High Performance Category Theory Implementation for Big Graph Transformations

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Master Internship 2016

Keywords: Category Theory, Big Data, Parallel programming, Graph Transformation, Rule Based Modeling, Anonymization

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Context

Graphs are used to describe a wide range of situations in a precise yet intuitive way. Different kinds of graphs are used in modelling techniques depending on the investigated fields, which include computer science, chemistry, biology, quantum computing, etc. When system states are represented by graphs, it is natural to use rules that transform graphs to describe the system evolution. There are two main streams in the research on graph transformations: (i) the algorithmic approaches and (ii) the algebraic approaches which define abstractly a graph transformation step using basic constructs borrowed from category theory.

This internship is concerned about the latter approach.

Internship Objectives

The aim of the internship is to implement categorical tools in order to:
— Provide a tool box (graph morphism, pushout, pullback, final pullback complement etc.) sufficiently generic in order to easily implement different categorical graph transformation frameworks. Component models will be used to achieve composability of the elements of the toolbox.
— Be a parallel implementation: typically rules are local (the effects only act on the matched nodes and neighbors) and can be applied in parallel. Finding matchings that do not overlap in an efficient way is a goal of this internship.
— Manage large set of data. Indeed, many application domains of graph transformation are data intensive. The internship will consider the application of graph transformation to the
problem of social data anonymization and chemical/biological simulation. In both cases graphs bigger than $10^9$ nodes have to be considered.

This internship is at the same time practical and theoretical in the sense that it is focused in the design and implementation of parallel algorithms of a high level programming approach.

Comments

The internship will be at the LIP, ENS Lyon, Lyon

Références


