Analysis of Spatio-Temporal Data

"There is a new tension in statistics, not between Bayesians and Frequentists, but between hierarchical and marginal models"   A.N Pettitt.

A research symposium on Analysis of Spatio-Temporal Data was held at the Australian National University, Canberra, from 11 to 14 September 2000. The Symposium was organised by Professor Alan Welsh and funded by the Centre for Mathematics and Its Applications and CSIRO Mathematics and Information Sciences. The timing provided an opportunity for participants to enjoy Olympic soccer in Canberra, played on the outrageously expensive turf at the outrageously expensive Bruce Stadium. The aim of the Symposium was to bring together those involved with the development of methodology and the actual analysis of spatio-temporal data to discuss current and future research on the topic.

Thirty participants, including several international keynote speakers, who all gave excellent talks, attended the Symposium. The small and focused nature of the Symposium created a friendly environment, which meant lots of discussion and comment by participants.

Data having a spatio-temporal structure are ubiquitous in the environmental and meteoro-

logical sciences so many of the applications presented in the symposium involved weather and ecological data. In many of these problems, the response of interest is binary, or has a distribution that is non-Gaussian, often with a spike at zero. One of the many interesting problems discussed was the prediction of wind speed and direction in Sydney Harbour. Even the best statistical models do not help if there is no wind at all, as was the case for many days during the Olympics. Despite this our sailors had a deal

of success - and we would like to believe that statistical modelling carried out at UNSW had something to do with this.

Complicated dependence structure among observations is usually a feature of spatio-temporal data. The three main approaches to solving problems having such complicated correlation structures were:

1. Hierarchical Bayesian Approach, where MCMC provides a technique for estimating complicated models for extremely large data sets.
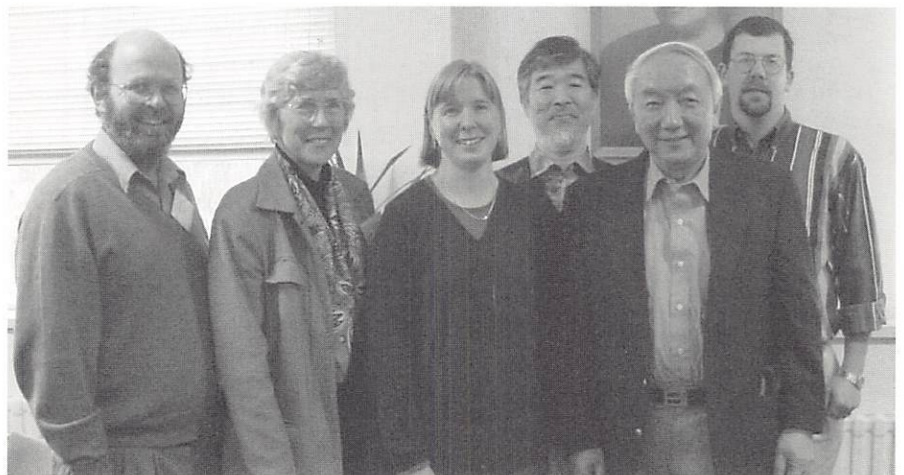
Professor Alan Welsh (ANU), Professor Lynne Billard (U.Georgia), Dr Alice Richardson (UC, President Canberra Branch SSAI), Professor Yoshihiko Ogata (Institute of Statistical Mathematics, Japan), Professor George Tiao (U.Chicago), Professor Christopher Wikle (U.Missouri)

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Talks demonstrating the use of this approach included "Some statistical models for local weather forecasting" presented by William Dunsmuir, (UNSW) and "A spatio-temporal model for hourly wind fields on Sydney Harbour" by Ed Cripps, also of UNSW. Both William and Ed have been collaborating with Christopher Wikle (University of Missouri) who gave an invited address on "Spatio-temporal modelling of physical systems" Well known Bayesian, Tony Pettitt (QUT) described a novel Gaussian conditional autoregressive formulation for the modelling of the spatial dependence and interactions between multivariate binary data at irregularly spaced sites.

2. Mixed Model Approach

The ever active Brian Cullis (Wagga Wagga Agricultural Institute) presented new research which extends work by Verbyla et al (1999) on the use of smoothing splines within a mixed model framework for the analysis of longitudinal data. We were also entertained by our friend, Terry Koen (NSW Department of Land and Water Conservation, Cowra) in his talk on an application of modelling spatio-temporal covariance structures within native grass survival data.

3. Time Series Approach

Invited speakers Lynne Billard (University of Georgia) applied spatio-temporal bilinear time series models to the analysis of surveillance data for mumps and George Tiao (University of Chicago) demonstrated the use of time series methods to develop parsimonious models for latitudinal patterns in satellite and temperature data.

Methodologies that could not be easily categorised under the above three approaches included a talk on mapping and monitoring the spread of dryland salinity in South Western Australia by Harri Kiiveri (CSIRO Mathematical and Information Sciences). Invited speaker, Yosihiko Ogata (Institute of Statistical Mathematics, Japan) used penalised likelihood methods to model seismic activity. He fitted his model to aftershock data which has continued for 110 years (so far) since the main earthquake.

Two lively discussion sessions on data quality and computing issues, facilitated by Brent Henderson (CSIRO Mathematical and Information Sciences) and John Maindonald (Statistical Consulting Unit, ANU) respectively, were held.

The last half-day of the symposium was conducted as a joint workshop with the Canberra Branch of the Statistical Society (described elsewhere in this Newsletter). In addition to the members attending the Symposium, fifteen additional members chose to participate in the Workshop. The joint arrangement demonstrated the benefits of cooperation as it reduced organisational workload, brought international, national and local statisticians together, and was essentially cost neutral for both parties. The well-organised and enjoyable Symposium/Workshop concluded with a delicious dinner catered for by the Parsley Patch.

