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On the conversion between IFPUG and COSMIC software functional size units: A theoretical and empirical study

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Abstract

Since 1984 the International Function Point Users Group (IFPUG) has produced and maintained a set of standards and technical documents about a functional size measurement methods, known as IFPUG, based on Albrecht function points. On the other hand, in 1998, the Common Software Measurement International Consortium (COSMIC) proposed an improved measurement method known as full function points (FFP). Both the IFPUG and the COSMIC methods both measure functional size of software, but produce different results. In this paper, we propose a model to convert functional size measures obtained with the IFPUG method to the corresponding COSMIC measures. We also present the validation of the model using 33 software projects measured with both methods. This approach may be beneficial to companies using both methods or migrating to COSMIC such that past data in IFPUG can be considered for future estimates using COSMIC and as a validation procedure.

Keywords: Functional size measurement; IFPUG; COSMIC; Software estimation

1. Introduction

Function point analysis or FPA is one the oldest and most widely used software functional size measurement method. It was proposed by Albrecht and his colleagues at IBM in 1979. Since 1984 this method is promoted by the International Function Point Users Group (IFPUG) (IFPUG, 2000). In 1994, the International Organization for Standardization (ISO) set up a working group to establish an international standard for functional size measurement. This group did not produce a measurement standard, but a set of standards and technical documents about functional size measurement methods, known as the ISO/IEC 14143 series (ISO/IEC, 1998, 2002a,b, 2003a, 2004). The FPA method became the standard ISO/IEC 20926 (ISO/IEC, 2003b) in 2003, its unadjusted portion being compliant with the ISO/IEC 14143 (ISO/IEC, 1998). Starting in 1998, a set of experts in software measurement created the Common Software Measurement International Consortium or COSMIC, and proposed an improved measurement method known as full function points (COSMIC FFP) (COSMIC, 2003). This method became the standard ISO/IEC 19761 in 2003 and is also ISO/IEC 14143 compliant. Both IFPUG and the COSMIC-FPP methods measure functional size of software, but produce different results. For this work, we briefly compare IFPUG and COSMIC definitions and propose a model to convert functional size measures obtained with the IFPUG method to the corresponding COSMIC FFP measures. To do so, we have used a repository of 33 projects measured using both methods.

The organization of the paper is as follows. Section 2 provides a high-level view of the mapping between both methods. Section 3 present the conversion rule proposed.

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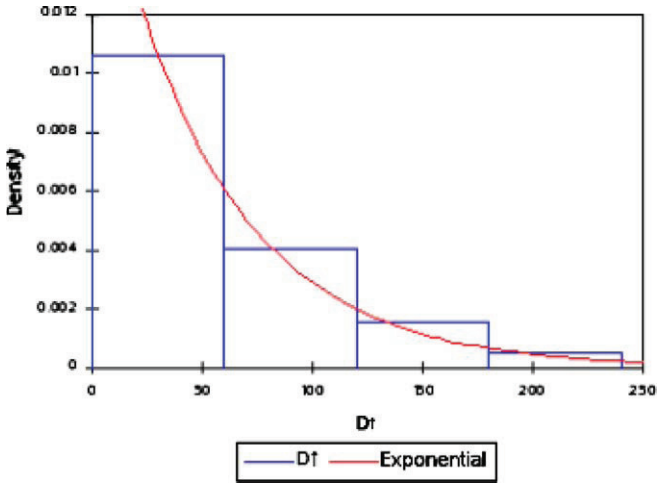

Fig. 3. Histogram for D".

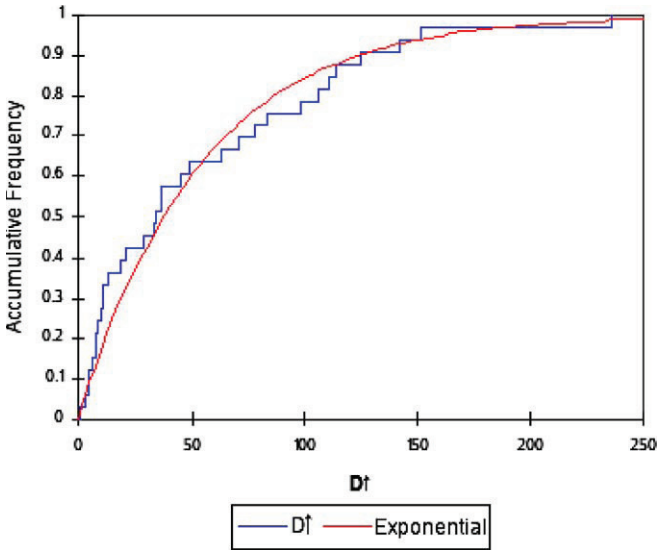

Fig. 4. Accumulative distribution for D".

for both variables. In these graphs it is possible to visually check the test results, in the sense that the adjustment in both cases is good, but it is better for variable D".

