to detect vanishing points in uncalibrated images of urban or indoor scenes.

This tool also allows automatic rectification of the vertical planes in the scene, namely generating images where these planes appear as if they were observed from a fronto-parallel view.

It is the Matlab implementation of the algorithm described in [6].

- Contact: Gilles Simon
- URL: https://members.loria.fr/GSimon/fastvp/

6.4. TheGridMethod

The grid method toolbox

KEYWORD: Experimental mechanics

FUNCTIONAL DESCRIPTION: This Matlab toolbox implements several efficient and state-of-the art algorithms to estimate displacement and strain fields from grid images deposited on the surface of a specimen submitted to mechanical testing.

- Contact: Frédéric Sur
- URL: http://www.thegridmethod.net/

<p style="text-align:center">**MULTISPEECH Project-Team**</p>

6. New Software and Platforms

6.1. dnnsep

Multichannel audio source separation with deep neural networks

KEYWORDS: Audio - Source Separation - Deep learning

SCIENTIFIC DESCRIPTION: dnnsep is the only source separation software relying on multichannel Wiener filtering based on deep learning. Deep neural networks are used to initialize and reestimate the power spectrum of the sources at every iteration of an expectation-maximization (EM) algorithm. This results in state-of-the-art separation quality for both speech and music.

FUNCTIONAL DESCRIPTION: Combines deep neural networks and multichannel signal processing for speech enhancement and separation of musical recordings.

NEWS OF THE YEAR: In 2017, we changed the type of multichannel filter used and modified the software so that it runs online in real time.

- Participants: Aditya Nugraha, Laurent Pierron, Emmanuel Vincent, Antoine Liutkus, Romain Serizel and Floris Fournier
- Contact: Emmanuel Vincent

6.2. KATS

Kaldi-based Automatic Transcription System

KEYWORD: Speech recognition

FUNCTIONAL DESCRIPTION: KATS is a multipass system for transcribing audio data, and in particular radio or TV shows in French, English or Arabic. It is based on the Kaldi speech recognition tools. It relies on Deep Neural Network (DNN) modeling for speech detection and acoustic modeling of the phones (speech sounds). Higher order statistical language models and recurrent neural network language models can be used for improving performance through rescoring of multiple hypotheses.

NEWS OF THE YEAR: Better acoustic models have been developed for French, English and Arabic languages. An NN-based speech detection module has been included, as well as rescoring with RNN language models.

- Contact: Dominique Fohr

6.3. SOJA

Speech Synthesis platform in JAva

KEYWORDS: Speech Synthesis - Audio

SCIENTIFIC DESCRIPTION: SOJA relies on a non uniform unit selection algorithm. Phonetic and linguistic features are extracted and computed from the text to drive selection of speech units in a recorded corpus. The selected units are concatenated to obtain the speech signal corresponding to the input text.

FUNCTIONAL DESCRIPTION: SOJA is a software for Text-To-Speech synthesis (TTS). It performs all steps from text input to speech signal output. A set of associated tools is available for elaborating a corpus for a TTS system (transcription, alignment. . .). Currently, the corpus contains about 3 hours of speech recorded by a female speaker. Most of the modules are in Java, some are in C. The SOJA software runs under Windows and Linux. It can be launched with a graphical user interface or directly integrated in a Java code or by following the client-server paradigm.

NEWS OF THE YEAR: SOJA now supports the unit selection with emotion tags.

- Participants: Alexandre Lafosse and Vincent Colotte
- Contact: Vincent Colotte

6.4. Xarticulators

KEYWORD: Medical imaging

FUNCTIONAL DESCRIPTION: The Xarticulators software is intended to delineate contours of speech articulators in X-ray and MR images, construct articulatory models and synthesize speech from X-ray films. This software provides tools to track contours automatically, semi-automatically or by hand, to make the visibility of contours easier, to add anatomical landmarks to speech articulators and to synchronize images with the sound. In addition we also added the possibility of processing digitized manual delineation results made on sheets of papers when no software is available. Xarticulators also enables the construction of adaptable linear articulatory models from the X-ray or MR images and incorporates acoustic simulation tools to synthesize speech signals from the vocal tract shape. Recent work was on the possibility of synthesizing speech from 2D-MRI films, and on the construction of better articulatory models for the velum, lips and epiglottis.

NEWS OF THE YEAR: New models of the lips, velum and epiglottis have been added. Xarticulators generates area functions from an MRI film annotated in terms of articulators.

- Contact: Yves Laprie
- Publication: Articulatory model of the epiglottis

6.5. Platforms

6.5.1. Platform MultiMod: Multimodal Acquisition Data Platform

We have set up an acquisition hardware platform to acquire multimodal data in speech communication context. The system was previously composed of the articulograph Carstens AG501 (which was acquired as part of the EQUIPEX ORTOLANG), 4 Vicon cameras (a motion capture system), and an Intel RealSense camera which contains four components: a video camera, an infrared laser projector, an infrared camera, and a microphone array. With such heterogeneous hardware the synchronization is essential; this is achieved through a trigger device. All the data processing is performed with the PLAVIS software.