The Retiring
Ross Cunningham

Accreditation: Recent developments

Progress with marketing Accreditation

The new SSAI logo is now in use, and the new website is operational. Both are essential elements for the Accreditation Marketing Plan, so the Accreditation committee was actively involved in their development. The assistance of the SSAI President, Ian James, particularly in the design and commissioning of the website, has been much appreciated by the committee.

The campaign to raise sponsorship to market accreditation will take place later this year.

Professional Development Courses

A survey will be conducted later this year to identify which courses Accredited members would like presented at the professional development program and associated special topics conference scheduled for July 2001, in Canberra.

Meet some recently accredited SSAI members

Helen Nicol, NSW Agriculture

Areas of interest: Biometrics, experimental design, agricultural surveys

Many years of experience in experimental design and analysis. A special interest in consulting - making sure the clients' aims and hypotheses are understood and that they understand why particular analyses have been performed.

Walter Robb, Office of Economic and Statistical Research, Qld Treasury

Areas of interest: Multivariate modelling, time series, performance indicators

I have been working in applied statistics within Qld Government since 1976. I have applied statistical approaches to health, education and crime modelling, planning, development of indices, resource allocation and evaluation. I am currently Assistant Government Statistician responsible for projects being done for clients external to our organisation.

Brenton Clarke, Murdoch University

Areas of interest: Robust statistics, linear models and experimental design, time series analysis

My interest in Statistics began with a BSc(hons) lst class at Flinders University awarded in 1977. My PhD in robust statistics was awarded by the Australian National University in 1981. I pursued teaching and research in postdoctural positions at the University of London, ETH-Zürich, and the University of North Carolina at Chapel Hill gaining interests in linear models and time series analysis. At Murdoch University I have pursued my statistical fields of interest in both teaching and research.

Martin Hazelton, University of Western Australia

Areas of interest: Statistical modelling and inference for road traffic systems; data smoothing; analysis of pedigree data

Obtained 1st class Honours in Mathematics (1989) and a doctorate in Statistics (1993) from the University of Oxford, U.K. Worked as a Research Officer modelling road traffic systems, then took up a lectureship in Statistics at University College London. Presently a lecturer in Statistics at the University of Western Australia.

Ian James, Murdoch University

Areas of interest: Biomedical Statistics, Applied Statistics

Graduated PhD in Statistics, Flinders University, 1973, followed by positions as Research Scientist (CSIRO), Lecturer to Associate Professor (UWA) and Director, Statistical Consulting Group (UWA). Moved to Murdoch University 1990 - currently Head, Mathematics and Statistics and Director (Murdoch), Centre for Clinical Immunology and Biomedical Statistics.

Michael Martin, Australian National University

Areas of interest: Resampling (bootstrap, jackknife), statistical modelling, graphical data analysis, asymptotic inference.

I completed my PhD in Statistics at the ANU in 1989. I then took up a position as Assistant Professor in the Department of Statistics, Stanford University, USA, from 1989-1994. I am currently Senior Lecturer in the Department of Statistics and Econometrics at ANU, a position I have occupied since 1995.

Steven Stern, Australian National University

Areas of interest: Variance components models, stochastic processes, maximum likelihood, GLMs, resampling methods

As a consultant at Failure Analysis Associates, I analysed longitudinal biomedical studies and performed meta-analyses of published literature. At the ANU, I have conducted research into likelihood-based methods and consulted in a variety of areas including designing audit samples and modelling output from the SHRIMPII developed at the ANU School of Earth Sciences to estimate the age of rock samples

N.I. Fisher
For the Accreditation and Accreditation Marketing Committees

Enquiries, Comments and Feedback

To find out more about how to apply for Accreditation, or to make enquiries or comments about marketing matters please contact Lesley Sieper at the SSAI Office:

phone/fax: 02 6249-8266
e-mail ssai@interact.net.au.

NEW SOUTH WALES

Hello all, Statistical Squirrel here. It seems that our regular correspondent didn't get his act together last time and it's left up to me to do the honours. Hmmph! When I next see that man I'll have his nuts for sure (I am a squirrel after all).

When last I left you it was a wild, woolly, wet, windy wintry night in March. Rodger Robertson had just unveiled his new strategic plan vision thingymajig for the NSW branch and the future looked rosy. The year lay before us, vast, unexplored, chock full of surprises and laden with disappointment (for Glory supporters anyway). But what was it that happened? What were the dramatic highs, the gut-wrenching lows? What trees will remain in the forest of memories long after the rest have fallen down? What golden moments will join the treasure chest of lifelong memories? What indeed?

Well may you ask, my adoring readers, for it is time for…(he-hem, drum roll please) "Statistical Squirrel's Year in Review".

March

Not a lot happened in March, except the AGM and Rodger Robertson's attempt to set a new branch meeting record for the longest talk ever at 1 hour 57 minutes (and he cut it short!) with the unveiling of "Strategic Plan 2000". The Nut of the Month award (hmmm, nuts) goes to our beloved leader for believing that the meeting could be all over in an hour (we still love you though).

April

April was the interrupted month. Family, flu and altogether too much time off work over Easter prevented me from hearing the elegant and eloquent Eugene Seneta speak on "Sampling, Politics and History". Bugger. The Nut of the Month award therefore goes to yours truly. Double bugger.

