UNIDIMENSIONAL SCALING pdf

1: Multidimensional Scaling

Sometimes, a unidimensional scale can over-simplify the concept you are studying. For example, scholarly ability can differ according to whether a student is stressed (e.g. exam mode) or non-stressed (e.g homework mode).

Overview From a non-technical point of view, the purpose of multidimensional scaling MDS is to provide a visual representation of the pattern of proximities i. For example, given a matrix of perceived similarities between various brands of air fresheners, MDS plots the brands on a map such that those brands that are perceived to be very similar to each other are placed near each other on the map, and those brands that are perceived to be very different from each other are placed far away from each other on the map. For instance, given the matrix of distances among cities shown above, MDS produces this map: In this example, the relationship between input proximities and distances among points on the map is positive: Had the input data been similarities, the relationship would have been negative: From a slightly more technical point of view, what MDS does is find a set of vectors in p-dimensional space such that the matrix of euclidean distances among them corresponds as closely as possible to some function of the input matrix according to a criterion function called stress. A simplified view of the algorithm is as follows: Assign points to arbitrary coordinates in p-dimensional space. Compute euclidean distances among all pairs of points, to form the Dhat matrix. Compare the Dhat matrix with the input D matrix by evaluating the stress function. The smaller the value, the greater the correspondance between the two. Adjust coordinates of each point in the direction that best maximally stress. Input Data The input to MDS is a square, symmetric 1-mode matrix indicating relationships among a set of items. By convention, such matrices are categorized as either similarities or dissimilarities, which are opposite poles of the same continuum. A matrix is a similarity matrix if larger numbers indicate more similarity between items, rather than less. A matrix is a dissimilarity matrix if larger numbers indicate less similarity. The distinction is somewhat misleading, however, because similarity is not the only relationship among items that can be measured and analyzed using MDS. Hence, many input matrices are neither similarities nor dissimilarities. However, the distinction is still used as a means of indicating whether larger numbers in the input data should mean that a given pair of items should be placed near each other on the map, or far apart. Calling the data "similarities" indicates a negative or descending relationship between input values and corresponding map distances, while calling the data "dissimilarities" or "distances" indicates a positive or ascending relationship. A typical example of an input matrix is the aggregate proximity matrix derived from a pilesort task. Each cell xij of such a matrix records the number or proportion of respondents who placed items i and j into the same pile. It is assumed that the number of respondents placing two items into the same pile is an indicator of the degree to which they are similar. An MDS map of such data would put items close together which were often sorted into the same piles. Another typical example of an input matrix is a matrix of correlations among variables. Treating these data as similarities as one normally would , would cause the MDS program to put variables with high positive correlations near each other, and variables with strong negative correlations far apart. Another type of input matrix is a flow matrix. For example, a dataset might consist of the number of business transactions occurring during a given period between a set of corporations. Running this data through MDS might reveal clusters of corporations that whose members trade more heavily with one another than other than with outsiders. Although technically neither similarities nor dissimilarities, these data should be classified as similarities in order to have companies who trade heavily with each other show up close to each other on the map. Dimensionality Normally, MDS is used to provide a visual representation of a complex set of relationships that can be scanned at a glance. Since maps on paper are two-dimensional objects, this translates technically to finding an optimal configuration of points in 2-dimensional space. However, the best possible configuration in two dimensions may be a very poor, highly distorted, representation of your data. If so, this will be reflected in a high stress value. When this happens, you have two choices: There are two difficulties with increasing the number of dimensions. The first is that even 3 dimensions are difficult to display on paper and are significantly more difficult to comprehend. Four or more dimensions render MDS virtually useless as a method of making complex data more accessible to the human mind. The second problem is that with increasing dimensions, you must estimate an increasing number of parameters to obtain a decreasing improvement in stress. The result is model of the data that is nearly as complex as the data itself. On the other hand, there are some applications of MDS for which high dimensionality is not a problem. For instance, MDS can be viewed as a mathematical operation that converts an item-by-item matrix into an item-by-variable matrix. Suppose, for example, that you have a person-by-person matrix of similarities in attitudes. You would like to explain the pattern of similarities in terms of simple personal characteristics such as age, sex, income and education. The trouble is, these two kinds of data are not conformable. The person-by-person matrix in particular is not the sort of data you can use in a regression to predict age or vice-versa. However, if you run the data through MDS using very high dimensionality in order to achieve perfect stress , you can create a person-by-dimension matrix which is similar to the person-by-demographics matrix that you are trying to compare it to. Stress The degree of correspondence between the distances among points implied by MDS map and the matrix input by the user is measured inversely by a stress function. The general form of these functions is as follows: In the equation, dij refers to the euclidean distance, across all dimensions, between points i and j on the map, f xij is some function of the input data, and scale refers to a constant scaling factor, used to keep stress values between 0 and 1. When the MDS map perfectly reproduces the input data, f xij - dij is for all i and j, so stress is zero. Thus, the smaller the stress, the better the representation. The transformation of the input values f xij used depends on whether metric or non-metric scaling. In other words, the raw input data is compared directly to the map distances at least in the case of dissimilarities: In non-metric scaling, f xij is a weakly monotonic transformation of the input data that minimizes the stress function. The monotonic transformation is computed via "monotonic regression", also known as "isotonic regression". From a mathematical standpoint, non-zero stress values occur for only one reason: That is, for any given dataset, it may be impossible to perfectly represent the input data in two or other small number of dimensions. On the other hand, any dataset can be perfectly represented using n-1 dimensions, where n is the number of items scaled. As the number of dimensions used goes up, the stress must either come down or stay the same. It can never go up. Of course, it is not necessary that an MDS map have zero stress in order to be useful. A certain amount of distortion is tolerable. Different people have different standards regarding the amount of stress to tolerate. The rule of thumb we use is that anything under 0. Care must be exercised in interpreting any map that has non-zero stress since, by definition, non-zero stress means that some or all of the distances in the map are, to some degree, distortions of the input data. The distortions may be spread out over all pairwise relationships, or concentrated in just a few egregious pairs. In general, however, longer distances tend to be more accurate than shorter distances, so larger patterns are still visible even when stress is high. See the section on Shepard Diagrams and Interpretation for further information on this issue. From a substantive standpoint, stress may be caused either by insufficient dimensionality, or by random measurement error. For example, a dataset consisting of distances between buildings in New York City, measured from the center of the roof, is clearly 3-dimensional. Hence we expect a 3-dimensional MDS configuration to have zero stress. In practice, however, there is measurement error such that a 3-dimensional solution does not have zero stress. In fact, it may be necessary to use 8 or 9 dimensions to bring stress down to zero. In this case, the fact that the "true" number of dimensions is known to be three allows us to use the stress of the 3-dimensional solution as a direct measure of measurement error. Unfortunately, in most datasets, it is not known in advance how many dimensions there "really" are. In such cases we hope with little foundation that the true dimensionality of the data will be revealed to us by the rate of decline of stress as dimensionality increases. For example, in the distances between buildings example, we would expect significant reductions in stress as we move from a one to two to three dimensions, but then we expect the rate of change to slow as we continue to four, five and higher dimensions. This is because we believe that all further variation in the data beyond that accounted for by three dimensions is non-systematic noise which must be captured by a host of "specialized" dimensions each accounting for a tiny reduction in stress. Thus, if we plot stress by dimension, we expect the following sort of curve: Thus, we can theoretically use the "elbow" in the curve as a guide to the dimensionality of the data. In practice, however, such elbows are rarely obvious, and other, theoretical, criteria must be used to determine dimensionality. Shepard Diagrams The Shepard diagram is a scatterplot of input proximities both xij and f xij against output distances for every pair of items scaled. Normally, the X-axis corresponds to the input proximities and the Y-axis corresponds to both the MDS distances dij and the transformed "fitted" input proximities f xij. An example is given in Figure 3. In the plot, asterisks mark values of dij and dashes mark values of f xij. Stress measures the vertical discrepancy between xij the map distances and f xij the transformed data points. When the stress is zero, the asterisks and dashes lie on top of each other. In metric scaling, the asterisks form a straight line. In nonmetric scaling, the asterisks form a weakly monotonic function 1 , the shape of which can sometimes be revealing e. If the input proximities are similarities, the points should form a loose line from top left to bottom right, as shown in Figure 3. If the proximities are dissimilarities, then the data should form a line from bottom left to top right. In the case of non-metric scaling, f xij is also plotted. It does, however, print out a list of the most discrepant poorly fit pairs of items. If you notice that the same item tends to appear in a number of discrepant pairs, it would make sense to delete the item and rerun the scaling. Interpretation There are two important things to realize about an MDS map. The first is that the axes are, in themselves, meaningless and the second is that the orientation of the picture is arbitrary. Thus an MDS representation of distances between US cities need not be oriented such that north is up and east is right. In fact, north might be diagonally down to the left and east diagonally up to the left.

