IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Utility Patent Application (Provisional)

METHOD AND PROCESS FOR RATING AND RANKING ACHIEVEMENTS

Carlos Quiles Casas

SPECIFICATION

FIELD OF THE INVENTION

[0001] The present invention relates generally to ranking achievements, and in particular to methods and processes that generate a comparable rating based on received achievements. Moreover it pertains specifically to such methods and processes which allow a user (the user can be an individual professional, an enterprise member or talent manager, a recruiter) to rate and rank persons in databases of achievements or merits, such as any database of documents containing resumes or curricula vitae, referring to academic (exams, courses, certifications, titles) or professional (job positions, publications, works) fields.

BACKGROUND OF THE INVENTION

[0002] Large numbers of companies and institutions seeking talented students, researchers, and employees, are confronted with the challenge of ranking candidates for the position available. One standard practice among human resource departments is to create a job description for each open position, then advertise the position along with the description. Recruiters and job seekers then have to review and analyze these descriptions in order to determine a match between job seekers and particular jobs. Due to the high number of applicants it is necessary to short-list and rank submitted curricula vitae based on their suitability for the job requirements. To reduce costs, error and time there is a strong desire from companies towards automating the processes of: specifying the requirements criteria for a given job (experience, skills, etc.) and matching between the applicants' profiles and the job requirements; to produce an applicants' ranking policy that gives consistent and fair results, which can be legally justified. However both these processes involve a high level of uncertainty, as they require the input of different occupation domain experts in the decision making process. These experts will have different opinions, expectations and interpretations for the requirements specification as well as for the applicants matching and ranking criteria.

[0003] Due to the developments in computer technology and its increase in popularity, a number of searching and ranking tools are available to a person searching on computer-based private databases of resumes or job offers, as well as on the Internet for recruiters and job seekers searching for the right job, based on matching and ranking of achievements. Such methods and processes are offered, for example, on well-known Internet Web sites including www.Monster.com, www.LinkedIn.com, www.Yahoo.com, www.CareerBuilder.com. Searching tools and selection methods currently available require the job seeker to select various criteria in the form of keywords, such as desired locations, types of jobs, desired compensation levels, etc. Similarly, the employers provide, in addition to the job description, levels of skill, education, years of experience, etc. required to be considered for a particular job, and some available tools help in rating such keywords. Searching tools then look up the seeker's keywords in a database of job descriptions and return, or display those job descriptions that contain the job seeker's keywords. Other methods try to help recruiters automate the process of ranking and selection, or help determine the consistency and reliability of each expert's decision making behaviors, trying to ensure that experts' decisions are unbiased and correctly weighted according to their level of knowledge and experience; with such methods, a standardized method for rating and ranking is focused on the individual expertise in human resource departments, instead of on the candidates.

[0004] These known methods and processes, however, fail to adequately filter prospective candidates according to their achievements. As such, the company or recruiter looking for prospective candidates may be inundated with resumes, many of whom are not close to the quality of candidates the company or recruiter is looking for. Often, recruiters also need to rate and rank personally all achievements and merits of applicants one after another, according to previously agreed, loose working and scoring schemes, to assign overall static ratings to each candidate. These ad hoc, highly personalized, and irreproducible methods tend to be highly inefficient and biased. In this human-based rating and ranking process, with or without the help of known automated methods and processes, lots of curricula from highly qualified candidates might be lost, and unwanted curricula might get to the latest, more expensive stages of personal selection.

SUMMARY OF THE INVENTION

[0005] Various aspects of the present invention provide computer-implemented methods and processes for rating and ranking achievements of persons in a database. One aspect provides a rating based on the scores obtained in evaluations of different academic exams, degree and non-degree courses, certifications, or titles obtained, and on the performance of the issuing institution. Another aspect of the present invention is to provide a rating based on the depth of knowledge achieved in the languages spoken by candidates, depending on the difficulty of the language, and on the performance of the evaluating institution. Another aspect provides a rating of job positions, based on the wage/salary obtained, on the professional level developed, and on the performance rating of the hiring entity. Additional aspects of the invention will become apparent in view of the following description and associated figures.

[0006] One aspect of the present invention is directed to a method and process for rating persons according to the addition of achievements selected by the user, using the different aspects of this method, and taking into account differences in achievements by age. Another aspect of the present invention is to provide a ranking method that is scalable and can be applied to large databases such as those available through the Internet, offering search and comparison possibilities to all users, either recruiters or career/job seekers.

[0007] Rather than determining relevance only from static rating schemes, or relying on the intuition or experience of those responsible of human resource or job recruitment departments, this invention assumes the validity of the measurement of scores or rewards obtained, as well as of the measurement of generally accepted difficulty levels of academic and professional achievements, and of performance ratings of entities. From these measurements, it offers the relative quantity of ability proven with them. That quantification may thus more intuitively be used for comparison of achievements, which is ultimately required by institutions and companies to select the best suited candidates.

[0008] The item response theory is a known scientific method of psychometrics and education whose statistical models are used for the development and analysis of single tasks called items (like questions in test exams), and to validate tests formed by such items and their results, or to estimate a selected ability or a group of them according to scores in items. The intuitive relationship that these statistical models offer between scores, items, and abilities, is used in this invention to quantify the ability that achievements of persons demonstrate. In this method, the generally accepted scores in evaluations, academic or professional levels of achievement, and performance rankings, are assumed to measure what they intend to measure, and therefore the strength and validity of the invention is dependent on their assumptions and improvement as measuring tools, and especially on the user's preferences, whereas the models used by this invention to obtain that quantification remain anchored in strong scientific foundations. New assumptions are then made in this invention, so that certain constraints of the item response theory models are broken, and emphasis is put on keeping a consistent and comparable rating of achievements, instead of on scientific validity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] **FIG. 1** is a flowchart of a method for rating and ranking achievements in a database of merits according to an embodiment of the present invention.

[0010] **FIG. 2** is a diagram of the available data from three curricula in a database.

[0011] **FIG. 3** is a diagram of a database illustrating the rating associated with each curriculum in accordance with the present invention.

[0012] **FIG. 4** illustrates a graph suitable for analyzing the position of different achievements in accordance with various embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0013] Although the following detailed description contains many specifics for the purposes of illustration, anyone of ordinary skill in the art will appreciate that many variations and alterations to the following details are within the scope of the invention.

Accordingly, the following specific embodiments, descriptions, and examples of the invention are set forth without any loss of generality to, and without imposing limitations upon, the disclosed invention.

[0014] It is generally agreed that the focus of scores in items (like questions in a test) is on measuring the ways people differ in their cognitive skills and knowledge. The intended meaning of the score for the item is that the person interacting with the item either has enough of all of the necessary skills and knowledge to select the correct answer, or that person is deficient in some critical component.

[0015] The relationship between scores, abilities and items has been described with different statistical models. An item response function gives the probability that a person with a given ability level will answer correctly. Persons with lower ability have less of a chance, while persons with high ability are very likely to answer correctly; for example, students with higher math ability are more likely to get a math item correct. The exact value of the probability depends, in addition to ability, on a set of item parameters for the item response function.

[0016] The most widely accepted item response theory (IRT) model, which will be used in the following descriptions of the different embodiments for simplicity purposes, is the simple one-parameter model, which has one parameter for describing the characteristics of the person, and one parameter for describing the characteristics of the item. Such descriptions are merely used to facilitate the discussion and are not intended to restrict the application of embodiments of the present invention.