May

New councillor Fred Osman stunned the watching audience at the May council meeting by actually having an original idea. It seemed that our beloved leaders' plan for a professional, productive, proactive and principled party of passionate, philosophically minded councillors capable of steering the branch into the Third Millennium was working. Needless to say Fred's idea (The Postgraduate Awards Day) was greeted with much salaaming and promises of love for evermore.

Faced with a room full of strangers, Eric Beh from the University of Wollongong gave the May meeting talk. Having been lavishly introduced by the ever full-of-beans John Rayner, Eric, who bears a passing resemblance to Barney Rubble, didn't look comfortable as he launched into his talk on "A non-iterative alternative to ordinal log-linear models". Eric's confidence grew as the talked progressed and as he felt more relaxed the equations flowed, the graphs prospered and the notation went forth and multiplied. By the end of the talk we were all full-bottle on estimating parameters from a log-linear model of ordinal categorical data without resorting to iterative procedures such as MLE and instead using orthogonal polynomials, and Eric felt much better (well, he ate like he felt much better). It has since been determined that Eric, who describes Cold Chisel's "Flame Trees" as one of his all-time favouritest songs, enjoyed the evening so much and was so proud to have

had the opportunity to speak at a meeting that he has offered to become a fully-fledged member of the Society but only if someone will fill out the form for him and pay for it.

The Nut of the Month award for May goes to John Rayner, whose dynamic and over-exuberant introduction of Eric obviously wore him out so much that he needed a nap midway through the talk.

June

"Oh let the sun beat down upon my face
Stars to fill my dreams
I am the traveller of both time and space
To be where I have been"

Robert Plant and Jimmy Page, one half of the ever legendary Led Zeppelin, wrote these words as they drove from Morocco to Kashmir. I must admit that they reflected my mood perfectly as I struggled my way west to the distant lands of UWS Nepean, bag of nuts and passport in hand, mapbook open and emergency supplies in the boot (the only thing missing was the Lonely Planet guide). Never before had we had to travel so far to indulge our passion in statistics.

The trip was not without it's good points though. Several nominations for the Nut of the Month award were received (a record) – one from Fred "Field of Dreams" Osman (he held it, we came), one from a certain Ms Maurer (who's means of communication was not properly silenced) and one from an anonymous Councillor who got halfway up the face of the Blue Mountains before realising he'd gone too far. The winners of the award were, however, the crazy gang from Wollongong (led by he who would not be denied), who journeyed far, stayed for dinner and then struggled home to be in bed well after the midnight hour. Congratulations all.

It was Richard Ollerton we'd gone to see, at his UWS Nepean stomping

ground, to hear him speak on "We have lots of data, what do they mean?". Recently returned from the College of Medicine at the University of Wales where he worked with lots of enthusiastic researchers, Richard wanted to share some experiences and highlight questions he felt needed to be asked about medical research.

Richard's main concerns were: that statisticians were not involved at all stages of research; that there was uncritical use of standard "cookbook" methods by non-statisticians; and that journals do not provide evidence that the right statistical questions have been asked. On the second point Richard stated that he could treat patients if the only ones that he saw were straight out of a textbook, as doctors do with statistics. Richard paused to let this sink in, while most of us worried about getting home with our internal organs intact.

Richard illustrated his issues by discussing some collaborative work undertaken with medical researchers at the College of Medicine. During the talk he raised many interesting points that caused a great deal of soul-searching amongst the audience and it is just a shame that his message couldn't be passed on to a wider group (that's a hint for you, Ian). In all, an outstanding talk and well worth the trip. Thank you Richard, from the bottom of my small, furry heart.

July

July was statistical ecstasy month. The 15th of those wonderful ASC's had rolled around and it was time for the multitude to descend upon the City of Churches for a celebration of cloudy beer, fine wine and statistical solemnity. Much was spoken, more was mooted and little was done as the brightest statistical minds in the country gathered together to ponder the infinite mysteries of right, wrong and regression. Ahhh, bliss!

The NSW Branch decided it could do little to compete with such righteous goings-on and held only a Council meeting in the month of July. Margaret Mackisack achieved a lifelong ambition in becoming the new Secretary for NSW Branch. Our previous correspondent (I can't bear to say his name) won the Nut of the Month award after taking a short trip to hospital, having eaten an Arnott's biscuit that he shouldn't have. How's that for Monte Carlo methods!

August

The lack of a July meeting saw the August meeting pushed to the start of the month (it also allowed us to get in another meeting before the dreaded Olympics hit town). The delightful Pam Shaw gave a talk on statistical education titled "What are children learning about Statistics?". I'm afraid I can't tell you what the children are learning about statistics because I was busy helping some children learn about big sticks and how to use them. Sorry.

September

It was standing room only as the last of the pre-Olympic NSW Branch meetings was held in early September. Marilyn Chilvers, from the NSW Bureau of Crime Statistics and Research, presented a talk titled "COPS and robbers, Ginis and judges". All very lurid, but guaranteed to keep the huge crowd entertained.

The NSW Bureau of Crime Statistics and Research (BOCSAR) are a statistical and research agency in the NSW Attorney General's Department charged (no pun intended) with reporting crime statistics and so on. They also function as an information service, processing around 1600 requests from information per year. The requests come from the public under FOI, and also from the media. As part of this is a public relations function – the public will be informed if trends are evident in the data.