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2: What does unidimensional mean? definition and meaning (Free English Language Dictionary)

Multidimensional scaling (MDS) is a means of visualizing the level of similarity of individual cases of a dataset. It refers to a set of related ordination techniques used in information visualization, in particular to display the information contained in a distance matrix.

What level of data is involved nominal, ordinal, interval, or ratio? What will the results be used for? Should you use a scale, index, or typology? What types of statistical analysis would be useful? Should you use a comparative scale or a noncomparative scale? Should there be an odd or even number of divisions? Odd gives neutral center value; even forces respondents to take a non-neutral position. What should the nature and descriptiveness of the scale labels be? What should the physical form or layout of the scale be? Scale construction method[edit] It is possible that something similar to your scale will already exist, so including those scale s and possible dependent variables in your survey may increase validity of your scale. Begin by generating at least ten items to represent each of the scales. Administer the survey; the more representative and larger your sample, the more confidence you will have in your scales. Review the means and standard deviations for your items, dropping any items with skewed means or very low variance. Run a principal components analysis with oblique rotation on your items and the other items for scales it will be important to differentiate from your own. Request components with eigenvalues greater than 1. It is easier if you group the items by targeted scales. The more distinct the other items, the better your chances your items will load only on your own scale. These are candidates to drop. These components and their items are candidates to drop. Look at the candidates to drop and the components to be dropped. Is there anything that needs to be retained because it is critical to your construct? For example, if a conceptually important item only cross loads on a component to be dropped, it is good to keep it for the next round. Drop the items, and rerun asking the program to give you only the number of components after dropping the uninterpretable and single-item ones. Go through the process again starting at Step 3. Run the Alpha program asking for the Alphas if each item is dropped. Any scales with insufficient Alphas should be dropped and the process repeated from Step 3. For better practices, keep the final components and all loadings of yours and similar scales selected to be used in the Appendix of your scale. Level of measurement The type of information collected can influence scale construction. Different types of information are measured in different ways. Some data are measured at the nominal level. That is, any numbers used are mere labels; they express no mathematical properties. Some data are measured at the ordinal level. Numbers indicate the relative position of items, but not the magnitude of difference. An example is a preference ranking. Some data are measured at the interval level. Numbers indicate the magnitude of difference between items, but there is no absolute zero point. Examples are attitude scales and opinion scales. Some data are measured at the ratio level. Numbers indicate magnitude of difference and there is a fixed zero point. Ratios can be calculated. Composite measures[edit] Composite measures of variables are created by combining two or more separate empirical indicators into a single measure. Composite measures measure complex concepts more adequately than single indicators, extend the range of scores available and are more efficient at handling multiple items. In addition to scales, there are two other types of composite measures. Indexes are similar to scales except multiple indicators of a variable are combined into a single measure. The index of consumer confidence, for example, is a combination of several measures of consumer attitudes. A typology is similar to an index except the variable is measured at the nominal level. Indexes are constructed by accumulating scores assigned to individual attributes, while scales are constructed through the assignment of scores to patterns of attributes. While indexes and scales provide measures of a single dimension , typologies are often employed to examine the intersection of two or more dimensions. Typologies are very useful analytical tools and can be easily used as independent variables , although since they are not unidimensional it is difficult to use them as a dependent variable. Comparative and non comparative scaling[edit] With comparative scaling , the items are directly compared with each other example: Do