[0017] Every human performance or action is complex and involves a multitude of component abilities – like skills, knowledge, or interests. In constructing a variable for these examples, we identify individual differences that can be mapped on a single real number line, establishing a variable that is unidimensional to a level of precision that is of some practical and theoretical use. The one-parameter model is based on the idea that useful measurement involves examination of only one human attribute at a time (unidimensionality) on a hierarchical “more than/less than” line of inquiry. It was proposed by Rasch as:

$$P(u_{ij} = 1 | A_j, B_i) = \frac{A_j B_i}{1 + A_j B_i}$$

[0018] Where u_{ij} is the score for Person j on Item i (0 for incorrect response, or 1 for a correct response), A_j is the j^{th} person parameter Ability (including skill, knowledge, or interests, also called trait) and B_i is the Item parameter (termed Evaluation in this method), which provides information about the ability level that is best measured by it, and about the likely probability of correct response. The development of the mathematical function is based on a number of assumptions for simplification purposes; among them, the so-called local independence assumes that responses by a person to one test item are independent of their responses to other test items. This model has some mathematical properties that make the estimation of the parameters of the model particularly convenient and useful.

[0019] The present invention, to allow for a calculation of the ability represented by achievements, treats observations immediately as if they were continuous, and the Rasch model as deterministic. The simplified descriptions of embodiments of this method depart from the common statistical one-parameter model to obtain the deterministic Equation:

$$A_j = \frac{P}{B_i(1 - P)} \qquad \textbf{(1)}$$

[0020] Where, for simplicity,

$$P = P(u_{ij} = 1 | A_j, B_i)$$

[0021] In descriptions of embodiments of the present invention, the following assumptions are made, for the simple one-parameter model to be applicable to the rating of achievements:

1. It is usually believed that people can be ordered along a large (but supposedly finite) number of continua for each one of the many ways that people differ in abilities. Since most of these continua are logically interrelated, we assume in this invention, for a unidimensional model, that a comprehensive set of human ability or skill/knowledge ***A*** can under ideal conditions be measured, and that the different A_j obtained by this method (that quantifies demonstrated achievements) are approximations to measuring parts of identifiable categories

or subsets A_k, all of which are part of that supposed general set $\boldsymbol{A}$. Of the subsets of this general ability in which a single person can be located, this method provides means to quantify those which have been explicitly or implicitly measured. The origin and unit of the ability continua are then of arbitrary natures, and they may be transformed to another arbitrarily. Unlike in the IRT models, in this invention the user's criteria define that person B with ability A_1 is superior to person C of ability A_2, and person C is superior to person D with ability A_3. The user's preferences also define in this invention that the superiority of B at C is greater than, equal to or less than, that of C to D. For the one-parameter model, all examinees with the same score in a certain evaluation have the same maximum likelihood estimate of A; therefore, selected abilities measured by an evaluation are comparable. Also, if the parameters specified by the user remain consistent, and local independence is respected, the summation of abilities obtained for each person may be compared, assuming that the relationship between locations can be represented as a continuous mathematical function, a desirable property in candidate selection.

2. Those interrelated continua of human ability are generally measured by evaluations B_i, according to generally accepted conventions on evaluation and measurement techniques, being sensitive to differences of many types, and forming in turn interrelated continua. Under the scope of this invention, the B-parameter is assumed to provide information about the ranges of ability levels for persons that are likely to respond or act correctly or incorrectly, when confronted to any task regarding for example the exams passed, languages learned, or jobs developed, by that person. The "easiness" parameter B_i has an intuitive relationship with real-world data, in the sense that it allows statements like "Person 1 has twice the proficiency of Person 2." The B-parameter in this method depends on two main factors. It depends on the actual "difficulty" level d_i of the ability measured, according to levels of achievement; and on the performance r_i of the scoring entity, representing the efficiency or precision of the entity in evaluating the abilities measured, because a higher performance of an entity implies less item misfits in evaluation, and a higher probability of correct response.

3. For many simple tests, the linear correlation between the *A*-estimate and a traditional score has been shown to be very high. We assume in this method that the different weighted scores (in terms of grades, levels of knowledge, monetary reward) of a person's evaluations, usually composed of many different examinations and grading or measuring methods, are reliable approximations to a fundamental measurement of scores in terms of probabilities *P* (of correct, 1, or incorrect, 0, response to any component of the evaluations), thus allowing for an estimate of *A*. For the purposes of these simplified examples of the method, a measurement error equal to zero is assumed, and thus the measurement variance is not taken into account.

[0022] The *B*-parameter may be conceived as a function relating difficulties and performances through summation, subtraction, multiplication, or any other relation. To allow for consistent descriptions of the following embodiments of the method, a simple inverse exponential function with base 10 has been used for B_i:

$$B_i = \frac{1}{10^{z(d_i + r_i)}} \qquad \textbf{(2)}$$

[0023] Where values may range by default, as in the descriptions below, as follows: d_i within the natural numbers, and r_i within [–0.25, +0.25], leaving the difficulties in their assigned value – i.e. in a range smaller than [–0.5, +0.5], which are the limits to the range of the previous and next natural numbers, respectively. The user can define higher values for r_i, which would make performance more important in relation with levels of achievement d_i, and lower values, which would have the opposite effect. The most appropriate scales for difficulty and performance parameters may then be selected as basis for the rating and ranking of achievements. The contribution of each evaluation is thus weighted by the information this evaluation can provide, although in this method it is for the users to define the most appropriate weighting according to their preferences and expectations. This makes it possible to compare achievements from different times and places, and to look at the relative difficulty of evaluations.

[0024] The interval for *P* is (0, 1). A maximum value *P*=1, frequent conventional representation of a maximum achievement in real life, is inconvenient because infinite proficiency on the ability required to respond to the test item is difficult to justify as a reasonable estimate. Therefore, a maximum of 0.99 is selected by convention here for values of *P* above it. Because of that, we select in Equation (**2**), for exponents r_i and d_i, the base 10^4, because the most usual range of scores [0.5, 0.99] gives a multiplier 1-99 from B_i in Equation (**1**). The higher values of *z*, the less important scores become related to the levels of achievements and performance, and vice versa. *P*=0 is also impossible, and in this model achievements with such a score are not taken into account, being the minimum score accepted for each achievement selected by the user.

[0025] The scales used in these embodiments are therefore arbitrary decisions, and the usefulness of the scales selected comes from the ease of interpretation and the relationships with other variables. Each parameter can be assigned any possible value or range of values by the user, so emphasis is put in these descriptions on the condition that equations are valid internationally, and that they remain consistent with each other, so that a consistent final summation and ranking of the ratings obtained in the different embodiments is possible. As anyone skilled in the art might infer, the smaller the administrative regions and ability subsets to which the method is applied, the easier to design, and more exact the result might become in comparing achievements. The following complicated, interrelated, and international examples are a proof of the possible applications of the method.

[0026] In one particular embodiment of this method, in which a person's academic ability evaluated in the education system will be measured, the unidimensional ability A_j denotes the person's ability in evaluations *i*, like examinations, degree or non-degree courses, certifications or titles, evaluated through grades or levels of achievements, considered as probabilities *P*. The *B*-parameter denotes the ability level that is best measured by the evaluation, and the likely probability of correct response.