The basis of Marilyn's talk was discussion of five areas; Are courts becoming more lenient?, Stolen goods market in NSW, Juveniles in crime, Public perception of neighbourhood crime in NSW and one more that I can't read from my scribbled notes
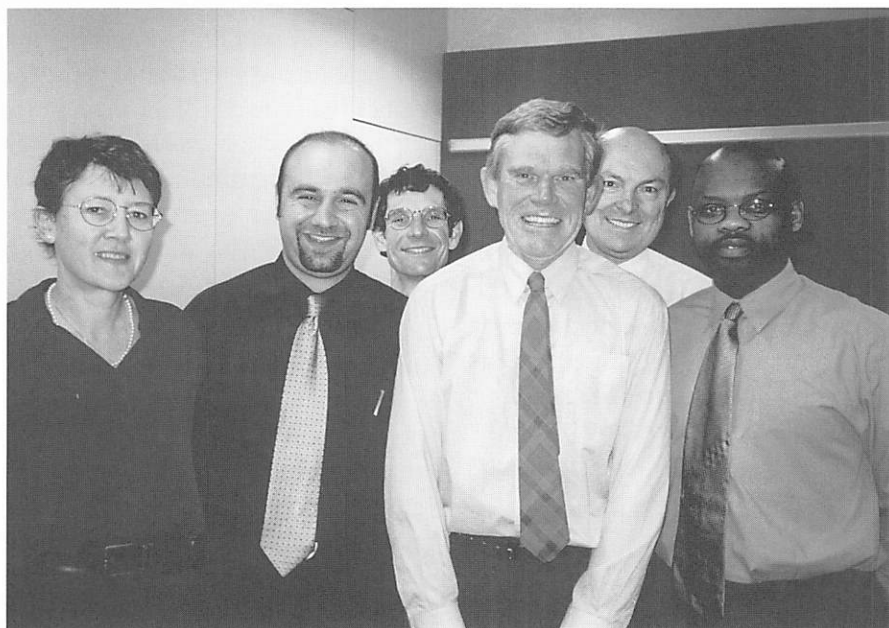
"The usual suspects at the NSW Branch Council meeting, July - (from left to right) Margaret Mackisack, Fred Osman, Jos Beunen, Rodger Robertson, Peter Wright and Abie Ekangaki"

(but interesting nonetheless). The first of these issues arose from adverse publicity in the media regarding sentencing. A descriptive study by BOCSAR provided information about convictions and penalties in courts and found results contrary to the scaremonger's attitudes.

The second area involved prison interviews, and provided police with information of real value on the stolen goods market, particularly into avenues of disposal of goods. The third area of investigation was undertaken to understand juvenile involvement in crime and hence hopefully reduce it. The most interesting figure quoted by Marilyn was that in a self-report study, 61% of students in NSW said that at some time they had committed an offence, so it seems the other 39% were liars (is that a crime?).

Perhaps the most interesting part of the talk was the crime dispersion index used to measure neighbourhood crime in NSW. The major issue was whether crime was concentrated in certain regions of NSW (e.g. around the 2UE office) or was dispersed. The major means used by BOCSAR to measure this involves Lorenz curves and the Gini index. Unfortunately Marilyn did not give us enough information to know whether we should go home and think about moving to a better suburb. Damn!

October

From the start of September to the very end of October. That's right, Halloween is the night we next meet to hear Alan Veever's talk on "Some statistical contributions to reliability engineering". Everyone else will be out trick-or-treating (in the US, anyway) but we'll be safely tucked up listening to our man from the CSIRO (although I thought I heard Peter Wright talking about a Black Mass and virgin sacrifices to really get us into the Halloween mood). This appears a very interesting talk, covering applications from the nuclear industry in-

volving system reliability and fire-spread as well as a solution to a freeway lamp replacement problem. Pumpkin anyone?

Well that's it from me (and about time too). I'll see you next time, reporting live from the Postgraduate Awards Day at Le Montage in Leichhardt as Fred Osman's pride and joy comes to life. Stay tuned for all the action, drama, heartbreak and intrigue. Till then...

Statistical Squirrel

VICTORIA
Painting Statistics

A / Prof. Peter Smith, the Head of the Department of Statistics and Operations Research at RMIT University spoke at the August 2000 meeting of the Victorian Branch.

This was an unusual presentation: paintings of statistics and statistics of paintings. As a statistical presentation it made a good art show. So it seems apt that as an art critic, I make a good statistician. I thought the presenter did a fair job of putting statistics into art, but did little to put art into statistics.

My first thought was that this was a self-indulgent presentation. But then, I thought, having derived some neat statistical result, I would want to get up and tell the world about it. This is a little more difficult with paintings, but the principle is really much the same. However, when the presentation continued way beyond the allotted time, I decided that perhaps first impressions may have an artistic validity.

The art works were generally a juxtaposition of nature and statistics. Visual images overlaid with figures: numerical and graphical. The natural beauty in the landscapes and seascapes was well portrayed, but to my eye the statistical beauty was not.

Often the nature was beautiful while the statistics provided a hard and even harsh contrast. Many of the works were wide and narrow — i.e. a large horizontal dimension small vertical dimension — an art critic might find a metaphor there somewhere.

The subjects presented included a range of natural phenomena: glaciers, seas, deserts, cyclones, shipwrecks, comets — and usually with a more or less loosely connected statistical reference and some underlying science: meteorology, oceanography, astronomy, geography and occasionally a touch of history.

The presenter was clearly affected by some childhood experience with comets. And comets were one of the themes of the art presented. Personally, I have found comets singularly disappointing, as they never managed to live up to what I'd been led to expect. Expectations have a lot to answer for. But the story of Halley's discovery of the cycle of the comet that now bears his name was an interesting side-line. As is often the case, the major part of the work was in the assembling of the data, the actual analysis was relatively simple.

The second part of the presentation was about the statistics of art — or rather the statistics of the economics of the art auction world. This was about the recent trends in prices at auction in the Australian market, based on data available through Christie's Auctions.