you prefer Pepsi or Coke? In noncomparative scaling each item is scaled independently of the others example: How do you feel about Coke? Comparative scaling techniques[edit] Pairwise comparison scale â€" a respondent is presented with two items at a time and asked to select one example: This is an ordinal level technique when a measurement model is not applied. Krus and Kennedy elaborated the paired comparison scaling within their domain-referenced model. The Bradleyâ€"Terryâ€"Luce BTL model Bradley and Terry, ; Luce, can be applied in order to derive measurements provided the data derived from paired comparisons possess an appropriate structure. Rasch model scaling â€" respondents interact with items and comparisons are inferred between items from the responses to obtain scale values. Respondents are subsequently also scaled based on their responses to items given the item scale values. The Rasch model has a close relation to the BTL model. Rank-ordering â€" a respondent is presented with several items simultaneously and asked to rank them example: Rate the following advertisements from 1 to This is an ordinal level technique. Bogardus social distance scale â€" measures the degree to which a person is willing to associate with a class or type of people. It asks how willing the respondent is to make various associations. The results are reduced to a single score on a scale. There are also non-comparative versions of this scale. Q-Sort â€" Up to items are sorted into groups based on rank-order procedure. Guttman scale â€" This is a procedure to determine whether a set of items can be rank-ordered on a unidimensional scale. It utilizes the intensity structure among several indicators of a given variable. Statements are listed in order of importance. The rating is scaled by summing all responses until the first negative response in the list. The Guttman scale is related to Rasch measurement; specifically, Rasch models bring the Guttman approach within a probabilistic framework. Constant sum scale â€" a respondent is given a constant sum of money, script, credits, or points and asked to allocate these to various items example: If you had Yen to spend on food products, how much would you spend on product A, on product B, on product C, etc. Magnitude estimation scale â€" In a psychophysics procedure invented by S. Stevens people simply assign numbers to the dimension of judgment. The geometric mean of those numbers usually produces a power law with a characteristic exponent. In cross-modality matching instead of assigning numbers, people manipulate another dimension, such as loudness or brightness to match the items. Typically the exponent of the psychometric function can be predicted from the magnitude estimation exponents of each dimension. Non-comparative scaling techniques[edit] Visual analogue scale also called the Continuous rating scale and the graphic rating scale â€" respondents rate items by placing a mark on a line. The line is usually labeled at each end. There are sometimes a series of numbers, called scale points, say, from zero to under the line. Scoring and codification is difficult for paper-and-pencil scales, but not for computerized and Internet-based visual analogue scales. The same format is used for multiple questions. It is the combination of these questions that forms the Likert scale. This categorical scaling procedure can easily be extended to a magnitude estimation procedure that uses the full scale of numbers rather than verbal categories. Phrase completion scales â€" Respondents are asked to complete a phrase on an point response scale in which 0 represents the absence of the theoretical construct and 10 represents the theorized maximum amount of the construct being measured. The same basic format is used for multiple questions. Semantic differential scale â€" Respondents are asked to rate on a 7-point scale an item on various attributes. Each attribute requires a scale with bipolar terminal labels. Stapel scale â€" This is a unipolar ten-point rating scale. Thurstone scale â€" This is a scaling technique that incorporates the intensity structure among indicators. Scale evaluation[edit] Scales should be tested for reliability , generalizability, and validity. Generalizability is the ability to make inferences from a sample to the population, given the scale you have selected. Reliability is the extent to which a scale will produce consistent results. Test-retest reliability checks how similar the results are if the research is repeated under similar circumstances. Alternative forms reliability checks how similar the results are if the research is repeated using different forms of the scale. Internal consistency reliability checks how well the individual measures included in the scale are converted into a composite measure.