[0027] The value of the so-called "easiness" parameter B_i is dependent, in this embodiment, on the i^{th} evaluation's depth or academic level d_i. The user may assign a preferred weighting (or range of weightings) to the variables, or else the values of d_i are obtained from the International Standard Classification of Education (ISCE) from the UNESCO, which maps international education systems: each level (ISCE 1-6) and sublevel or destination (ISCE A, B, C) may be assigned a value, resulting in an interval [1, 13]. If the user does not set a starting year, the first level taken into account may be the secondary education level, in the interval [5, 7] (corresponding to ISCE 3C, 3B, 3A), since previous levels of education are generally accounted for into those, thus respecting local independence; so, for example, by default the college admission test might be the first level (ISCE 3A) considered by users looking for candidates with undergraduate studies.

[0028] The B-parameter depends also on the actual performance r_i of the institution which scores and issues the evaluations, understood in this embodiment as the performance of the entity known for each education level and field of the exam, degree or non-degree course, certification, or title. The performance is usually given by rating entities in a range of scores [0, 100] for all institutions evaluated, adjusted in this description by default to an interval [–0.25, +0.25], to the values of d_i; as, for level ISCE 5A (university/college education), d=12, the precise value is located in the interval [11.75, 12.25], depending on the performance of the institution. Performance ratings r_i may thus be assigned from public or private ratings of institutions. For secondary education, data may be obtained from national rankings, or international evaluations of national education (like the International Mathematics and Science Study or European PISA study). For undergraduate and postgraduate studies, data may be obtained from national or international rankings for higher education institutions, either general or by academic fields, made e.g. from objective parameters (like the Academic Ranking of World Universities), from specialized questionnaires (like the Times Higher Education World University Ranking), from analysis of research (as the SCImago Institutions Ranking), or from return of investment analysis (like that of PayScale). Any rating can be used either from modern or historical, from national, regional, or international perspectives, or a combination of certain rankings and perspectives, depending on the user's preferences; or failing that, according to a standardized selection of some or all of them. Also, internal ratings of institutions for the own faculties or degrees can be used to further define the rating of the college/university. By default, when lacking data about the institution's rating, the minimum (by default r=−0.25) is assigned. Care should be taken to make the institution rankings selected for the embodiments –

national or international, modern or historical – comparable, to allow for summation and comparison of candidates.

[0029] While the difficulty level of different ability fields is usually deemed different, rankings of educational institutions are known to take into account the difficulty of the disciplines taught, because of the weighting factors used; hence B_i in this simplified model already includes such differences. The user may further define differences in B_i based on the perceived or calculated different levels of ability required for a certain degree field, according e.g. to the division of the ISCE into 9 broad fields, 25 fields of education, or 65 fields of training.

[0030] The score P received in a certain evaluation corresponds to a measure of a person's ability according to that evaluation. Under the scope of this description, a grade point average (GPA) of A in a certain exam, course, certification, or title, corresponding to 4.5-5.0 in a numerical scale 0-5, would correspond to a probability of 90-100%, with a mean of 95%, i.e. P=0.95 in the interval (0, 1). That means, equating scores of evaluations in this invention to probabilities in IRT models, that a student with a GPA of A in a certain evaluation would have an estimated probability of 95% of giving a correct answer to any task testing the skill/knowledge measured by that evaluation.

[0031] A simplified equation, for international comparison of the overall ability of a person from academic achievements, may thus be obtained with equation:

$$A_k = \sum_{j=1}^{n} w_i A_j y_i \qquad \textbf{(3)}$$

[0032] Where i=1, 2, ..., n, are the evaluations, and therefore A_j is the corresponding ability evaluated by certain score or level of achievement in a certain exam, course, certification, or title. w_i is the weighting – by default within interval [0, 1] – of the evaluations; for example, it may assign lower values to those evaluations not interesting for the user of this method according to the ISCE fields of education; to the non-degree condition of the evaluations; to the non-core character of the evaluation within a degree; or to any other selection. Its value may be automated, selecting for example the return of investment analysis for each degree or academic field; it may also take into account the proportional completion of the degrees (to rate lower the courses from incomplete degrees); and it may also include a multiplication of more than one weighting. By default it is left as w=1, giving the same weighting to all evaluations.

[0033] There are many different academic standards, with different credit hour systems; because of that, the parameter y_i takes into account the number of standard academic years as defined by the user, by default equivalent to the number of credit hours per year in each education system or institution. For example, to 60 ECTS, according to the Bologna system, to 30 U.S. credit hours in certain U.S. colleges. From that equivalence, each evaluation would be measured in terms of proportion of a standard academic year. For example, if a student of a Bachelor's degree in Mathematics passes the course Calculus, a subject of 6 ECTS, it would have a multiplier y=6/60, i.e. y=0.1. Equivalent divisions for all achievements (whether in terms of credit hours, trimesters, semesters, or years) should be made to obtain a comparable rating, because in this method the relationship between scores and ability is exponential; i.e. the ability calculated for an arithmetic mean of scores from evaluations results in less rating than the sum of abilities calculated for the differentiated evaluations, unless all scores are the same.

[0034] To respect local independence, the rating should not to take into account the same subjects from different evaluations. For example, for some student with two different degrees, e.g. in Mathematics and Statistics, the corresponding proportion of the planned academic years, y_i, which are shared in both degrees, should be accounted for only once, especially regarding transfer credits, which have been proven to be equal by the second issuing institution.

[0035] According to another embodiment of the invention, which evaluates the ability of languages i spoken by a person, the equation relates the score or proficiency level P in evaluations like exams, courses, certificates, or titles. For example, for English as second language, the scores 0-120 of the Internet-based Test of English as a Foreign Language, or the scores 0-9 of the IELTS, P may be adjusted arbitrarily to a range (0, 0.9], with a maximum of 90%, because it is known that learners rarely achieve complete native-like control of the second language. Non-general evaluations, which test and score a particular level or depth, corresponding to a range of values, may then be adjusted to the grades obtained; as, in an upper level certificate (like the Certificate of Proficiency in English, of the Cambridge ESOL), ranging IELTS 7.5-9, or 75-90%, passed with 50%, gives P=0.875. Once the minimum passing grade is obtained, it is adjusted within that range; as, for an A-grade, a 95% of the range 0.75-0.9 is obtained, i.e. P=0.8925. For native language proficiency level, a maximum P=0.99 may logically be assigned.

[0036] Language proficiency evaluation, unlike academic degree levels, includes the ability of the previous difficulty levels. Because of that, in this particular description, for Equation (**2**), respecting local independence, and according to academic levels in **[027]**, we may assume full second language proficiency to be acquired by default at a maximum ISCE level 4. The difficulty of full language acquisition would then correspond to a post-secondary and pre-tertiary education, or d=11 (=ISCE 4A), because its teaching is not usually finished in secondary education, but tertiary education level is not necessary either. r_i may indicate the particular quality of the evaluation (or of the evaluating or issuing institution), in a default interval [–0.25, +0.25] in these descriptions, and when lacking data r=−0.25. Its value may be measured by a standard rating of top influential languages, taking into account then all generally accepted standard tests for any language, since the most influential languages are usually those with better standards of evaluation; or it may take into account, for example, the number of institutions accepting each standard evaluation, to assign an external rating to all available evaluations for each language.

