PhFit: A General Phase-type Fitting Tool

Andrea Bobbio
DISTA,
Università del Piemonte Orientale,
Alessandria, Italy,*bobbio@unipmn.it*

András Horváth, Miklós Telek
Dept. of Telecommunications,
Budapest University of Technology and Economics,
Hungary, {*horvath,telek*}*@webspn.hit.bme.hu*

Abstract

PhFit, a new Phase-type fitting tool is presented in this paper. PhFit allows for approximating distributions or set of samples not only by continuous but by discrete Phase-type distributions as well. The implemented algorithms separate the fitting of the body *and the* tail *part of the distribution which results in satisfactory fitting also for heavy-tail distributions. Moreover, PhFit allows the user to choose the distance measure according to which the fitting is performed. The tool is equipped with a graphical interface that visualizes the goodness of the provided approximation from several aspects.*
Keywords*: Phase-type distribution, Phase-type fitting*

1 Introduction

Continuous and Discrete Phase-type (CPH,DPH) distributions are defined as the distribution of time to absorption in Continuous- and Discrete-time Markov chains with one absorbing state, respectively. In the recent decades, a lot of research was carried out to handle stochastic models in which durations are CPH or DPH distributed.

In order to exploit recent advances in handling models with PH distributed activity durations, one needs algorithms to determine the parameters of the applied PH distribution. Despite the effort made to invent fitting algorithms, none of the methods gained widespread use in applied stochastic modeling. The aim of this paper is to present PhFit, a Phase-type fitting tool which is novel from several aspects and provides the modeler with functionality to perform and validate the fitting process. The next section gives a brief overview of the input, output and the algorithms implemented in PhFit. A more detailed description of the tool is given in [3].

2 PhFit

The tool requires the following input:
• The distribution to be fitted can be given either by a finite set of samples or can be chosen from a set of distributions.
• PhFit implements a special method to fit distributions with heavy-tailed behavior [2]. The user has to define the type of the tail decay (either polynomial or exponential), its associated parameter and its weight.
• The fitting can be performed either by CPH or by DPH distributions. A comparison of CPH and DPH distribution can be found in [1]. In case of DPH fitting of a continuous distribution the time unit of the discrete approximation has to be defined as well. This time unit is the mapping of one step of the DPH to some natural time unit.
• The distance measure which is minimized by the fitting algorithm has to be selected. The measure can be the cumulative density function (cdf) area difference, the probability density function (pdf) area difference or the cross-entropy.
• The user has to define the number of phases to fit the body and the number of phases to fit the tail of the distribution.
The output of the tool consists of
• the representation of the approximate PH distribution,
• figures depicting either the body or the tail of the cdf, pdf or complementary cdf of the approximating distribution,
• various indicators of the goodness of fitting like moments and their relative errors, the distance of the approximating distribution from the original one according to various distance measures (cdf and pdf area difference, cross-entropy), figures depicting the relative error of the pdf, cdf or ccdf.

References

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