A Measurement Technique for Intelligent System

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Abstract

Using intelligent systems, many users do effectively their works. In general, the effective usages of the systems have to possess the usability and accuracy. So, we need some measurements for evaluating the performance of the criteria. But, in most cases, objective measurements for the evaluation are not. In this paper, we propose a measurement technique for objective evaluated measuring of intelligent systems using probability measure.

1. Introduction

In many fields of computer science, diverse intelligent systems have been used by users[2-15],[18],[19]. In this cases, the satisfaction of use has to be evaluated by some measures. These are the values that we assign for these properties[16]. Ordinary, quantitative measures are quite easy to represent. But it is difficult to represent qualitative measures which are needed to intelligent systems. Generally, effective usages of the systems are depicted by usability and accuracy. But, some objective measurements for the evaluation are not. So, we need some measurements for evaluating the performance of the usage. In this paper, we propose a measurement technique for objective evaluated measurement of intelligent systems using probability measure.

2. Related Works

In real analysis, measure is a theory of measurable sets[17]. Also, a measure is a set function which is an assignment of a number to each set[1]. Some have to be imposed on the class of sets. For new measure technique, probability considerations may be a good motivation for the type of structure required. If is a set whose points correspond to the possible outcomes of a random experiment, certain subsets of will be called 'events' and assign a probability. In this paper, we consider two definitions which are field and probability measure as the followings[1].

Definition 1.

Let F be a collection of subsets of a set. Then F is called a field iff. $\Omega \in F$ and F is closed under complementation and finite union, that is,

(a) $\Omega \in F$

(b) If $A \in F$ then $A^c \in F$

(c) If $A_1, A_2, \cdots, A_n \in F$ then $\cup_{i=1}^{n} A_i \in F$

It follow that F is closed under finite intersection. For if $A_1, A_2, \cdots, A_n \in F$, then

$$\cap_{i=1}^{n} A_i = (\cup_{i=1}^{n} A_i^c)^c \in F$$

If (c) is replaced by closure under countable union, that is,

(d) $A_1, A_2, \cdots, A_n \in F$, then $\cup_{i=1}^{\infty} A_i \in F$

F is called a σ-field.

Definition 2.

A measure on a σ-field F is a nonnegative, extended real-valued function μ on F such that whenever $A_1, A_2, \cdots$ form a finite or countably infinite collection of disjoint sets in F, we have

$$\mu(\cup_n A_n) = \sum_n \mu(A_n)$$

If $\mu(\Omega) = 1$, μ is called a probability measure. Also, if μ is a probability measure, (Ω, F, P) is called a probability space.

Finally we use random variable to construct a measure technique of usability measurement for evaluating the intelligent systems. A random variable is a quantity that is measured in connection with a random experiment. If (Ω, F, P) is a probability space and the outcome of the experiment corresponds to the point $\omega \in \Omega$, a measuring process is carried out to obtain a number $X(\omega)$. Thus X is a function from the sample space Ω to the real.

3. An Effective Measurement for Intelligent Systems

To find an efficient measurement for intelligent systems, we use the following process of theory building.

measurement $\xrightarrow{\text{by probability measure}}$ *construct* $\xrightarrow{\text{by statistical inference}}$ *theory*

Fig. 1. Theory building process

In the above figure, a measurement is constructed by probability measure. We use statistical inference to evaluate a theory building. Therefore, we find an measurement for evaluating the intelligent systems in the following figure.

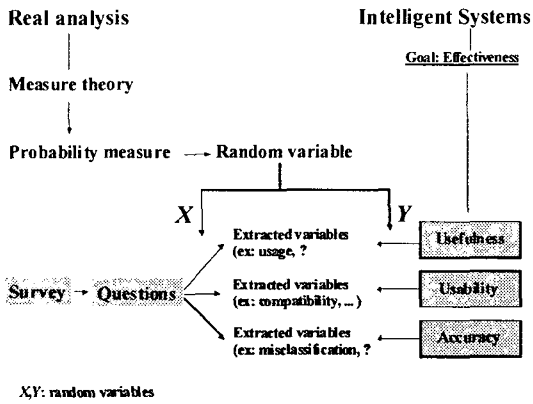

Fig. 2. New measurement technique for intelligent systems

For objective evaluation of measurement tool, we use probability measure of real analysis in this paper. Using random variable by probability measure, objective evaluation of intelligent systems is possible. In this paper, three criteria are used. They are confidence interval, unbiased estimator, and minimum variance.

4. Conclusions

In this paper, we propose an effective measurement technique for evaluating the usability of intelligent systems. To construct the technique we use the probability measure including random variable. Also, confidence interval, unbiased estimator, and minimum variance criteria are used for evaluating an measurement tool. In future study, we will apply this measurement technique to real experiments which are diverse usages of intelligent systems.

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