[0037] Because second languages differ in difficulty from the point of view of the first language of the speaker, second language proficiency levels may also be estimated in terms of years of study required for the maximal proficiency. Therefore, the evaluation of ability in languages would be adjusted to the years of planned study, obtained from Equation (**3**), i.e. multiplied by the planned years y_i, corresponding to the estimated standard academic years to acquire that level. For example, for native English speakers, the proficiency level may be extrapolated from the hours of study estimated by the Foreign Service Institute of the U.S. Department of State (for adults of a mean of 40 years) to attain a proficiency level 3 within the Interagency Language Roundtable scale. According to the standard academic year defined in **[033]**, the most difficult languages, like Chinese, would require approximately 5 academic years of full study for maximal proficiency; difficult languages, like Russian, would require 3 years of study; medium languages, like German, would require 2 years of study; while easy languages, like French, would require approximately 1.5 years. Such estimations for a language family or subfamily need to be further adjusted by the languages already known, to respect local independence. For example, if an English speaker learns Russian with high proficiency, being a difficult language according to the FSI, then other Slavic languages would correspond to a lesser degree of difficulty, roughly to the degree of difficulty of those languages from the perspective of a Russian speaker; so, Slavic languages would require approximately 1.5 years each, and a Baltic language would require 2 years of study. These adjustments may be automated by default, according to the different estimations available, unless the user defines other preferences. Failing data, a default minimum y=1.5 may be assigned to any language, including native languages.

[0038] The weighting w_i, assigns a value, by default in a range [0, 1], to the individual languages, language families, or subfamilies, especially looked for (or fully rejected by) the user of this method; it is by default left as 1.

[0039] This embodiment of the method, which calculates the relative ability in languages, may also include the knowledge demonstrated by any evaluation, like exams, courses, certifications, or titles, from a field or subfield of ability with similar characteristics to language acquisition. So, for example, according to the user's preferences, it may take into account achievements in different programming languages, software programs, system administration duties, accounting, or technician examinations.

[0040] In one embodiment of this method, to evaluate the ability of professional achievements in the job positions i, developed by a single person, Equation (**1**) may include a score P in terms of wage or salary level, for any time frame selected. P would then be set by default in terms of mean wage per hour in that job position, which may be adjusted by purchase power parity (PPP) to allow for international comparison, within an interval (0, 1). A theoretical P=1 would correspond to $\ln(v_{MAX})$, i.e. the natural logarithm of the world's individual maximum PPP-adjusted wage per hour (in the period when the job position is evaluated), being the other natural logarithms of wages divided by this value. So if the highest mean hourly wage of a person in the world is a PPP-adjusted $1000, then $\ln(v_{MAX})$=6.907, while a wage of $50/hour of another person in the same period (e.g. the same month, or the same year) would yield a natural logarithm of 3,912, which divided by $\ln(v_{MAX})$ yields P=0.566. From a regional or national perspective, if data is available, a simpler method to obtain P may include the position of the person's wage within the cumulative percentage of wage ranges for that region or country, in the period for which such data were obtained.

[0041] For some unpaid or low pay work, like extracurricular activities, work for nonprofit organizations, or social work, the user may select a different method to evaluate P. For example, the user may define the potential wins in terms of mean score of a previous period (either academic or professional), hence assuming the mean score obtained if the person had not spent the time of ability growth, in academic or professional fields, to work without a measurable reward.

[0042] The B-parameter is adjusted to the professional level d_i developed, which may be obtained from equivalence to the U.S. General Schedule (GS), or the United Nation's Civil Service levels, which should be adjusted according to these descriptions of the method, to keep consistency, to the academic levels described in **[027]**, but +1 level (the professional development would then signify a higher academic level than the one necessary to get to it). Thus, for the GS, gs-2 is d=8, gs-3 is d=9, gs-4 is d=10, gs-5/gs-6 (requiring at least 4 years of a Bachelor's degree) are d=12, gs-7/gs-11 (requiring excellence in Bachelor's degree, or further graduate education) are d=13, gs-12/gs-15 (requiring a previous Ph.D. for direct access) are d=14, and above it Senior Executive Service positions are d=15. These natural numbers may also be divided within their maximum intervals [–0.5, +0.5]. By default, for non-manual works d=6, assuming a minimum vocational education, while for manual works d=5, assuming compulsory lower secondary education.

[0043] The B-parameter is also dependent on the prestige or performance ranking r_i of the institution or company in its field, which may be obtained by international or national rankings, as university ratings for professors and researchers, or hospital ratings for health workers. When specific rating data is not available, by default r_i may be obtained with the institution's budget or the company's capitalization, in a logarithmic scale [0, 100], where 100 (corresponding to r=+0.25 in these descriptions) is the natural logarithm of the maximum annual PPP-adjusted budget or capitalization of any world institution or company within the period of evaluation; the natural logarithm of the budget or capitalization of all other institutions and companies of the same field would then be divided by this maximum value. For example, an r=+0.25 would correspond to the U.S. Government, for the maximum government budget, if no other international or national rating of governments is specified.

[0044] The A-parameter estimation is obtained from Equation (**3**), i.e. multiplied by the number of years y_i in each job position, which, like the standard academic year defined in [**033**], should take a standard value according to the user's preferences. For example, an international standard year may be defined as having 40 hours per week with 4 weeks of holidays, and from this standard workweek, any number of hours worked can be obtained in terms of a standard year. The weighting w_i, by default ranging [0, 1], refines the selection of the job position categories or levels, as well as professional fields, especially looked for (or fully rejected by) the user of this method; by default it is left as 1.

[0045] In another embodiment of this method, to evaluate the ability behind research articles i, the method may take into account the number of citations P in a scale (0, 1), where 100% would correspond to the maximum number of citations of a single article in the academic field; a logarithmic scale may be selected instead, to give less weight to the differences in number of citations. The B-parameter in Equation (**2**) would be dependent on r_i, the performance of the publication, which may correspond to the impact factor (measured by one or more of the ratings available), being the ratings adjusted to the range [–0.25, +0.25], where the maximum weighted review of the year of publication divides all other weightings, to obtain the different values, and where by default r=−0.25. The factor d_i may therefore be adjusted to the mean academic years of study of researchers in the field +1 level; e.g. d=13 in Medicine, because most international researchers have at least a Bachelor's degree and a Master's degree or equivalent postgraduate studies; and by default d=12, i.e. college/university level.

[0046] In this embodiment, the weighting w_i in Equation (**3**) may distinguish among academic fields or reviews especially looked for (or fully rejected by) the user of this method, ranging [0, 1]. It may also include the proportional share of the achievement assigned to each author; the summation of ability assigned to all persons can be greater than the original value calculated for the achievement A_j, because each contribution may be interpreted as representing an independent ability value for each person. w_i in that case may by default correspond to a division by the number of persons who co-authored the paper i, and it may then be adjusted by the user to give certain increased weightings to each position of the author name in the article. y_i may be interpreted as the mean number of standard academic years necessary to publish a research paper by authors in that academic field, according to the user's preferences (keeping a consistent standard with other embodiments), which by default could be assigned to 1 article per full-dedicated month, or y=1/12.

[0047] An embodiment of this method is used to evaluate publications which do not enter into the scholarly circuit of impact factor and citations, or into the usual professional achievements; like teaching material, specialized books or parts thereof, or other literature, articles in magazines or journals, lectures or conferences given. In this case the maximum number of readers or audience may be compared for P. The B-parameter may be obtained from a comparison of estimated academic level d_i of the field of the particular publication, by default d=11 (i.e. a minimum post-secondary education +1 level, consistent with previous descriptions); and the r-factor with the rating of the editor, publisher, journal, or other entity in that field, following by default the budget/capitalization criterion in **[043]**. From Equation (**3**), according to the user's preferences, the mean number of comparable publications per author in a standard academic year in the field may be used for y_i. When lacking data, values are set by default to the minimum, as in other embodiments.