First we learnt that size does matter; and just how to standardise for dimensions — this was found to be dependent on shape as well as area: shapes closest to the golden rectangle did relatively better. Then after adjusting for outliers (and a few more little art stories) we got to an art market index (AMI) based on sixty top painters (allowing for price and volume of sales): a sort of all-toffs rather than all-ords. And, we were not at all shocked to learn that the AMI fol-

lowed the Stock Market index. We also learnt that we should spend our idle $50K on the moderns and women artists rather than the colonials and traditionals. Brack is in, Dobell is out.

So, in the words of Lamia Gurdleneck (one of Maurice G. Kendall's anagramic alter-egos): "It's not the figures themselves, it's what you do with them that matters". Putting them into art was something her fiancé hadn't considered. I'm sure Lady Nuttal would have been impressed.

Ray Watson

Gene Expression Microarray Data: An Exceptional Opportunity For Statisticians

Prof. Terry Speed of the Division of Genetics & Bioinformatics, Walter & Eliza Hall Institute of Medical Research and the Department of Statistics, University of California at Berkeley spoke at the 3 October 2000 meeting of the Victorian Branch.

Statisticians (and the occasional biologist) gathered from around Victoria to hear Professor Speed discuss the opportunities afforded to statisticians by the new medical technology associated with genetic analysis. In a talk that was as motivational as it was educational, Professor Speed explained that the number of micro-array experiments being carried out had created unprecedented demand for statistical analysis.

A micro-array is a slide with between 5 and 10 thousand genetic markers arranged on a grid. Although production quality varies, the genetic marker for each location on the grid is typically known in advance.

A typical micro-array experiment compares the genetic make-up of control and treatment cells by attaching different dyes (red and green) to control and treatment cells and then hybridising cellular material onto a micro-array. If the array is excited with lasers of the appropriate colour, the relative intensity of red and green light can be measured for each genetic marker.

Assuming red dye is attached to the treatment cell, a preponderance of red light at certain locations on the array implies that the genes associated with those locations are over-expressed in the treatment cell. A preponderance of green light implies that the genes associated with those locations are under-expressed in the treatment cell.

The standard measure for comparing the relative intensity of red and green light is the log2(red intensity / green intensity). Professor Speed explained that base 2 is considerably easier to explain to biologists than base e. In any case, the data quality is such that log-intensities in the interval (-0.5,0.5) are typically dismissed as noise.

Two analytical case studies were presented. The first showed how cluster analysis was used to distinguish between the genetic signatures of two different varieties of lymphoma. The analysis supported clinical evidence that the one variety of lymphoma was more lethal than the other.

The second case study involved the relative expression of genetic material between a normal and a genetically engineered mouse. The study demonstrated that removing one gene from mouse's genetic make-up affected the performance of other genes in a statistically significant sense.

Ed Bosworth

SOUTH AUSTRALIA

Brief History of Statistics in South Australian Secondary Schools –and a forward look

The August meeting presented a topic of interest to many of the academic statisticians and others interested in the exposure of statistics in schools. Anthony Harradine, Head of Mathematics at Prince Alfred College has been involved in the teaching and examining of students that study Quantitative Methods (the SSABSA Stage 2 subject) since 1993. He acknowledged the strong influence of the pioneer in this area in SA, Mr Bob Hall.

His experience in devising a statistics curriculum (years 8 to 12) and writing materials to support that curriculum was evident during an exercise conducted at the meeting. The object was that the audience should determine which topics are covered and in what year. The surprise that no group was able to accurately guess the correct sequence established a lively tone for the rest of the evening especially as some of the examples were derived from 1970 and the rest from the current year.

Anthony elaborated on the reality that teaching statistics in schools receives little priority and has consisted mainly of graphical representation and measures of central location and spread. The late 80's saw the demand for a non-algebraic Year 12 subject, culminating in Quantitative Methods. This subject which included a project has been unpopular with universities and hard to teach. However, there has been rework of statistics courses over the past eight to ten years to ensure the sequential development of ideas in the four years prior to Year 12. Anthony outlined the main components of each syllabus for Years 8 to 12 and the developments planned for the years to come.

The fundamental question whether the subject is a waste of precious time which could be better devoted to algebra was discussed. Also, the plea that teachers need support from the profession in order to achieve the objectives was made to the right audience.

Statistical Inferences from the Environmental Protection Agency Ambient Water Data

Dr Gordon Smyth, Centre for Statistics University of Queensland spoke

at the September meeting and presented some consulting work he has done on water quality data. Ambient water quality data consisted of monthly measurements made on biomass, nutrient and physical water characteristics at various sites in water catchments and estuaries throughout Queensland. The objective was to detect trends in ambient measurements, assess compliance with water quality guidelines and set water quality guidelines. The data often contains censored data, exhibits seasonality and concentrations often require transformation.

Trends in water quality data are traditionally assessed using a simple non-parametric rank-based method, Kendalls Seasonal Trend Test. This method is fairly efficient, being unaffected by transformation and outliers, but doesn't allow for non-montonic trends, inability to incorporate covariate information or estimate seasonal components or quantiles, or allow for changing detection limits. Gordon described a modelling approach in which seasonal, monotonic and non-monotonic trends were estimated using regression splines and the S-Plus function CensorReg. A heavy-tailed distribution is used to achieve robustness against outliers. Appropriate adjustment is made for left censoring (values below the minimum detectable threshold) and right censoring (values for SECCHI depth above the physical depth of the stream).

Quantiles from the fitted model can be used to assess compliance with guidelines and to set reference limits for comparable streams impacted by pollution sources. Examples highlighted the huge variability in Queensland streams, some of which showed seasonality and trends, others only seasonality. The quantiles showed strong seasonality and guidelines should be set according to season. An example of this showed that the 80th percentile for the concentration of a water quality indicator in winter was less than the 20th percentile for summer for the same indicator.

