Lisp in Summer Projects Submission

Submission Date	2013-10-24 01:55:26
Full Name	Karen Sargsyan
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Project Name	liTopos
Type of software	command-line/terminal app
General category	other
LISP dialect	Commmon Lisp
GitHub URL	https://github.com/karsar/liTopos
Did you start this project?	Yes, all the code is written by me
Project Description	I want to describe my project in this form.
Purpose	Create software for Topological Data Analysis and design a programming language for Computational Topology. Write book about Computational Topology/ Topological Data Analysis and describe how to do it with lisp.
Function	Project contains a draft of the book, describing Topological Data Analysis. Accompanying software performs K-means, hierarchical clustering and Mapper algorithm.
Motivation	There is a lack of information about Computational Topology and Topological Data Analysis. Most of available information is inaccessible to non professionals. The framework containing methods under the same roof is absent. It it not clear how the coding language for such purposes should look like. This topic is new and is not a mainstream, at the moment. However, due to it's potential, one needs to present those methods for a broader audience.
Audience	Everyone who deals with data analysis. At first, scientists who use machine learning and data analysis in their work,

	but who are not specialists in topology. The book has to be accessible for undergraduates in Computers Science.
Methodology	Most of the information is contained in the first draft of the book. At this stage, the project is an early prototype. The book is rather a sketch. The difficulty with fast progression is that one needs to read through many scientific publications to figure out the way methods has to be presented, simplify and make them accessible. It's not obvious how one should "deform" lisp toward "language for computational topology", so there are no macroses at this stage. The algorithms as they are implemented are not fast enough and further work is to improve them for practical applications. Many topics outlined in the draft of the book will produce additional algorithms, so the prototype is incomplete as well. It's my first experience with lisp, and I've chosen "safe and slow" mode of working. The code needs refactoring and to be extensively tested. This are future plans. More details in the draft of the book. The github contains only "Summer" part of the code and will be updated in December.Unfortunately, this summer was extremely busy. I even was close not to sendthis project. Anyway, although it's very immature, as of now, I hope to receive feedback and useful suggestion.
Conclusion	The sketchy draft of the book is written. K-means, Hierarchical clustering and Mapper algorithms are implemented. Some additional code that serves for infrastructure is prepared. The main limitations are simple versions of algorithms (not speedy, all in lists), truncation procedure for hierarchical clustering might be better, there are many empty parts in the draft of the book, absence of plotting routine in my lisp code. The future directions are: 1. make algorithms faster 2. finish the draft of the book (sections with red in the text are future parts) 3. new algorithms on homology, cohomology, homotopy 4. certifying code with proof assistant (Coq) 5. making prototype of "coding language for topology"
Build Instructions	Everything in the draft of the book (.pdf file)
Test Instructions	Everything in the draft of the book (.pdf file)
Execution Instructions	Everything in the draft of the book (.pdf file)
Describe any bugs or caveats	slow implementations of algorithms, Mapper algorithm is susceptible to noise in data
Official	I have read rules and have abided by them. I am 18 years of age or older. I am not living in Brazil, Quebec, Saudi Arabia, Cuba, Iran, Myanmar (Burma), North Korea, Sudan, or Syria.