[0048] In another embodiment of this method, discontinuous jobs (not evaluated under professional achievements) are rated, like professional (internships, participation in research projects, patents) or artistic works. In this case, the score P may be obtained from monetary evaluation (investment in the project, estimated or realized licensing price of the patent, price of the work of art), compared to the evaluation of other works in the field (possibly in a logarithmic scale, as in **[040]**). It may take into account the academic level d_i of the field, by default d=11, and the rating r_i of the institution, publisher, museum, gallery, or other entity in that field, following by default the budget/capitalization criterion in **[043]**. From Equation (**3**), according to the user's preferences, the mean number of comparable publications per author and year in the field may be used for y_i. When lacking data, values are set by default on the minimum, as in other embodiments.

[0049] In an embodiment of this method, the evaluation of academic and professional awards, like Nobel prizes or Fields medals, is measured as defined by the user, for example by the rating P of the award within the field. B_i may be obtained by the prestige r_i, as indicator of performance of the award among all fields, and the mean level of academic or professional achievement d_i of those receiving the award or prize, by default the post-secondary +1 level d=11. In Equation (**3**), the y-parameter may correspond to the mean period in terms of standard academic years necessary to obtain it – from a single research paper, with a default value y=1/12, to a prize for a whole career, e.g. taking into account the number of years y_i of professional development usually necessary to create the works awarded. w_i may take into account the number of co-awarded people, whose value may be further adjusted by the user.

[0050] In another embodiment of this method, persons are located on the general set of ability continua $\boldsymbol{A}$. An overall equation, that calculates a numerical value assigned to the ability of persons e, adds up different calculations of the general ability demonstrated or purposely achieved by the person. By adding all selected subsets A_k, calculated from different embodiments of this method, a general equation results:

$$A_e = \sum_{k=1}^{n} \frac{w_k A_k}{t_k} \qquad (\mathbf{4})$$

[0051] Where the weighting w_k is assigned by users of the method to each A_k, according to their preferences, by default in a range [0, 1]; failing that selection, it is by default 1, since all should have been calculated with consistent variables, and may be added up without further weighting. A time factor t_k may divide each A_k, thus reflecting the fact that the productivity potential estimates of academic and professional achievements, when related to age, seem to follow different inverted u-shaped functions. The user may define the use of growth estimates from those already described by scholars for the different professional fields and positions, obtaining the cumulative distribution function in a range (0, 1], where 1 is the maximum achievement in the field and position. If sufficiently large data from a database of achievements is available, we may obtain the estimated age-related distribution function for the growth of each ability A_k. If t is actually used (and not left by default as 1), it would give a comparable rating of achievement potentials for each subset of ability A_k, among those selected by the user; this would allow for more exact inter-age comparisons.

[0052] When different subsets of abilities A_k are added, care should be taken to avoid infringing the local independence assumption. For example, when adding language knowledge and academic achievements, ratings strictly related to the same achievement (whose ability is already accounted for with one of the evaluations) should be eliminated from the other subset. Also, if an award evaluates the same parameters – like a prize for maximal achievement in scores in a degree, compared with fellow students, or a maximal number of citations in research papers –, a conventional assignment of a maximum value in those embodiments should be preferred (e.g. in scores, P=0.99, or in performance, r=+0.25), instead of using the specific embodiment of this method for awards.

[0053] In another embodiment of this invention, the results of a standardized quantification of achievements for persons, obtained with Equation (**4**), and stored in a database, are shown in a discontinuous rating scale, R_e (scaled rating of person e) in intervals [0, 10], [0, 100], or in any other scale. Because the different A_e obtained could show huge differences, they may be shown in a logarithmic scale, by assigning the maximal value of the scale to $\ln(A_{MAX})$, where A_{MAX} is the maximum value of A_e among all persons in the database, and dividing the other $\ln(A_e)$ values by that $\ln(A_{MAX})$. That would show an intuitive and user-friendly scaled rating of ability achievements of persons.

[0054] "**FIG. 1** shows one embodiment of a computer-implemented method for calculating a rating for achievements of candidates in a database. At a step **110**, the user selects the subsets of ability A_k to be quantified. At a step **120**, the user specifies the preferred values or range of values for parameters used in Equations (**1**)-(**3**) to calculate the different A_k, and their summation A_e in Equation (**4**). At a step **130**, the values specified by the user are assigned, and those not specified by the user are set to the default ones. At a step **140** the rating A_e of each Person e in the database is calculated. At a step **150**, a function rank() for achievements of Person e from a e^{th} component is determined. An illustrative case in **FIG. 2** and **FIG. 3** shows the same simple database with three curricula vitae (documents with achievements of persons), the three accomplishing the initial criterion of having obtained a certain degree in Mathematics. In **FIG. 2**, each curriculum in the unordered database may be evaluated personally, according to experience and intuition of the recruiter, or to automated processes involving more keyword and keyword-rating selection, or a combination of such methods, as it is usually done nowadays. In **FIG. 3**, the rating method has been applied, and documents have been ranked (with scaled rating R_e shown for each candidate in the illustration). In practice, there may be thousands of documents containing achievements in a database, and it is not possible to select the most suited curricula – with the methods currently available – immediately from **FIG. 2**."

[0055] If the time factor t_k is not available or not selected by the user to obtain the ratings of persons, we may still select the maximum achievement of a person A_{MAX} corresponding to each age (or age range), and then divide each rating of persons of that age or age range by that value. We can thus obtain a general inter-age rating, instead of showing ratings consisting of a sum of achievements, which tend to overestimate aged candidates over young ones. Users interested in achievement potentials will not need to compare each possible ranking by age.

[0056] The rating A_e could be obtained from unverified achievements submitted by the person, or by verified or documented achievements, so that the user of this method can select the level of trust, i.e. the level of candidate freedom to contribute achievements without proof. A combination or comparison of both ratings in terms of differences in percentage may also be specified by the user to decide which unverified curricula to revise manually. Also, since international and inter-field comparisons are more difficult to obtain, a selection of different comparisons may be defined by the user; as, between national-only rankings and international rankings, rankings among fields and general rankings, or any other combination, to further compare the achievements of candidates according to the user's criteria.

[0057] In another embodiment of this method, an estimated cumulative rating of entities c is obtained by adding up all A_e obtained from the curricula of their members e. So, for example, we may evaluate a college/university in terms of the ability of professors and researchers, or a company in terms of the ability of workers, by adding the persons' A_e, obtained from Equation (**4**) according to the user's preferences, or obtaining a mean value of them:

$$A_c = \frac{1}{n}\sum_{e=1}^{n} A_e \qquad (\mathbf{5})$$

[0058] In one embodiment of this method, if the results of the cumulative ratings A_c of similar entities, obtained with the same criteria, are compared, a ranking based on collective R_c for entities can be obtained, as it is obtained for persons.

[0059] In an embodiment of this method, a rating of entities is made with the estimated A-growth for a person. From the initial A_e of persons e, that studied in or worked for a certain entity, we may subtract their A_e after a certain period in terms of standard academic or professional year, obtaining the mean A-growth rate for that entity, for the specified time frame. With this past A-growth rate, candidates would have an estimated A-growth rate within that temporal frame, if they decided to study in or work for that entity for a certain period. The user may therefore select the appropriate similarities of the situation; as, the initial background and rating of the persons e to be taken into account, or the academic or professional fields of the study or job position to evaluate.