Margaret Swincer

WESTERN AUSTRALIA

The Kelly System: Is it worth the gamble?

The June meeting of the WA Branch of the SSA Inc was treated to a lively Power Point presentation on "The Kelly System: Is it worth the gamble?" by Dr. Michael Levitan, currently visiting Perth at the University of Western Australia and haling from Villanova University, Pennsylvania. He is no stranger to Perth, having visited three times previously. His presentation covered areas of "gambling" from the casino (blackjack and roulette wheels) to communication theory (related to Shannon and Kelly) where interestingly the nomenclature of "bits" for binary digits associated with the capacity of a discrete channel was attributed to J.W. Tukey.

Michael's example in his abstract connecting the ideas of communication to gambling was as follows. "Imagine that you are listening on the wire to the results of a horse race before the Totalisor Agency Board (TAB) knows that the race has even been run. What do you do? How much do you bet? What do you do if there is static on the line, and you are not completely sure of the results?" He went on to consider situations of how one should bet under various criteria, starting with the model of independent Bernoulli trials for each experiment where $p = P$ (winning each bet) and $q = P$ (losing each bet), $p + q = 1$. With experienced blackjack players, $p = 0.51$ for example. Towards the end of his talk he considered investments in the securities market, showing how Kelly's ideas translated into investment strategies. Thorp, another player in this area, claimed in May 1998 that the partnership, which he had managed, had increased at a compound rate of approximately 20% per year. Michael noted that the partnership started in 1960. Ignoring tax consequences, an investment of $10,000 in 1960 would be worth $18,000,000 today.

On a lighter note Michael preempted a discussion on whether or not he used these strategies on betting himself by telling a story. Three different people died and went up to the Pearly Gates where St Peter questioned them on their activities in their last year on earth. The first person said he made $2,000,000. St Peter said "How did you do that?" whence the person replied, "By gambling." St. Peter said, "All right you can go in". The second person said she made $150,000 in the last year. St. Peter said "And what did you do? " She replied "I was a barrister." St Peter was impressed and said she could go in. The third person said he made $8,000 in the last year. St Peter turned to him and said "Oh and what courses did you teach?"

Handwriting recognition and some related statistical problems

At the September 19th meeting of the WA Branch of the Statistical Society of Australia Dr Andrzej Kozek from Macquarie University, SEFS Department of Statistics spoke on "Handwriting recognition and some related statistical problems". His visit to Western Australia also coincided with a visit to Murdoch University organized by Dr Brenton Clarke. This visit in a sense allowed for a personal exchange of ideas on robustness in statistics, which began some 13 years beforehand when Dr Clarke was invited by Dr Kozek to visit his previous employer in The University of Wroclaw in Poland.

Dr Kozek introduced a fairly general survey of handwriting recognition, and related this to statistical
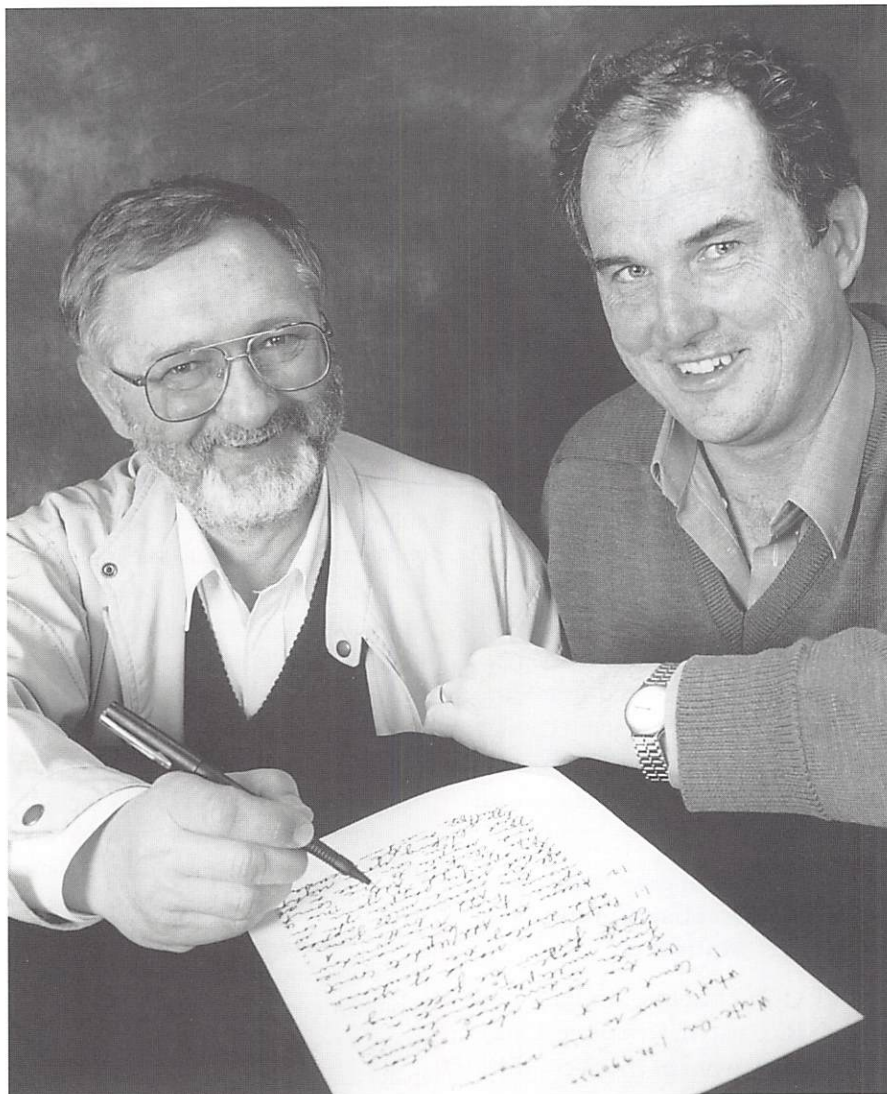
Dr Andrzej Kozek (left) and Dr Brenton clarke perusing some of the finer points of handwriting recognition