This year, we have replaced the 4 Vicon cameras by 8 optitrack cameras. The new motion capture system allows acquiring higher spatial and temporal resolution data, and allows faster acquisition and processing.

We are currently using the system to acquire expressive audiovisual data to build an expressive audiovisual speech synthesis in addition to a lipsync system.

- Participants: Slim Ouni, Vincent Colotte, Valerian Girard, Sara Dahmani
- Contact: Slim Ouni

<p align="center" style="color:red">**ORPAILLEUR Project-Team**</p>

6. New Software and Platforms

6.1. ARPEnTAge

Analyse de Régularités dans les Paysages : Environnement, Territoires, Agronomie

KEYWORDS: Stochastic process - Hidden Markov Models

FUNCTIONAL DESCRIPTION: ARPEnTAge is a software based on stochastic models (HMM2 and Markov Field) for analyzing spatio-temporal data-bases. ARPEnTAge is built on top of the CarottAge system to fully take into account the spatial dimension of input sequences. It takes as input an array of discrete data in which the columns contain the annual land-uses and the rows are regularly spaced locations of the studied landscape. It performs a Time-Space clustering of a landscape based on its time dynamic Land Uses (LUS). Displaying tools and the generation of Time-dominant shape files have also been defined.

- Partner: INRA
- Contact: Jean-François Mari
- URL: http://carottage.loria.fr/index_in_english.html

6.2. CarottAge

KEYWORDS: Stochastic process - Hidden Markov Models

FUNCTIONAL DESCRIPTION: The system CarottAge is based on Hidden Markov Models of second order and provides a non supervised temporal clustering algorithm for data mining and a synthetic representation of temporal and spatial data. CarottAge is currently used by INRA researchers interested in mining the changes in territories related to the loss of biodiversity (projects ANR BiodivAgrim and ACI Ecoger) and/or water contamination. CarottAge is also used for mining hydromorphological data. Actually a comparison was performed with three other algorithms classically used for the delineation of river continuum and CarottAge proved to give very interesting results for that purpose.

- Participants: Florence Le Ber and Jean-François Mari
- Partner: INRA
- Contact: Jean-François Mari
- URL: http://carottage.loria.fr/index_in_english.html

6.3. CORON

KEYWORDS: Data mining - Closed itemset - Frequent itemset - Generator - Association rule - Rare itemset

FUNCTIONAL DESCRIPTION: The Coron platform is a KDD toolkit organized around three main components: (1) Coron-base, (2) AssRuleX, and (3) pre- and post-processing modules.

The Coron-base component includes a complete collection of data mining algorithms for extracting itemsets such as frequent itemsets, closed itemsets, generators and rare itemsets. In this collection we can find APriori, Close, Pascal, Eclat, Charm, and, as well, original algorithms such as ZART, Snow, Touch, and Talky-G. AssRuleX generates different sets of association rules (from itemsets), such as minimal non-redundant association rules, generic basis, and informative basis. In addition, the Coron system supports the whole life-cycle of a data mining task and proposes modules for cleaning the input dataset, and for reducing its size if necessary.

- Participants: Adrien Coulet, Aleksey Buzmakov, Amedeo Napoli, Florent Marcuola, Jérémie Bourseau, Laszlo Szathmary, Mehdi Kaytoue, Victor Codocedo and Yannick Toussaint
- Contact: Amedeo Napoli
- URL: http://coron.loria.fr/site/index.php

6.4. Tuuurbine

KEYWORD: Semantic Web

FUNCTIONAL DESCRIPTION: Tuuurbine: a Generic Ontology Guided Case-Based Inference Engine. The experience acquired since 5 years with the Taaable system conducted to the creation of a generic cased-based reasoning system, whose reasoning procedure is based on a domain ontology. This new system, called Tuuurbine, takes into account the retrieval step, the case base organization, and also an adaptation procedure which is not addressed by other generic case-based reasoning tools. Moreover, Tuuurbine is built over semantic web standards that will ensure facilities for being plugged over data available on the web. The domain knowledge is represented in an RDF store, which can be interfaced with a semantic wiki, for collaborative edition and management of the knowledge involved in the reasoning system (cases, ontology, adaptation rules).

- Contact: Emmanuel Nauer
- URL: http://tuuurbine.loria.fr/

6.5. LatViz: Visualization of Concept Lattices

- Contact: Amedeo Napoli
- URL: http://latviz.loria.fr/
- KEYWORDS: Formal Concept Analysis, Pattern Structures, Concept Lattice, Implications, Visualization

FUNCTIONAL DESCRIPTION.

LatViz is a tool allowing the construction, the display and the exploration of concept lattices. LatViz proposes some noticeable improvements over existing tools and introduces various functionalities focusing on interaction with experts, such as visualization of pattern structures for dealing with complex non-binary data, AOC-poset which is composed of the core elements of the lattice, concept annotations, filtering based on various criteria and a visualization of implications [70]. This way the user can effectively perform interactive exploratory knowledge discovery as often needed in knowledge engineering.