[0060] Other embodiments of this method include the use of logarithmic transformations of the scales of the parameters, as well as the display of graphical representations of the models used, and of the locations of persons in them, to facilitate the candidate selection. θ_j is easily derived from the following simple logistic model, where $\theta_j = \ln(A_j)$ and $b_i = -\ln(B_i)$:

$$P(u_{ij} = 1 | \theta_j, b_i) = \frac{e^{\theta_j - b_i}}{1 + e^{\theta_j - b_i}} \qquad (\mathbf{6})$$

'Mathematics', from the curricula vitae of **FIG. 2** and **FIG. 3**. While the difficulty d_i is supposed to be the same for the same degree, the performance ranking r_i of each college where degree 'Mathematics' has been obtained determines the different location of each curve – those with better performance (or higher difficulty) are to the right of those with worse performance (or lower difficulty). Because the one-parameter model has a common value for the maximum slope for the evaluations, the model is said to include an assumption that all evaluations have the same discriminating power. Because 'Iowa' has a lower ranking than 'Cornell', and 'Cornell' a lower ranking than 'Harvard', the score obtained by each person combined with the specific curves gives a different value for θ_j than is expected by the scores alone. **FIG. 4** illustrates two important properties of the Rasch model as applied in this method to rate achievements:

1. Within the same evaluation curve, higher scores (departing from a pass grade at P=0.5) indicate a higher proportional achievement in terms of ability.
2. A higher difficulty or ranking of the evaluation differentiates better between persons with higher achievements."

[0062] Embodiments of this invention include derivations of the simple one-parameter model, like the two-parameter or three-parameter logistic models, as well as polytomous models, differentiated from the simple dichotomous Rasch model. For example, for any embodiment considering many different components of the response and scoring each of those components (e.g. in academic or professional evaluations scored with pre-defined levels of achievement), the user may select the known unidimensional polytomous partial credit model – designed for items with two or more ordered categories. In it, δ-parameters (threshold for the u^{th} score category for evaluation i) would include the difficulty d_i of each knowledge depth level (with performance rating r_i remaining constant for the same evaluation), being k the score on evaluation i, and m_i the maximum score on evaluation i:

$$P(u_{ij} = k|\theta_j) = \frac{e^{\left[\sum_{u=0}^{k}\theta_j - \delta_{iu}\right]}}{\sum_{v=0}^{m_i} \left[\sum_{u=0}^{v}\theta_j - \delta_{iu}\right]} \quad (7)$$

[0063] Embodiments of this method include multiple evaluations and multiple abilities to be measured. Those quantifications of multiple abilities or evaluations require further conventional divisions of the ability and evaluation sets into differentiated continua. As anyone of ordinary skill in the art will appreciate, such embodiments also fall within the scope of this invention, and users of this method may further refine their search for the location of a person within their preferred multidimensional models. So for example, a user may divide, in a logistic multidimensional model, between the ability in the academic fields $\theta_1, ..., \theta_n$ in a certain evaluation i; or between hypothesized continua of academic knowledge and professional skills $\theta_1, ..., \theta_n$, pre-defined for a certain evaluation i; or between different response categories $x_1, x_2, ..., x_n$, of evaluations i, which may also be (as in the multidimensional partial credit model) score categories or graded responses $k_1, k_2, ..., k_n$.

[0064] Embodiments of this invention may include different types of ability and evaluation estimators, from available data on scores, evaluations, and responses to them as defined in this method, according to the user's preferences. Statistical estimators are based on the fact that in making observations that reflect properties, the actual properties are not observed – only their manifestations are observed. Departing from the deterministic models of this invention – where parameters are defined by the user (as the range of values for P and B_i), and taken as certain –, the calculation of abilities A may be further refined by using statistical models, if sufficiently large data of certain achievements (or external statistical information of them) obtained according to this method are available.

[0065] A description of embodiments that include ability estimators may differentiate a vector V_x of response patterns or categories $(x_1, x_2, ..., x_n)$ to evaluations i, selected according to the user's preferences; thus, the user may divide a degree i into the different courses x; or a language i composed of categories x (like speaking, listening, writing, speaking); or a job position i composed of different performance categories x. The specified responses of evaluation i have possibly different probabilities, hence:

$$P_{x_i}(\theta) = \Pr\{x_i|\theta\}$$

[0066] Where $P_{xi}(\theta)$ denotes the probability of a specified evaluation response x_i, being expressed as a function of the ability θ; hence, if $P_V(\theta)$ denotes the probability of a specified response pattern V_x we have:

$$P_V(\theta) = \prod_{x_i \in V} P_{x_i}(\theta)$$

[0067] The likelihood function $L_V(\theta)$ is the probability of the response pattern $P_V(\theta)$ itself. From which the likelihood equation is given by:

$$\frac{\partial}{\partial\theta} \log L_V(\theta) = \frac{\partial}{\partial\theta}\left[\sum_{x_i \in V} \log P_{x_i}(\theta)\right]$$
$$= 0$$

[0068] Precision may be added to any model used, as it is done in IRT, by a linear transformation of the likelihood function, adding the information from a density function of the ability variable, $f(\theta)$, to obtain a more precise estimator than the common maximum likelihood estimator, giving the transformed function:

$$B_V(\theta) = f(\theta) L_V(\theta) = f(\theta) \prod_{x_i \in V} P_{x_i}(\theta)$$

[0069] The Bayes modal estimator, which makes $B_V(\theta)$ absolutely maximal, is obtained in the same way that the likelihood equation is defined:

$$\frac{\partial}{\partial\theta} \log B_V(\theta) = \frac{\partial}{\partial\theta}\left[\log f(\theta) + \sum_{x_i \in V} \log P_{x_i}(\theta)\right]$$
$$= 0$$

[0070] When there is little empirical information about the form of the distribution of the density function $f(\theta)$, the standard multivariate normal distribution with an identity matrix for the variance/covariance matrix may be used as prior distribution for Bayesian analysis in this method, being often the default distributional assumption for the analysis of educational and psychological data.

[0071] The user may classify the *n* evaluations into a certain number of arbitrary categories, like an academic category T composed of all achievements in education, a language category T composed of all achievements in language knowledge, or a general professional category T composed of all achievements in the works developed. Then $P_T(\theta)$, the probability of response to such a category, T, is given by:

$$P_T(\theta) = \sum_{V \in T} P_V(\theta)$$

$$= \sum_{V \in T} \prod_{x_i \in V} P_{x_i}(\theta)$$

[0072] Embodiments of this method may therefore include the well-known IRT ability estimators. The user may further define the use of different available estimates for the selected models; as, for the partial credit model, the user may select a combination of weighted likelihood estimates, expected a posteriori estimators, or plausible values. In a complex example, ability estimators may be used for a pre-defined multidimensional model: for the estimation of different θ_j in evaluations i, we may select a vector V_k of graded response patterns or categories (k_1, k_2, ..., k_n), defined according to the user's preferences; these could correspond to the different courses (conforming a degree i) scored with a discrete evaluation, in form of letter grades A-E, with the defined (or estimated) "step" difficulty of each response in a higher category of evaluation i.

