

Data Mining: Concepts and Techniques (2nd edition)

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Morgan Kaufmann Publishers, 2006

Bibliographic Notes for Chapter 2 Data Preprocessing

Data preprocessing is discussed in a number of textbooks, including English [Eng99], Pyle [Pyl99], Loshin [Los01], Redman [Red01], and Dasu and Johnson [DJ03]. More specific references to individual preprocessing techniques are given below.

Methods for descriptive data summarization have been studied in the statistics literature long before the onset of computers. Good summaries of statistical descriptive data mining methods include Freedman, Pisani and Purves [FPP97], and Devore [Dev95]. For statistics-based visualization of data using boxplots, quantile plots, quantile-quantile plots, scatter plots, and loess curves, see Cleveland [Cle93].

For discussion regarding data quality, see Redman [Red92], Wang, Storey, and Firth [WSF95], Wand and Wang [WW96], Ballou and Tayi [BT99], and Olson [Ols03]. Potter's Wheel (<http://control.cx.berkeley.edu/abc>), the interactive data cleaning tool described in Section 2.3.3, is presented in Raman and Hellerstein [RH01]. An example of the development of declarative languages for the specification of data transformation operators is given in Galhardas, Florescu, Shasha, et al. [GFS⁺01]. The handling of missing attribute values is discussed in Friedman [Fri77], Breiman, Friedman, Olshen, and Stone [BFOS84], and Quinlan [Qui89]. A method for the detection of outlier or "garbage" patterns in a handwritten character database is given in Guyon, Matic, and Vapnik [GMV96]. Binning and data normalization are treated in many texts, including Kennedy, Lee, Van Roy, et al. [KLV⁺98], Weiss and Indurkha [WI98], and Pyle [Pyl99]. Systems that include attribute (or feature) construction include BACON by Langley, Simon, Bradshaw, and Zytkow [LSBZ87], Stagger by Schlimmer [Sch86], FRINGE by Pagallo [Pag89], and AQ17-DCI by Bloedorn and Michalski [BM98]. Attribute construction is also described in Liu and Motoda [LM98, Le98]. Dasu, Johnson, Muthukrishnan, and Shkapenyuk [DJMS02] developed a system called Bellman wherein they propose a set of methods for building a data quality browser by mining on the structure of the database.

A good survey of data reduction techniques can be found in Barbará, Du Mouchel, Faloutsos, et al. [BDF⁺97]. For algorithms on data cubes and their precomputation, see Sarawagi and Stonebraker [SS94], Agarwal, Agrawal, Deshpande, et al. [AAD⁺96], Harinarayan, Rajaraman, and Ullman [HRU96], Ross and Srivastava [RS97], and Zhao, Deshpande, and Naughton [ZDN97]. Attribute subset selection (or *feature subset selection*) is described in many texts, such as Neter, Kutner, Nachtsheim, and Wasserman [NKNW96], Dash and Liu [DL97], and Liu and Motoda [LM98, LM98b]. A combination forward selection and backward elimination method was proposed in Siedlecki and Sklansky [SS88]. A wrapper approach to attribute selection is described in Kohavi and John [KJ97]. Unsupervised attribute subset selection is described in Dash, Liu, and Yao [DLY97]. For a description of wavelets for dimensionality reduction, see Press, Teukolsky, Vetterling, and Flannery [PTVF96]. A general account of wavelets can be found in Hubbard [Hub96]. For a list of wavelet software packages, see Bruce, Donoho, and Gao [BDG96]. Daubechies transforms are described in Daubechies [Dau92]. The book by Press, et al. [PTVF96] includes an introduction to singular value decomposition for principal components analysis. Routines for PCA are included in most statistical software packages, such as SAS (www.sas.com/SASHome.html).

An introduction to regression and log-linear models can be found in several textbooks, such as James [Jam85], Dobson [Dob01], Johnson and Wichern [JW02], Devore [Dev95], and Neter, Kutner, Nachtsheim, and Wasserman [NKNW96]. For log-linear models (known as *multiplicative models* in the computer science literature), see Pearl [Pea88]. For a general introduction to histograms, see Barbará et al. [BDF⁺97] and Devore and Peck [DP97]. For extensions of single attribute histograms to multiple attributes, see Muralikrishna and DeWitt [MD88] and Poosala and Ioannidis [PI97]. Several references to clustering algorithms are given in Chapter 7 of this book,

which is devoted to the topic. A survey of multidimensional indexing structures is given in Gaede and Günther [GG98]. The use of multidimensional index trees for data aggregation is discussed in Aoki [Aok98]. Index trees include R-trees (Guttman [Gut84]), quad-trees (Finkel and Bentley [FB74]), and their variations. For discussion on sampling and data mining, see Kivinen and Mannila [KM94] and John and Langley [JL96].

There are many methods for assessing attribute relevance. Each has its own bias. The information gain measure is biased towards attributes with many values. Many alternatives have been proposed, such as gain ratio (Quinlan [Qui93]), which considers the probability of each attribute value. Other relevance measures include the gini index (Breiman, Friedman, Olshen, and Stone [BFOS84]), the χ^2 contingency table statistic, and the uncertainty coefficient (Johnson and Wichern [JW02]). For a comparison of attribute selection measures for decision tree induction, see Buntine and Niblett [BN92]. For additional methods, see Liu and Motoda [LM98]b, Dash and Liu [DL97], and Almuallim and Dietterich [AD91].

Liu, Hussain, Tan, and Dash [LHTD02] performed a comprehensive survey of data discretization methods. Entropy-based discretization with the C4.5 algorithm is described in Quinlan [Qui93]. In Catlett [Cat91], the D-2 system binarizes a numerical feature recursively. ChiMerge by Kerber [Ker92] and Chi2 by Liu and Setiono [LS95] are methods for the automatic discretization of numerical attributes that both employ the χ^2 statistic. Fayyad and Irani [FI93] apply the minimum description length principle to determine the number of intervals for numerical discretization. Concept hierarchies and their automatic generation from categorical data are described in Han and Fu [HF94].

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