The fact that both variables D# and D" have exponential distribution not only confirms our hypothesis, but further corroborates our hypothesis. On the one hand, it means that the probability of obtaining smaller differences between measures and extremes is higher, and the probability of obtaining larger differences between measures and extremes is lower. On the other hand, it also means that the distances are always positive, i.e., measures using COSMIC will never be outside the interval calculated according to our model.

5. Conclusions and future work

In this paper, we have shown a method to convert from IFPUG function points defined by the International Function Point Users Group (IFPUG) to COSMIC full function points (COSMIC FFP) defined by the Common Software Measurement International Consortium (COSMIC). Although both methods produce different results, we have empirically shown an equation that given an estimate in IFPUG limits the upper and lower value of the estimate with COSMIC, i.e., the conversion value is kept within a range.

The validation of the model was performed with data obtained with 33 software projects measured with both estimation methods and validated by experts. The estimates obtained with the conversion rule were always within the range proposed. Also, distributions followed an exponential regression which statistically confirming the exponential distribution.

This approach may be beneficial to companies in several ways: companies using both estimation methods can use the conversion rule as a way of validating or confirming new estimates; also organizations wanted to migrate or start measuring with COSMIC can still consider historical projects measured with IFPUG for future estimates using COSMIC.

Future work will consist in performing further case studies within academia and industrial organizations.

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References

COSMIC, 2003. COSMIC measurement manual ver. 2.2. Tech. rep., Common Software Measurement International Consortium.

COSMIC, 2005a. Guideline for sizing business application software 1.0. Tech. rep., Common Software Measurement International Consortium.

COSMIC, 2005b. COSMIC-FFP Method Update Bulletin #2. Tech. rep., Common Software Measurement International Consortium.

Fetcke, T., 1999. The warehouse software portfolio: a case study in functional size measurement. Tech. Rep. 1999-20, Technische Universitaet Berlin, Fachbereich Informatik.

IBM, 2004. Course registration system. Tech. rep., IBM Rational.

IFPUG, 2000. Function point counting practices manual 4.1.1. Tech. rep., The International Function Point Users Group.

IFPUG, 2001. Practical guidelines for counting logical files, Addendum to CPM Release 4.1 Series. Tech. rep., The International Function Point Users Group.

IFPUG, 2005. IFPUG: case study 1 Release 3.0. Tech. rep., International Function Point Users Group.

ISO/IEC, 1998. ISO/IEC 14143-1:1998. Information technology, software measurement, functional size measurement, Part 1: Definition of concepts. Tech. rep., International Standards Organization & International Electrotechnical Commission.

ISO/IEC, 2002a. ISO/IEC 14143-2:2002. Information technology, software measurement, functional size measurement, Part 2: Conformity evaluation of software size measurement methods to ISO/IEC-14143-1:1998. Tech. rep., International Standards Organization & International Electrotechnical Commission.

ISO/IEC, 2002b. ISO/IEC 14143-4:2002. Information technology, software measurement, functional size measurement, Part 4: Reference

model. Tech. rep., International Standards Organization & International Electrotechnical Commission.

ISO/IEC, 2003a. ISO/IEC 14143-3:200. Information technology, software measurement, functional size measurement, Part 3: Verification of functional size measurement methods. Tech. rep., International Standards Organization & International Electrotechnical Commission.

ISO/IEC, 2003b. ISO/IEC 20926:2003. Software engineering, IFPUG 4.1 unadjusted functional size measurement method, counting practices manual. Tech. rep., International Standards Organization & International Electrotechnical Commission.

ISO/IEC, 2004. ISO/IEC 14143-5:2004. Information technology, software measurement, functional size measurement, Part 5: Determination of functional domains for use with functional size measurement. Tech. rep., International Standards Organization & International Electrotechnical Commission.