[0073] In this invention it is assumed that a user has access to a digital database of achievements. For example, suppose that three candidates apply for a job as described by a recruiter, where the only requirement is to have obtained the undergraduate degree in Mathematics. The candidates fill in the appropriate form for achievements, whose descriptions are then contained in records of a database, within standardized record fields; for example, as a record type Table (field1, field2, field3, field4), which may correspond, as illustrated in **FIG. 2**, to Education (degree, college, score, credit), or Job (position, company, wage, hours), where each achievement recorded is assumed to be linked to the candidate obtaining it.

[0074] In this method, the user needs to assign a parameter value to each different field value; we assume that the database has been created with record fields corresponding to parameters as described in the different embodiments. As illustrated in the flowchart of **FIG. 1**, the user is prompted at a step **110** to select the subsets of ability to quantify. In this case, the recruiter with access to the digital database will be prompted to select the desired tables to evaluate. Assuming that the recruiter is looking for an evaluation of education achievements alone, he selects the table Education. Thus, records from table Job will not be taken into account in the calculation.

[0075] At a step **120**, the user is prompted to define a difficulty level d_i for each different degree field value in the database, a rating r_i for each different college field value in the database, and the P-parameter in interval (0, 1) for each score field value. In this example, for table Education, the recruiter will be asked to define: a value d_i for 'Mathematics' and 'Medicine'; a value r_i for 'Iowa', 'Mayo', 'Harvard', and 'Cornell'; a value P for 'A', 'B+', and 'B'; and the number of standard credit hours per year that divide the credit field values, to obtain the y-parameter. The user can assign the same parameter value to all different field values, so that the parameter does not help differentiate achievements in the calculation.

[0076] Although this assignment of parameter values may be made personally by the user as exemplified, when there are large numbers of achievements, with many different field values, the assignment of parameter values could more efficiently be made using external data, which will be automatically retrieved by the implementation of the method, after being manually assigned the first time – either by the designer of the particular implementation, or by the user. According to the descriptions made of embodiments of this invention, the recruiter in this case selects: difficulties d_i from an academic level scale; college ratings r_i from the preferred college/university ranking; the official correspondence of the letter grade system to the interval [0, 100]; and the official or mean credit hours of one academic year.

[0077] The user is then asked to define the equation to obtain B_i (which relates d_i and r_i, and both of them with P when estimating ability), and the equation to estimate the ability A_j of each person. The recruiter in this case will be prompted to select the preferred equation B_i, which he defines as Equation (**2**), with z=4; and an equation for ability estimation, which he defines simply as Equation (**1**). The user is then prompted to assign a weighting to each record, based on the value of the record's first field. The recruiter in this case, looking especially for achievements in degree Mathematics, defines a weighting w=1 for records with degree field value 'Mathematics', and w=0.01 for all other records; therefore, the record of Person 1 with degree field value 'Medicine' in table Education will have little impact on the comparison of candidates. Since the recruiter has not selected more than one table, w_k and t_k need not be defined – if more than one table had been selected in this case, they would apply weightings to ability estimations for each table. The user is also prompted, in this implementation, to define a range of values for a scaled rating R_e of candidates; in this case, the recruiter selects an integer interval [0-100].

[0078] At a step **130**, the values specified by the user are assigned, or else default values (as pre-defined in the particular implementation of this method) are automatically assigned. At a step **140** the rating A_e of each Person e in the database is calculated, according to the values and equations selected, which in this case will include only the A_k corresponding to the summation of records from table Education, for each candidate. At a step **150**, the function rank(), based on the calculated ability A_e, is applied for Person e from a e^{th} component of the database. In this case, with the parameter values defined by the recruiter, Person 2 ranks ahead of Person 3, and Person 3 ranks ahead of Person 1. The recruiter will also obtain scaled integer ratings as illustrated in **FIG. 3**, where A_2 is A_{MAX} (to which a maximum value R_2=100 is assigned), and the other calculated values A_1 and A_3 are divided by A_1, and rounded to the nearest integer in the scale to obtain R_1 and R_3. The recruiter could also select to display graphically, in a logarithmic scale, the values of the calculated θ_j= ln(A_j), for records with degree field value 'Mathematics', as illustrated in **FIG. 4**.

[0079] The user can apply the computer-implemented method repeatedly to the same data, to compare the different ratings and graphs obtained when different parameter values are assigned. The recruiter in this case could thus compare graphically the curve shifts due to the changes in parameter values r_i, d_i, or to the equation defined for B_i. The recruiter could also compare confidence intervals from statistical estimations of ability for each achievement, and a graphical representation of those intervals (instead of a single point in each curve as illustrated in **FIG. 4**), further refining the intended comparison of achievements. If the parameter values eventually selected by the recruiter, compared for a small number of persons (as the three candidates of the example), are then applied to large numbers of candidates in a database of achievements, the process of candidate rating will be automated according to the recruiter's preferences, and the ranking of candidates obtained will be the expected one.

[0080] Although certain embodiments have been illustrated and described herein for purposes of description of the preferred embodiment, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent embodiments or implementation calculated to achieve the same purposes may be substituted for the embodiments shown and described without departing from the scope of the present invention. Those with skill in the art will readily appreciate that embodiments in accordance with the present invention may be implemented in a very wide variety of ways. This application is intended to cover any adaptations or variations of the embodiments discussed herein.

ABSTRACT OF THE DISCLOSURE

A computer-implemented method and process assigns standardized ratings to achievements, allowing for ranking persons in a database, such as any database of achievements from resumes or curricula vitae. The rating assigned to a person is calculated from the grades or levels of achievements in exams, courses, certificates, titles, publications, job positions, and works. In addition, the rating of a person is calculated from a parameter representing the ability levels measured by those evaluations, and the performance of the evaluating institution in measuring them. The method and process is particularly useful in ranking the academic and professional achievements of persons, enhancing the performance of search results from databases of personal achievements, used by companies and recruiters.