techniques which by their very nature must be robust to small changes. For example, a person's signature may not be exactly the same on any two presentations of it. Modern digitalization of handwriting allows for recording of geometric variables such as area, ink length; time variables such as overall down and up times, speed, etc; events, position at which the pen achieves a local minimum or maximum speed. In fact there are currently 91 measures currently available for identifying signatures.

He went on to discuss further aspects of handwriting recognition, provid-

ing motivation for serious study of handwriting techniques. He noted that President Clinton only recently signed a new electronic Signature Law, allowing for validity of electronic signatures in the market place. Governor Pataki also signed a New York State E-Commerce Proclamation electronically. Here Pen Op and Waccom Technology were used to sign a Proclamation signalling the start of an E-Commerce/E-Government Initiative.

Applications of handwriting recognition included forensic science, identifying imitation signatures, computer diaries, just to name some.

Brenton Clarke

How to assess a vaccine

Professor Niels Becker of the National Centre for Epidemiology and Population Health, Australian National University, discussed how to assess a vaccine at the August meeting of the branch.

Whilst the traditional measure of vaccine efficacy, VE=1-(proportion of cases in the vaccinated group)/(proportion of cases in the unvaccinated group), has the strength of being a relatively simple concept, it has a particularly worrisome weakness when the vaccine induces only partial immunity against a transmissible disease. In the case of infectious diseases, VE is also unable to measure whether the vaccine reduces infectivity.

Niels presented alternative concepts of vaccine efficacy, which address these issues and which reduce to the traditional definition of VE in the case when it works well. Data from an outbreak of mumps in a school in Ohio, USA, was used to illustrate the calculation of vaccine efficacy.

Branch workshop: Analysis of spatio-temporal data

In September, the branch enjoyed another well-attended and well-presented half-day workshop. The topic of this year's workshop was "Analysis of spatio-temporal data". The workshop, fast becoming an annual event for the branch, was held jointly with the ANU's Research symposium on spatio-temporal data, organised by Alan Welsh, Sue Wilson and Peter Hall. (The Symposium was held in Canberra on 11 - 14 September and has been summarised by Ross Cunningham elsewhere in this newsletter).

Mr Warren Muller from CSIRO Mathematical and Information Sciences commenced the afternoon with a talk on modelling epidemics of a rust fungus in its host plant populations. Mr

Greg Griffiths of the Australian Bureau of Agriculture and Resource Economics followed with a talk on spatial smoothing of farm survey data. We then heard from Dr Alison Smith of NSW Agriculture in Wagga Wagga on modelling covariance structures using multiplicative mixed models. The fourth speaker for the afternoon was Mr Ross Cunningham, part-time Head of the Statistical Consulting Unit at the Australian National University. Ross discussed whether the Southern Oscillation Index (SOI) was a good predictor of regional rainfall in Australia and presented some amusing examples of dubious consequences of El Nino, as published by various sources. The other part-time Head of the Statistical Consulting Unit, Dr Ann Cowling, presented work she had undertaken whilst working as a Biometrician at CSIRO Marine Research, on developing an annual biomass index for juvenile Southern Bluefin Tuna in the Great Australian Bight for 1993-2000.

Professor George Tiao of the University of Chicago presented the keynote address at the workshop. George has spent more than 20 years studying global atmospheric changes, and in particular, addressing the statistical issues in trend analysis of ozone, temperature and UV radiation data. His collaborations have culminated in the publication of over 3000 papers in the geophysical literature. At the workshop, he spoke on "Modelling latitudinal correlations for satellite data".

George discussed how he developed a class of parsimonious, predictive models for the latitudinal correlation patterns of satellite ozone and temperature data. The data consisted of the monthly average total ozone, temperature, cloud cover, solar flux, and other atmospheric variables, for each 5-degree latitudinal zone of the TOMS data from the Nimbus 7 satellite over the time period November 1978 to November 1992. The models con-

sisted of three components: deterministic relationship, temporal correlations, and latitudinal correlations. In particular, regression models with time series errors were fitted separately for each of the 26 latitudinal zones. Strong contemporaneous latitudinal correlations, which decay at different rates depending on latitudes and become negative at moderate distances, were observed from the residuals of all latitudinal zones. The latitudinal covariance matrix was modelled by three components, to accommodate different spatial patterns and variances: a basic component, namely ARMA(2,1); an equatorial component; and a polar component.

At the conclusion of the workshop, participants were treated to a wonderful dinner, catered by the Parsley Patch. Thanks to both the organisers and presenters for such a successful afternoon.

Methodological developments at the Australian Bureau of Statistics

At the October meeting, Mr Bill Gross and Mr Richard McKenzie each presented talks given at the Second International Conference on Establishment Surveys, which was held in Buffalo, New York in June this year.

