Proposition de projets

Développement d'applications informatiques

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Projet 1

Stephane Goyette (stephane.goyette@unige.ch, Jérôme Kasparian, Nonlinearity and climate group - ISE, Sciences)

Context

One of the most commonly used data format climatology, meteorology and oceanography applications (e.g., weather forecasting, climate change) is called NetCDF for Network Common Data Form. It is a set of software libraries and self-describing, machine-independent data formats that support the creation, access, and sharing of array-oriented scientific data. This format is "self-describing", meaning that there is a header which describes the layout of the rest of the file, or metadata in the form of name/value attributes. However, dealing with the extraction of temporal or spatial subset and transforming into ASCII is often cumbersome but much needed at ISE.

Description

The main task of this project aims at developing a user-friendly software that plot, extract, and save into user defined data format (e.g. ASCII) geo-referenced and other arrays from NetCDF climatological – meteorological data. There are some existing sofwares (e.g. https://www.giss.nasa.gov/tools/panoply/) that perform reasonably well to display these data but do not allow much for extracting subsets in space and in time and converting in other format for exportation. NetCDF files may be downloaded previously or be accessible via an URL. Tasks would be to 1) Slice and plot geo-referenced latitude-longitude, latitude-vertical, longitude-vertical, time-latitude or time-vertical arrays from larger multidimensional variables; 2) Extract a "regional subset" of large NetCDF datasets for specific variables at a given time; 3) Extract a time-slice (i.e. temporal series) of large NetCDF datasets for specific variables at given locations; 4) Allow exporting data in text format (ASCII) that may be in the form of 2D matrices

for data selected in task 1) and 2) if the time series of different variables or time series of different location are gathered together for convenience. This software would ultimately provide a range of commands for manipulation and analysis of NetCDF files including record concatenating, array slicing and averaging.

Projet 2

Hugues CAZEAUX (hugues.cazeaux@unige.ch/e-Research/DiSTIC)

Context

- Bodmer Dataset Ingester
- Research Data Preservation in Digital Humanities
- Bodmer Lab / DLCM project

Description

The project consists in developing a batch tool to import in mass Bodmer datasets into the DLCM preservation system. The tool must crawl a directory, prepare the data and the metadata of each dataset and import them through DLCM RESTful web services. The Java programming is a prerequisite.

Technologies: Java, Maven, Spring Boot, XML, XLST, JSON, REST

Projet 3

Hugues CAZEAUX (hugues.cazeaux@unige.ch/e-Research/DiSTIC)

Context

- DLCM System Monitor
- Research Data Preservation
- DLCM project

Description

The project consists in developing a tool to monitor the DLCM preservation system, which is distributed and modular. The tool must inspect regularly all DLCM modules, gather system information (memory, threads, heap, errors...), send this information into an Elasticsearch index and build a dashboard using Kibana to display the system state and KPIs. The Java programming is a prerequisite.

Technologies: Java, Maven, Spring Boot, JSON, REST, Elasticsearch, Kibana

Projet 4

Hugues CAZEAUX (hugues.cazeaux@unige.ch/e-Research/DiSTIC)

Context

- Book Transformer
- Research Data Preservation in Digital Humanities
- DLCM project

Description

The project consists in developing a tool to convert a DLCM archive (made of different files) into an ebook (either in PDF, or ePub formats). The tool must get a DLCM archive, get its metadata & data, extract relevant information and convert its in a PDF (or an ePub) file to rebuild a virtual or digital book. In the Bodmerlab, for instance, the archive contains one image per page, and building the ebook asks for merging all files in the right order. The Java programming is a prerequisite.

Technologies: Java, Maven, Spring Boot, XML, JSON, REST, Image (Jpeg, Tiff), PDF

Projet 5

Hugues CAZEAUX (hugues.cazeaux@unige.ch/e-Research/DiSTIC)

Context

- Web Transformer
- Research Data Preservation
- DLCM project

Description

The project consists in developing a tool to convert a DLCM archive to a Web ARChive format. The tool gets a DLCM archive, extracts its metadata & data, and other relevant information, and converts it into a WARC file (ISO 28500:2009). Some conversion rules have to be implemented, i.e., image -> JPEG 2000, word -> PDF, etc. The resulting WARC files can then be used by the Wayback Machine (http://www.archive.org/web/web.php). The Java programming is a prerequisite.