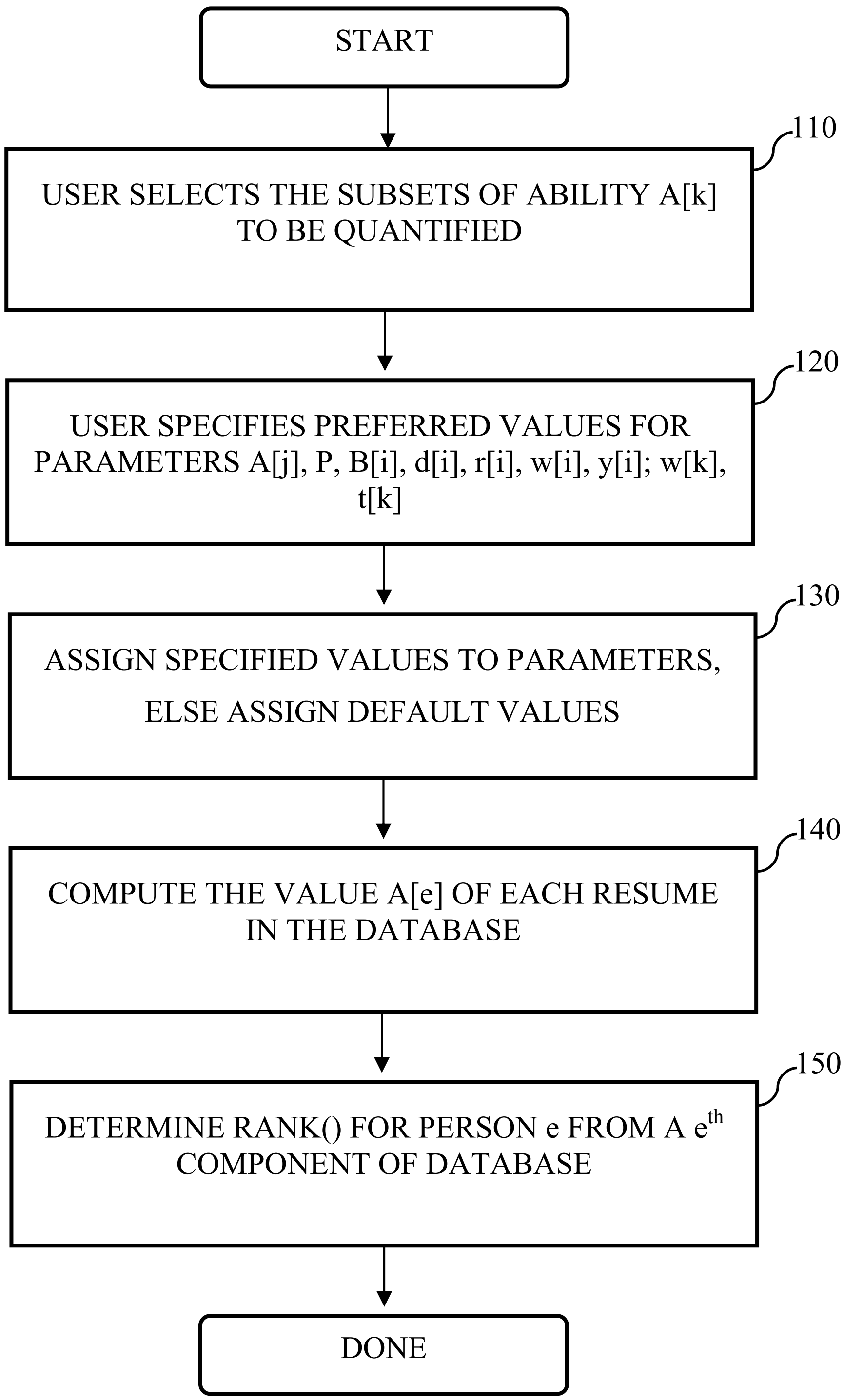
START
110
USER SELECTS THE SUBSETS OF ABILITY A[k] TO BE QUANTIFIED
120
USER SPECIFIES PREFERRED VALUES FOR PARAMETERS A[j], P, B[i], d[i], r[i], w[i], y[i]; w[k], t[k]
130
ASSIGN SPECIFIED VALUES TO PARAMETERS, ELSE ASSIGN DEFAULT VALUES
140
COMPUTE THE VALUE A[e] OF EACH RESUME IN THE DATABASE
150
DETERMINE RANK() FOR PERSON e FROM A eth COMPONENT OF DATABASE
DONE

FIG. 1

Person[1]

Education ('Mathematics', 'Iowa', 'A', 120);

('Medicine', 'Mayo', 'B', 130);

Job ('gs-5', 'IBM', 20, 400);

Person[2]

Education ('Mathematics', 'Harvard', 'B', 130);

Job ('gs-6', 'Microsoft', 25, 500);

Person[3]

Education ('Mathematics', 'Cornell', 'B+', 125);

Job ('gs-6', 'Google', 27, 200);

FIG. 2

R[1]=68

Person[1]

Education ('Mathematics', 'Iowa', 'A', 120);

('Medicine', 'Mayo', 'B', 120);

Job ('gs-5', 'IBM', 20, 400);

R[2]=100

Person[2]

Education ('Mathematics', 'Harvard', 'B', 130);

Job ('gs-6', 'Microsoft', 25, 500);

R[3]=74

Person[3]

Education ('Mathematics', 'Cornell', 'B+', 125);

Job ('gs-6', 'Google', 27, 200);

FIG. 3

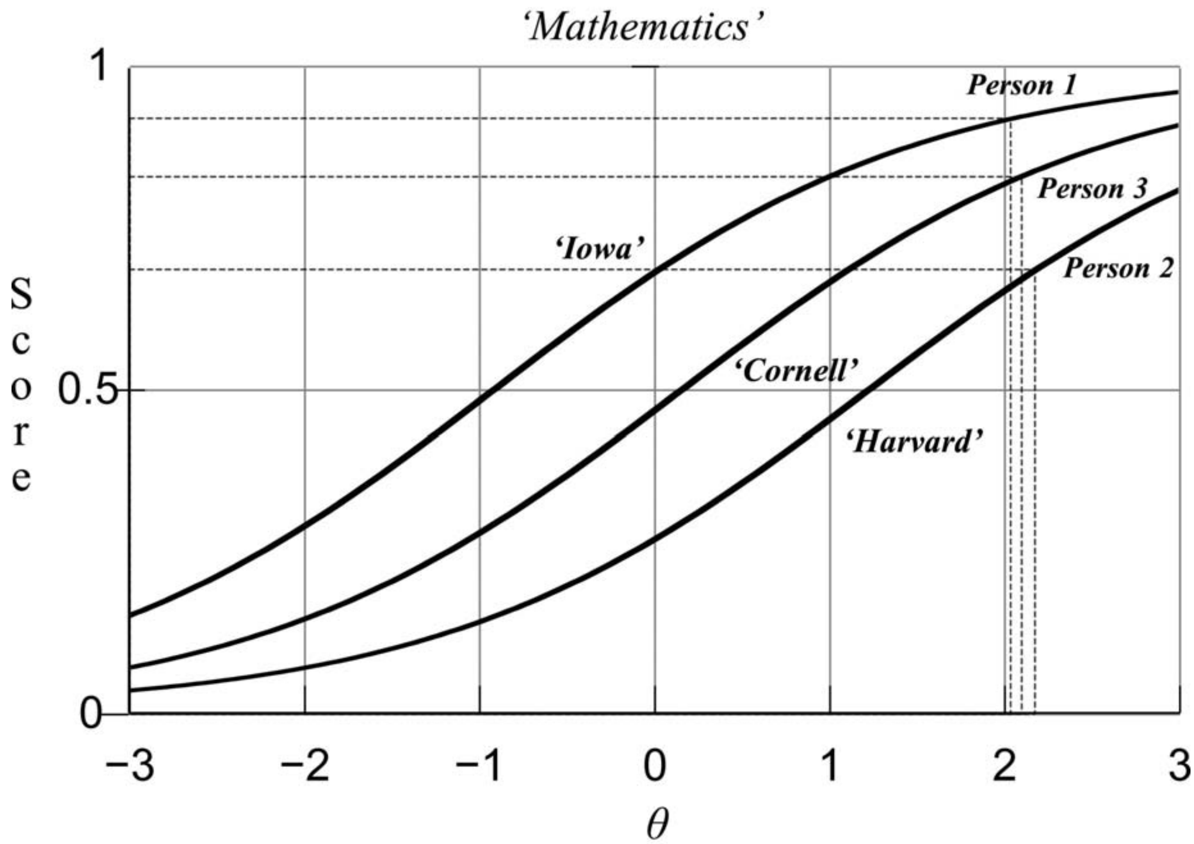
'Mathematics'
1
0.5
0
Score
Person 1
Person 3
Person 2
'Iowa'
'Cornell'
'Harvard'
−3
−2
−1
0
1
2
3
θ

FIG. 4