The Latviz platform can be associated with the Coron platform and extends its visualization capabilities (see http://coron.loria.fr). Recall that the Coron platform includes a complete collection of data mining algorithms for extracting itemsets and association rules.

6.6. OrphaMine: Data Mining Platform for Orphan Diseases

- Contact: Chedy Raïssi
- URL: http://orphamine.inria.fr/
- KEYWORDS: Bioinformatics, data mining, biology, health, data visualization, drug development.

FUNCTIONAL DESCRIPTION.

The OrphaMine platform enables visualization, data integration and in-depth analytics in the domain of "orphan diseases", where data is extracted from the OrphaData ontology (http://www.orpha.net/consor/cgi-bin/index.php). At present, we aim at building a true collaborative portal that will serve different actors: (i) a general visualization of OrphaData data for physicians working, maintaining and developing this knowledge database about orphan diseases. (ii) the integration of analytics (data mining) algorithms developed by the different academic actors. (iii) the use of these algorithms to improve our general knowledge of rare diseases.

6.7. Siren: Interactive and Visual Redescription Mining

- Contact: Esther Catherine Galbrun
- URL: http://siren.gforge.inria.fr/main/
- KEYWORDS: Redescription mining, Interactivity, Visualization.

FUNCTIONAL DESCRIPTION.

Siren is a tool for interactive mining and visualization of redescriptions. Redescription mining aims to find distinct common characterizations of the same objects and, vice versa, to identify sets of objects that admit multiple shared descriptions. The goal is to provide domain experts with a tool allowing them to tackle their research questions using redescription mining. Merely being able to find redescriptions is not enough. The expert must also be able to understand the redescriptions found, adjust them to better match his domain knowledge and test alternative hypotheses with them, for instance. Thus, Siren allows mining redescriptions in an anytime fashion through efficient, distributed mining, to examine the results in various linked visualizations, to interact with the results either directly or via the visualizations, and to guide the mining algorithm toward specific redescriptions.

New features, such as a visualization of the contribution of individual literals in the queries and the simplification of queries as a post-processing, have been added to the tool, during the internship of IUT student Laëtitia Lemière.

SEMAGRAMME Project-Team

5. New Software and Platforms

5.1. ACGtk

Abstract Categorial Grammar Development Toolkit

KEYWORDS: Natural language processing - NLP - Syntactic analysis - Semantics

FUNCTIONAL DESCRIPTION: ACGtk provides softwares for developing and using Abstract Categorial Grammars (ACG).

- Participants: Philippe De Groote, Jiri Marsik, Sylvain Pogodalla and Sylvain Salvati
- Contact: Sylvain Pogodalla
- Publications: A syntax-semantics interface for Tree-Adjoining Grammars through Abstract Categorial Grammar - ACGTK: un outil de développement et de test pour les grammaires catégorielles abstraites - Discourse Modeling with Abstract Categorial Grammars - On the expressive power of Abstract Categorial Grammars: Representing context-free formalisms - Towards abstract categorial grammars
- URL: http://calligramme.loria.fr/acg/

5.2. Dep2pict

KEYWORDS: Syntactic analysis - Semantics

FUNCTIONAL DESCRIPTION: Dep2pict is a program for drawing graphical representation of dependency structures of natural language sentences. Dep2pict takes into account the modified format mixing surface and deep syntactic information used in deep-sequoia.

- Contact: Bruno Guillaume
- URL: http://dep2pict.loria.fr/

5.3. Grew

Graph Rewriting

KEYWORDS: Semantics - Syntactic analysis - Natural language processing - Graph rewriting

FUNCTIONAL DESCRIPTION: Grew is a Graph Rewriting tool dedicated to applications in NLP. Grew takes into account confluent and non-confluent graph rewriting and it includes several mechanisms that help to use graph rewriting in the context of NLP applications (built-in notion of feature structures, parametrization of rules with lexical information).

- Contact: Bruno Guillaume
- URL: http://grew.loria.fr/

5.4. LEOPAR

KEYWORD: Parsing

FUNCTIONAL DESCRIPTION: Parser for natural language based on interacation grammars

- Participants: Bruno Guillaume, Guillaume Bonfante and Guy Perrier
- Contact: Bruno Guillaume

5.5. ZombiLingo

KEYWORDS: Syntactic analysis - Natural language processing - Lexical resource - Collaborative science

FUNCTIONAL DESCRIPTION: ZombiLingo is a prototype of a GWAP where gamers have to give linguistic information about the syntax of natural language sentence, currently in French, and later to other languages.

- Authors: Bruno Guillaume, Karën Fort, Nicolas Lefebvre and Valentin Stern
- Contact: Karën Fort
- URL: http://zombilingo.org/

5.6. Platforms

5.6.1. SLAMtk

SLAMtk is a processing chain of transcriptions of interviews for the SLAM project (see Section 7.1.1). In particular, it products of a full anonymized and randomized version of the resources. Some extensions, based on Distagger (tagging of disfluencies) and MElt (tagging of part-of-speech and lemmas), have been implemented in order to run linguistic analyses. The tool was reimplemented in order to propose generic treatments for the different corpora.

- Contact: Maxime Amblard
- URL: http://slam.loria.fr