Bill spoke about the method of synchronised sampling, which is used for choosing samples for business surveys. Formally, synchronised sampling is a permanent random number sampling technique, which controls sample rotation within repeated stratified surveys and controls sample overlap between different surveys. The sample in each stratum is specified as an interval and overlap is achieved by constraining the interval to move within a survey range. While it does not automatically control rotation or overlap when the stratification of a survey changes (eg two stratums combine to form a new stratum), some control in maximising the common sample is achieved by

careful choice of selection intervals and survey ranges. Maximising the common sample is important because the clients are interested in estimated change, such as growth or decline, in repeated surveys. Illustrations and examples were presented to support the main ideas of the talk.

Richard presented work on developing and assessing a framework for priority contact of non-respondents, leading to implementation in a survey. Traditionally, businesses which have not replied to a mail survey are subject to intensive follow up (IFU), by telephone or other means, to obtain a response. This procedure may imply high costs, so strategies to determine which businesses are given higher priority for contact were adopted. Models for the probability of response with and without IFU for the set of non-respondents were investigated at a particular point in time in the survey, leading to models for the reported and imputed values for this set of non-respondents being developed. A score function was derived which, for a fixed number of contacts, maximises the expected improvement in accuracy. The developments were illustrated through an application to the ABS Survey of Employment and Earnings.

At the conclusion of the meeting, a decent crowd moved on to Anatolia's Turkish restaurant in Civic to partake in samplings of a different kind.

News from the Canberra branch

Dr Ann Cowling has recently returned to Canberra and taken up the part-time position of Head of the Statistical Consulting Unit at the Australian National University, which will become full-time when Ross Cunningham retires in early March next year. Welcome back Ann!

Melissa Dobbie

CONFERENCE SUMMARY

International Congress on Intelligent Systems and Applications (ISA'2000), 12-15 December 2000, University of Wollongong.

Information: http://www.icsc.ab.ca isa2000.htm.

Biennial Australasian Genstat Conference, 31 January - 2 February, Mercure Resort, Surfers Paradise, Gold Coast.

Information: e-mail genstat01@dpi.qld.gov.au. Genstat 2001 web page (http://www.dpi.qld.gov.au/genstat).

There is a list of Australasian statistics conferences for 2000 and 2001 at:

http://www.maths.uq.oz.au/~gks/webguide/conf.html

Clunies Ross National Science & Technology Award 2001

**Hotel Sofitel, Melbourne
28 March 2001**

Award recipients will be publicly honoured at a formal ceremony and dinner to be held at Hotel Sofitel, Melbourne on Wednesday 28 March 2001.

This annual Award has now honoured 52 special Australians who have made an outstanding contribution to the application of science and technology for the economic, social or environmental benefit of Australia.

For further details contact Mary Bolger on (03) 9854 6266 (email: icr@crnet.com.au) or visit our web site at http://www.cluniesross.org.au

Symposium in honour of Emeritus Professor David Vere-Jones

**Victoria University of Wellington, New Zealand
19-21 April 2001**

General invitation to all David's many friends and colleagues.

David Vere-Jones will be 65 years of age on 17 April 2001. This Symposium is being held at Victoria University of Wellington, New Zealand, to celebrate the occasion and to acknowledge David's many far-reaching contributions across a broad spectrum in probability, statistics and the mathematical sciences. As part of that celebration David will be presented with a special festschrift written in his honour.

The dates of the Symposium are from midday Thursday 19 April 2001 to midday Saturday 21 April 2001 and the Symposium will partially overlap an international statistical seismology workshop held at the same venue.

Further details are given on the web site www.statsresearch.co.nz

Peter Thomson

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Email: robertk@agsm.edu.au
Tel: (02) 9931 9265, Fax: (02) 9662 7621**

The AGSM is a School of both The University of Sydney and The University of New South Wales

International Conference on Recent Developments in Statistics and Probability and their Applications, 30 December - 3 January 2001, New Delhi, India.

Information: Kanwar Sen, Department of Statistics, University of Delhi, Delhi 110007; tel. +91 11 723 1427 (h) or +91 11 725 6617 (o); email dustats@del3.vsnl.net.in; http://www.stat.ohiostate.edu/~hnn/IISA.html.

Sixth International Conference on Mathematical Population Dynamics, 3-8 June 2001, Marrakech, Morocco.

Information: Department of Mathematics, Chalmers University of Technology, and University of Goteborg, S-412 96 Goteborg, Sweden; tel. +46 31 772 35 30; fax +46 31 772 35 08; email: mpd6@math.chalmers.se; http://www.math.chalmers.se/~ziad/popdyn/Mpd6/index.html.

Bayesian Nonparametrics (BNP) Workshop, 27 July - 2 August, 2001, University of Michigan, Ann Arbor.

Information: Contact Paul Damien (pdamien@umich.edu) in Canada and the USA, Stephen Walker (s.walker@is.ac.uk) in Europe.

Fifth International Chinese Statistical Association (ICSA) International Conference will be held at the University of Hong Kong, Pokfulam Road, Hong Kong, 17-19 August 2001.

These dates are chosen with the purpose that potential participants can easily make arrangements to attend the International Statistical Institute meeting to be held in Seoul, South Korea, on the following Wednesday.

Keynote speakers will be Professor Peter Hall and Professor Tze-Leung Lai.

Information: Professor W.K. Li <hrntlwk@hku.hk> or visit website at <http://www.hku.hk/statistics/ICSA2001/>

New Web Site

The new SSAI web site based on a template design from Education Image is now running at the address http://www.statsoc.org.au

Many of the pages remain under construction at this stage and others contain fairly minimal information which we hope will be supplemented with contributions and information from members.

For the moment any corrections, submissions, news items, etc can be forwarded to james@prodigal.murdoch.edu.au for incorporation.

In the future it is expected that this activity will move to central office.

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