3: Scale (social sciences) - Wikipedia

Provides an introduction to the fundamentals of scaling theory and construction, focusing on a variety of unidimensional scaling models. The authors present.

Why not just create text statements or questions and use response formats to collect the answers? First, sometimes we do scaling to test a hypothesis. We might want to know whether the construct or concept is a single dimensional or multidimensional one more about dimensionality later. Sometimes, we do scaling as part of exploratory research. We want to know what dimensions underlie a set of ratings. For instance, if you create a set of questions, you can use scaling to determine how well they "hang together" and whether they measure one concept or multiple concepts. But probably the most common reason for doing scaling is for scoring purposes. Dimensionality A scale can have any number of dimensions in it. Most scales that we develop have only a few dimensions. Think of a dimension as a number line. If we want to measure a construct, we have to decide whether the construct can be measured well with one number line or whether it may need more. For instance, height is a concept that is unidimensional or one-dimensional. We can measure the concept of height very well with only a single number line e. Weight is also unidimensional -- we can measure it with a scale. Thirst might also bee considered a unidimensional concept -- you are either more or less thirsty at any given time. But what about a concept like self esteem? What would a two-dimensional concept be? Many models of intelligence or achievement postulate two major dimensions -- mathematical and verbal ability. In this type of two-dimensional model, a person can be said to possess two types of achievement. Some people will be high in verbal skills and lower in math. For others, it will be the reverse. In other words, in order to describe achievement you would need to locate a person as a point in two dimensional x,y space. Psychologists who study the idea of meaning theorized that the meaning of a term could be well described in three dimensions. Put in other terms, any objects can be distinguished or differentiated from each other along three dimensions. They labeled these three dimensions activity, evaluation, and potency. They called this general theory of meaning the semantic differential. Their theory essentially states that you can rate any object along those three dimensions. For instance, think of the idea of "ballet. On the other hand, think about the concept of a "book" like a novel. Now, think of the idea of "going to the dentist. The theorists who came up with the idea of the semantic differential thought that the meaning of any concepts could be described well by rating the concept on these three dimensions. In other words, in order to describe the meaning of an object you have to locate it as a dot somewhere within the cube three-dimensional space. What are the advantages of using a unidimensional model? Unidimensional concepts are generally easier to understand. But the best reason to use unidimensional scaling is because you believe the concept you are measuring really is unidimensional in reality. If you try to measure academic achievement on a single dimension, you would place every person on a single line ranging from low to high achievers. But how do you score someone who is a high math achiever and terrible verbally, or vice versa? They are similar in that they each measure the concept of interest on a number line. But they differ considerably in how they arrive at scale values for different items.

4: Advantages & Disadvantages of Multidimensional Scales | Sciencing

It's also important to understand what a unidimensional scale is as a foundation for comprehending the more complex multidimensional concepts. But the best reason to use unidimensional scaling is because you believe the concept you are measuring really is unidimensional in reality.

5: Multidimensional scaling - Wikipedia

Provides an introduction to the fundamentals of scaling theory and construction, focusing on a variety of unidimensional scaling models. The authors present an overview and comparative analysis of such techniques as Thurstone scaling, Likert scaling, Guttman scaling, and unfolding theory, with emphasis on their varying conceptions of dimensionality.

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6: Measurement: Unidimensional/Multidimensional Scales

Define unidimensional. unidimensional synonyms, unidimensional pronunciation, unidimensional translation, English dictionary definition of unidimensional. adj. One-dimensional. adj of or having only one dimension adj. 1. having one dimension only.

7: Social Research Methods - Knowledge Base - General Issues in Scaling

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8: Social Research Methods - Knowledge Base - Scaling

Unidimensional scaling (Mair & De Leeuw,) is the one-dimensional special case of multidimensional scaling with the objective to find for each object a coordinate along a line while minimizing.

9: unidimensional scaling | www.enganchecubano.com

A pain scale is a tool that doctors use to help assess a person's pain. A person usually self-reports their pain using a specially designed scale, sometimes with the help of a doctor, parent, or.

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Malawi: The rubbish dumb Steve Chimombo U2022 Deva Tat (Buddha of Siam34 The rising sun (A Lyceum book) Star wars dot to dot Physical Appearance, Stigma, and Social Behavior (Ontario Symposium on Personality and Social Psychology/ Public land policy Pain Management Testing Reference Pauls divinely given task and his suffering for the Gentiles (3:1-13) Mackie 1402 vlz manual Extremity trauma skills Dubai map high resolution The Mysterious Stranger (Signet Classics) Daily Math Adventures Why do we need friends? The turner diaries deutsch Engineering mechanics by ramamrutham European Company Information Geotechnical earthquake engineering nptel Till it happens to you sheet music Edit latex with viewer Views in Australia or New South Wales Van Diemens Land delineated Stephen Bulls bar restaurent Alles Morrison Practical nude photography Winning the inner war Literacy Land: Story Street: Beginner: Step 3: Guided/Independent Reading: Brave Mouse Interpreting otherwise than Heidegger Thevar caste history in tamil Rise of the king salvatore St. Patrick, his writings and life Colonial legacies and spatial transformations : from the big house to the flat KJV Sapphire Reference Bible Thumb index, black French morocco leather, O242YG Hope, Faith and Charlie Stray bullet Gary Brandner Bad Cripple (Counterpunch) Training for self-rule Part one : General. Companies on the cutting edge Folio Physician Directory of New Jersey, 2005 My reveries on the art of war by M. de Saxe Maths reference books for class 11