Technologies: Java, Maven, Spring Boot, XML, JSON, REST, Format Conversion, WARC

Projet 6

Hugues CAZEAUX (hugues.cazeaux@unige.ch/e-Research/DiSTIC)

Context

- IIIF Transformer
- Research Data Preservation
- DLCM project

Description

The project consists in developing a tool to extract information and data from DLCM archive to feed an IIIF server (http://iiif.io/) . The tool must get a DLCM archive, get its metadata & data, extract images, convert them in correct format and generate metadata needed of the IIIF server. The Java programming is a prerequisite.

Technologies: Java, Maven, Spring Boot, XML, JSON, REST, Image conversion

Projet 7

Costanza Bonadonna (costanza.bonadonna/Earth Sciences/Science)

Context

Aggregation of volcanic ash plays a fundamental role in the sedimentation from volcanic plumes with significant implications on the associated hazards. Nevertheless several fundamental aspects of particle aggregation still need to be understood and characterized. One of these key aspects is aggregate porosity. The porosity of a limited number of aggregates has been derived from field observations. However, the evolution of aggregate porosity with time has not been characterized even though it represents a fundamental component of theoretical models

Description

The main goal of this project is to compile a computer model that can simulate the creation of a 3D aggregate according to the minimisation of a priori physical quantities. The initial step is to recreate a realistic packing of a population of spheres. However, the code must be flexible and potentially extended to more complex shapes. One of the final aims of the project is the efficiency of the algorithm that should be executed several times within a Monte Carlo approach. As a result, the success of this project mostly relies on numerical modelling.

Projet 8

Constant Bonard (constant.bonard@unige.ch/Julien Deonna/Philosophy/Lettres & Swiss Center for Affective Sciencess)

Context

Moods are mysterious psychological states, from both a personal and a scientific perspective. It is often difficult to say why we are in a certain mood or what influences they have on our everyday life. Sometimes we notice their influence only because our relatives tell us. Being in better mood makes us happier, and bad moods could constitute chronic anxiety, depression, etc.

Moods are a caveat in affective sciences. Unlike emotions, it is hard to produce moods in a lab. They are elusive states that are hard to describe in subsequent subjective reports. Their evolutionary function is not well understood.

Description

The project would consist in developing an app for smartphones that allows people to track their moods. The basic framework would be that, twice a day, say, a notification would pop up asking 'What's your mood?' with a few emoticons as possible answers. The smartphone users would just need to click on one of these emoticons (write a facultative comment) and the notification would disappear. Opening the app would allow tracking their moods in the past days, weeks, months, ...

To go further, we could link users' ratings to several information. Emoticons could be cues to theoretical affective components like valence (e.g. sad or angry –> negative), coping potentials (angry or joyful –> empowering affects), or other dimensions (normative significance, agentive causality, etc.). The app could then show curves of these dimensions, helping the user to understand theirs affects.

Other developments would be to link the app with others e.g., calendar, whatsapp, facebook, photos, Google Maps, or sports apps, etc. Users could then look up 'why' they were in a bad or a good mood during this or that period. With the users' permission, affective scientists could also use some information for scientific purposes.

Projet 9

Prof. Matthias Kliegel (Matthias.Kliegel@unige.ch/Psychology/FPSE)

Context

Prospective memory (PM) - remembering to do something after a delay (e.g., taking medication in time, calling someone at a specific time) is key for independence across the lifespan. Most laboratory tasks are abstract, little motivating and must be performed in the lab. Thus, we have suggested to develop game scenarios that can be played over the smartphone to measure PM. Our group has piloted a driving game (where one has to remember to get gas according to either external cues or a running fuel gauge) on PC. This scenario should be adapted to run mobile on iOS or Android.

Description

The project consists of developing a mobile version of an existing driving-game where the player is involved in driving a car through traffic (the ongoing/main activity) and has to remember to get gas according to schedule (prospective memory task). The game allows to vary the difficulty parameters of the ongoing driving activity (e.g., more/less cars on the road, speed of the other/own car) and to vary the schedule of the gas filling task (e.g., gas filling indicated by a running fuel gauge that is either visible or hidden and must be activated). The game should record the driving performance according to a scoring scheme to-be-discussed and record the performance on the gas filling task (e.g., on time, late, not at all etc.). For the first phase, students could use the available stationary PC program as a model and program their mobile version. In a second step, this application could then be refined to be more flexible for research purposes (allowing to vary further parameters) and/or other games may be developed that adhere to the principle of comprising an ongoing activity plus a recall task (as natural part of the main task) and that are suitable for different age/clinical groups.

