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ABSTRACT

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An Algebraic solution of maximum likelihood function in case of Gaussian mixture distribution

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Abstract

Traditionally, least squares method (LSM) has been employed as a standard technique for parameter estimation and regression fitting of models to measured points in data sets in many engineering disciplines, geoscience fields as well as in geodesy. To get the optimal linear unbiased estimator, which provides minimum variance, the model error should follow a Gaussian distribution with zero mean. However, this may not always be the case due to contaminated data (i.e., the presence of outliers) or data from different sources with varying distributions. This study proposes an algebraic iterative method that approximates the error distribution model using a Gaussian mixture distribution, with the application of maximum likelihood estimation as a possible solution to the problem. The global maximization of the likelihood function is carried out through the computation of the global solution of a multivariate polynomial system using numerical Groebner basis in order to considerably reduce the running time. The novelty of the proposed method is the application of total least square (TLS) error model as opposed to ordinary least squares (OLS) and the maximization of the likelihood function of the Gaussian mixture via algebraic approach. Use of TLS error model rather than OLS enables errors in all the 3 coordinates of the model of a 3D plane (i.e., $z = \alpha x + \beta y + \gamma$) to be considered. The proposed method is illustrated by fitting a plane to real laser point cloud data containing outliers to test its robustness. Compared to the RANdom Sample Consensus (RANSAC) and Danish robust estimation methods, the results

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An algebraic solution of maximum likelihood function in case of Gaussian mixture distribution

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ABSTRACT

Traditionally, the least-squares method has been employed as a standard technique for parameter estimation and regression fitting of models to measured points in data sets in many engineering disciplines, geoscience fields as well as in geodesy. If the model errors follow the Gaussian distribution with mean zero in linear models, the least-squares estimate is linear, unbiased and of minimum variance. However, this may not always be the case owing to contaminated data (i.e. the presence of outliers) or data from different sources with varying distributions. This study proposes an algebraic iterative method that approximates the error distribution model using a Gaussian mixture distribution, with the application of maximum likelihood estimation as a possible solution to the problem. The global maximisation of the likelihood function is carried out through the computation of the global solution of a multivariate polynomial system using numerical Groebner basis in order to considerably reduce the running time. The novelty of the proposed method is the application of the total least square (TLS) error model as opposed to ordinary least squares (OLS) and the maximisation of the likelihood function of the Gaussian mixture via an algebraic approach. Use of the TLS error model rather than OLS enables errors in all the three coordinates of the model of a 3D plane (i.e. $z = \alpha x + \beta y + \gamma$) to be considered. The proposed method is illustrated by fitting a plane to real laser-point cloud data containing outliers to test its robustness. Compared with the Random Sample Consensus and Danish robust estimation methods, the results of the proposed algebraic method indicate its efficiency in terms of computational time and its robustness in managing outliers. The proposed approach thus offers an alternative method for solving mixture distribution problems in geodesy.

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KEYWORDS

Robust parameter estimation; expectation maximisation; maximum likelihood estimation; Groebner basis; outliers; point cloud; algebraic solution; Gaussian distributions; total least squares

Introduction

In geodesy, as in many engineering disciplines, the least-squares method (LSM) is employed as a standard technique for parameter estimation and regression fitting of models to points of measured data sets (e.g. Grafarend & Awange, 2012). If the model errors follow the Gaussian distribution with mean zero in linear models, the least-squares estimate is linear, unbiased and of minimum variance. However, this may not always be the case owing to contamination of the dataset (e.g. resulting from the presence of outliers) or having data that originates from different types of sources with different distributions. In either case, a mixed distribution has to be reckoned with (e.g. Koch & Kargoll, 2013; Koch, 2014; Lange, Little, & Taylor, 1989; Xu, 2005).

