DEPARTMENT OF STATISTICS

Special Lecture Series:
Dimension Reduction in Regression
by
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This lecture series consists of three lectures to introduce high-dimensional semiparametric regression estimation procedures as follows.

September 22, 2014- Lecture 1

Why dimension reduction and how dimension reduction: some basic concepts

In regression modelling, data visualization plays an important role and some useful tools have been developed such as residual plots when we do not have specific model structure at hand. In low-dimensional paradigms, these tools are very useful to get ideas about underlying regression models. However, in high-dimensional paradigms, residual plots can only get the profiles of the whole picture of underlying models and the information may mislead further modelling. Therefore, if we explore and identify dimension reduction structure first and then the further modelling can be proceeded such that the classical visualization tools can be satisfactorily performed. In this lecture, the sufficient dimension reduction concept, particularly the dimension reduction subspace called the central subspace will be introduced as the preparation for us for dimension reduction estimation in lectures 2 and 3 later.

September 29, 2014- Lecture 2

Dimension reduction estimation: can linear methods solve nonlinear problems?

In this lecture, we introduce two approaches to identify and estimate the central subspace, or equivalently, the base vectors of the subspace. Interestingly we will show that under certain regularity conditions, the ordinary least squares method (OLS) that is for linear regression models can be well applied to identify one of the base vectors. It is particularly useful when underlying model has only one such vector. The examples of models include some nonlinear and even semiparametric models such as generalized linear models, transformation models and single-index models. Further, another moment-based method called the principal Hessian direction (pHd) is introduced which can identify and estimate more than one base vector. Both need no nonlinear or nonparametric estimation procedure even underlying models are nonlinear and semiparametric.
Estimation: can inverse regression methods solve forward regression problems?

In this lecture, mainly two more methods are introduced to identify and estimate the central subspace. The so-called inverse regression notion is introduced for this purpose. The method is based on the conditional expectation of the covariate given the response rather than the regression function that is the conditional expectation of the response given the covariate. This is why we call it the inverse regression method. The methods are called the sliced inverse regression (SIR) and sliced average variance estimator (SAVE). In this lecture, some further developments will also be described very briefly in the sufficient dimension reduction field.

TIME AND PLACE FOR ALL LECTURES
4:40 – 5:30 p.m.
Philip E. Austin Building – Room 344

Coffee will be served at 4:10 in room 326

Dr. Lixing Zhu is the structural chair professor and the head of Department of Mathematics at Hong Kong Baptist University, Hong Kong. His research interests include semiparametric and nonparametric statistics, high-dimensional data analysis, applications of empirical process theory to statistics and econometrics. He has published more than 250 papers in a wide variety of decent journals among which, more than 30 papers have appeared in Annals of Statistics, JASA, JRSS B and Biometrika. He has received many awards and honors, including the Humbolt Research Award from Germany (The only awardee from Asia in statistics up to now) and the State Natural Science Award of China (Class II) (the second awardee in Statistics in China up to now). Dr. Zhu is an elected fellow of ASA and IMS, an elected member of ISI. He is also an honorary chair professor/distinguished adjunct professor for various universities, including a Chang-Jiang Chair Professor at Renmin University of China. He serves as a member in the physical science panel of the University Grants Council of Hong Kong.