A Generator for Random Argumentation Frameworks

Federico Cerutti
Cardiff University, UK

Mauro Vallati
University of Huddersfield, UK

Massimiliano Giacomin
University of Brescia, Italy

Abstract

In this paper we summarise AFBenchGen2—first introduced in (Cerutti, Vallati, and Giacomin, 2016)—which allows to randomised argumentation frameworks for testing purposes with a large variety of structures.

Introduction

In previous research we introduced AFBenchGen (Cerutti, Giacomin, and Vallati, 2014), allowing for the generation of challenging AFs based on the Erdös-Rényi model (Erdös and Rényi, 1959). However, as (Bistarelli, Rossi, and Santini, 2014) discussed, different structures can give rise to interesting different results w.r.t. performance for existing solvers of decision and enumeration problems on Dung's AFs. In (Cerutti, Vallati, and Giacomin, 2016) we presented AFBenchGen2, the first open-source, configurable system for generating AFs with a variety of structures.

AFBenchGen2

Differently from its predecessor, AFBenchGen2 (Cerutti, Vallati, and Giacomin, 2016)[1] is written in Java and can create AFs with a configurable number of arguments, and of type: (1) Erdös-Rényi (Erdös and Rényi, 1959); (2) Watts-Strogatz (Watts and Strogatz, 1998); (3) Barabasi-Albert (Barabasi and Albert, 1999).

Erdös-Rényi Erdös-Rényi graphs (Erdös and Rényi, 1959) are generated by randomly selecting attacks between arguments. AFBenchGen2 allows the selection of the probability of attacks via the parameter `-ER_probAttacks` (between 0 and 1).

Watts-Strogatz Watts and Strogatz (1998) show that many biological, technological and social networks are neither completely regular nor completely random, but something in the between. These systems can be highly clustered, like regular lattices, yet have small characteristic path lengths, like random graphs, and they are named *small-world* networks by analogy with the small-world phenomenon.

[1] `https://sourceforge.net/projects/afbenchgen/`

AFBenchGen2 generates a ring of n arguments where each argument is connected to its k nearest neighbors in the ring: k can be specified via the parameter `-WS_baseDegree` and it must satisfy $n \gg k \gg \log(n) \gg 1$ to ensure a connected graph. Then AFBenchGen2 considers each argument and *rewires* each of its edges toward the not yet processed arguments with randomly chosen arguments with a probability β that can be specified with the parameter `-WS_beta` (between 0 and 1).

Barabasi-Albert As discussed in (Barabasi and Albert, 1999), a common property of many large networks is that the node connectivities follow a scale-free power-law distribution. Therefore, generating a Barabasi-Albert graph requires to iteratively connect a given number of new nodes and to prefer sites that are already well connected. In order to resemble online discussions, we chose to tune AFBenchGen2 to add a single new argument at every iteration: however, this can be made configurable.

Both Watts-Strogatz and Barabasi-Albert would result in undirected graph (or, directed graph with no cycles); we therefore added an additional parameter `-BA_WS_probCycles` (between 0 and 1) that describes the probability of an argument to be in at least one cycle. AFBenchGen2 will therefore add extra attacks accordingly.

References

Barabasi, A.-L., and Albert, R. 1999. Emergence of scaling in random networks. *Science* 286(5439):11.

Bistarelli, S.; Rossi, F.; and Santini, F. 2014. Enumerating Extensions on Random Abstract-AFs with ArgTools, Aspartix, ConArg2, and Dung-O-Matic. In *CLIMA'14*. 70–86.

Cerutti, F.; Giacomin, M.; and Vallati, M. 2014. Generating Challenging Benchmark AFs. In *COMMA'14*, 457–458.

Cerutti, F.; Vallati, M.; and Giacomin, M. 2016. Generating Structured Argumentation Frameworks: AFBenchGen2. In *COMMA 2016*, 467–468.

Erdös, P., and Rényi, A. 1959. On random graphs. I. *Publ. Math. Debrecen* 6:290–297.

Watts, D. J., and Strogatz, S. H. 1998. Collective dynamics of 'small-world' networks. *Nature* 393(6684):440–2.