In the emerging field of integrated geodesy, for example, where observations from global satellite navigation system and those of laser scanning, photogrammetry and CAD modelling are integrated (e.g. Agnello & Lo Brutto, 2007;

Borne, 2006; Buot & Richards, 2006), such integration brings with it a mixture of different types of distributions that could be Gaussian or non-Gaussian. Furthermore, outliers that corrupt the laser-scanned data could occur owing, for example, to occlusions, off-surface points and multiple reflectance, thereby limiting surface reconstruction using point cloud. Further examples include the case where the global positioning system (GPS) and Interferometric Synthetic Aperture Radar (InSAR) are related to a slip distribution model used in modelling coseismic surface displacements (e.g. Sun et al., 2011). GPS ambiguity resolution problems where the carrier phase observations are very precise but contain integer unknowns leading to a mixed observation model (e.g. Xu, 1998) and assimilation of stream flow observations and satellite data in order to carry out hydrological model calibration. Other disciplines where integrated data of mixed distributions are encountered include meteorology, oceanography and seismology, where sampling data are imperfect and noisy.

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Corporate Governance and Earnings Conservatism in Malaysia

Abstract

The objective of this paper is to examine whether earnings conservatism increased after the amendment of corporate governance code in 2007 (MCCG 2007). Based on both asymmetric timeliness by Basu (1997) and accrual-based conservatism models by Ball and Shivakumar (2005), we find that MCCG 2007 enhances earnings conservatism. Our extended analyses of corporate governance variables contribute to the understanding of audit committee independence and audit committee expertise.

JEL classification: M41, M48, G34, G38

Keywords: Earnings conservatism, Malaysia, corporate governance, audit committee, expertise

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Corporate governance and earnings conservatism in Malaysia

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Abstract

Purpose – This paper aims to investigate whether the revised Malaysian Code on Corporate Governance in 2007 enhances earnings conservatism. In addition, the authors examine the relationship between board of directors' expertise and conservatism. The third objective is to investigate the relationship between audit committee characteristics and earnings conservatism.

Design/methodology/approach – The sample of this study is based on 3,303 firm-year observations for a period of 2004–2008. The authors hand-collected the corporate governance variables, whereas the remaining data were extracted from Compustat Global. The authors used two measures of conservatism. The first is the market-based model by Basu's (1987), and the second measure is the accrual-based measure by Ball and Shivakumar (2005).

Findings – The authors find that the revision of Malaysian Code on Corporate Governance 2007 results in improving earnings conservatism. The authors find two audit committee characteristics, namely, audit committee financial expertise and independence increase earnings conservatism, after 2007. However, the authors could not find support whether board financial expertise mix affect conservatism.

Research limitations/implications – This study did not consider other possible corporate governance variables that could influence earnings conservatism, as it would be a difficult task to gather them.

Originality/value – The authors provide evidence on the role of corporate governance and earnings conservatism in Malaysia.

Keywords Malaysia, Corporate governance, Earnings conservatism, MCCG 2007

Paper type Research paper

JEL classification – M41, M48, G34, G38

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Mistakes on display: Incorrect examples refine equation solving and algebraic feature knowledge

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Running Head: MISTAKES ON DISPLAY

Keywords: erroneous examples, incorrect worked examples, self-explanation, algebra equation solving, algebraic feature knowledge

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Fat composition in infant formula contributes to the severity of necrotizing enterocolitis

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Abstract

Necrotizing enterocolitis (NEC) is a devastating disease that typically affects formula-fed premature infants, suggesting that dietary components may influence disease pathogenesis. Triglycerides are the major fat component of infant formula, and their digestion requires pancreatic lipases, which may be naturally deficient in premature neonates. We hypothesize that NEC develops in part from the accumulation of incompletely digested long chain triglyceride-containing unsaturated fatty acids within the intestinal epithelial cells, leading to oxidative stress and enterocyte damage. We further hypothesize that the administration of a formula that contains reduced triglycerides ("pre-digested fats") that don't require lipase action may reduce NEC severity. To test these hypotheses, we induced NEC in neonatal mice using three different fat formulations, namely "standard fat", "pre-digested fat", or "very low fat", and determined that mice fed "standard fat" developed severe NEC, which was significantly reduced in mice fed "pre-digested fat" or "very low fat". The expression level of the critical fat digesting enzyme carboxyl-ester lipase was significantly lower in the newborn compared to older pups, leading to impaired fat

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The amount of all nutrients used in animal studies could reasonably be expected to be achieved in the human population as they are derived from ready to feed infant formulas.

There are no in vitro studies, so the statement as requested by the British Journal of Nutrition that the "molecular form of the nutrient or nutrients used in in vitro studies is the same as that which the cell type in which the test was performed would encounter in vivo" does not apply.

This work does not involve any probiotics.

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