Projet 10

Prof. Michel Milinkovitch (Genetic & Evolution/Science)

Context

Comprendre la coloration et les motifs à la surface des animaux.

Description

Utiliser un la méthode de Bolzmann sur réseau pour simuler les interférences lumineuse dans le but d'expliquer les couleurs physiques, par exemple la couleur bleutée des oeufs de salamandre dans l'eau ou les reflets cuivrés sur la carapace de certains scarabés.

Projet 11

Frédéric Magnin (CERN)

Context

Le site du CERN est une petite ville avec des routes, des carrefours, des parkings, etc. Dans le but de mieux comprendre les bouchons qui se forment aux heures de pointes, on aimerait pouvoir simuler le traffic et tester plusieurs scénarios.

Description

Extraire la description du réseau routiers du campus du CERN et la convertir en un format utilisable par les outils de simulation du traffic.

Projet 12 (Writing optimizations for a code generator)

Prof. Didier Buchs (Informatique/Sciences)

Context

A compiler can be seen as software that transforms source code written in some programming language (e.g. C, C++, Java, ...) to a format readable by a processor, a virtual machine or an interpreter (an object file). Modern compilers are implemented in the form of a toolchain, where the different steps involved in the aforementioned transformation are clearly distinct. Usually, these steps are:

Parsing The source text is transformed to an abstract syntax tree (AST).
Semantic analysis Each node of the AST is annotated with a meaning, i.e. associated with a type and/or operation.
Code generation The annotated AST is transformed into an object file.

Optimizations can be made at each step, so as to produce an object file that is smaller in size and/or faster to execute, without modifying its semantics. A lot of these optimizations do not depend on the source language (e.g. constant propagation). Therefore, there exists libraries, such as LLVM, that already implement a healthy collection of language-independent optimizations. However, other optimizations may depend on the language, and hence require a custom-made approach.

Description

This project consists of developing language-dependent optimizations for the Anzen (anzen-lang.org) programming language. A compiler toolchain (written in Swift[1]) is already available, and implements the AST generation (parsing) of source text, the semantic analysis (including type inference) of the AST, and the code generation to LLVM Intermediate representation (LLVM IR). However, it currently does not perform any language-dependent optimizations.

The objectives of the project are the following:

- Get familiar with the programming language syntax and semantics.
- Identify the language-dependent optimizations that could be performed right after semantic analysis.
- Implement those optimizations.

[1] https://swift.org

Some knowledge of the Swift programming language is desirable but not mandatory. Other technologies involved include C/C++ and LLVM[2]. The project has to be carried out on a Unix environment.

[2] http://llvm.org

Projet 13 (Adapting Robot programming to Drone programming)

Prof. Didier Buchs (Informatique/Sciences)

Context

A project has been made for advertisement of computer science to high school. It consists in prgramming robots to perform a simple task. A specific language has been designed to program the robot (mindstorm) has shown in the video: .This project consists in adapting the language to a 3D environnement and to keep the idea of first programming, then test the program by simulating its behavior and finnally execute the program on the real device.

Description

The objectives of the project are the following:

- Get familiar with the current implementation of the demo.
- Extend the language.
- Implement the drone control.

Some knowledge of the Java programming language is desirable but not mandatory. Other technologies involved include Eclipse. The project has to be carried out on a Unix environment.

Projet 14

Prof. Bastien Chopard (Informatique/Sciences)

Context

La Nuit de la Science est un événement convivial et festif qui rapproche public et scientifiques. Le thème de l'édition 2018 sera «Tout un art?». Dans ce cadre nous aimerions réaliser une démo mélant art et informatique.

Description

Les toiles les plus célèbres de Piet Mondrian[3] sont caractérisées par un arrangement géométrique de lignes noires et de rectangles colorés. En utilisant une série de transformation d'image, on aimerait écrire un programme capable de transformer une image choisie par l'utilisateur pour ressembler à une telle toile. Le langage à choisir est libre et une librairie appropriée de manipulation d'image sera utilisée pour implémenter un algorithme proposé.

[3] https://en.wikipedia.org/wiki/Piet_Mondrian