MATHEMATICAL AND COMPUTATIONAL LINGUISTICS PROJECT N.3 SYNTACTIC PARAMETERS AS A SPIN GLASS MODEL

CS101/MA191 CLASS WINTER 2015, MATILDE MARCOLLI

1. Syntactic Parameters and Language Evolution

It is known from Historical Linguistics that syntactic parameters have changed in the course of language evolution, likely due to the interaction between languages with different values of the parameters. In a computational approach, one would like to produce simulations of language evolution based on available current data and models of how languages interact.

2. Spin Glass Models

Spin glass systems are widely developed models in statistical physics, describing systems of interacting spins, with up/down spin variables assigned to the vertices of a graph and interaction energies associated to the edges, which favor alignment of neighboring spins, [2].

3. Plan of the project

The project consists of running simulations of language evolution as a spin-glass model, on a graph with vertices a group of languages and edges representing the interaction between them. The syntactic parameters are viewed as spin variables at the vertices. The current data of syntactic parameters of various languages provide the initial configuration. An extensive database of syntactic parameters for many world languages is available at [4]. As database for the underlying graph topology of language interaction and for the strength of the interaction energies along the edges, one can use the Global Language Network data [3]. There are some online resources for spin glass models, including the Vampire open source software [1].

References

[1] R.F.L. Evans, W.J. Fan, P. Chureemart, T.A. Ostler, M.O.A. Ellis and R.W. Chantrell, *Atomistic spin model simulations of magnetic nanomaterials*, J. Phys.: Condens. Matter 26 (2014) 103202
http://www-users.york.ac.uk/ rfle500/research/vampire/
[2] K.H.Fischer, J.A.Hertz, *Spin Glasses*, Cambridge University Press, 1991.
[3] Global Language Network
http://language.media.mit.edu/visualizations/books
[4] SSWL Database of Syntactic Parameters:
http://sswl.railsplayground.net/