

University of Southern Queensland
Faculty of Sciences

Project Topics for Prospective Postgraduate Research Students

Project Description	Staff Member(s)	Email
<p>Title: Modeling, analysis and design of layered networks</p> <p>Area of Interest: Layered network design, fractional Brownian motion, Gaussian measures, financial mathematics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project is conducted in conjunction with the City University of Hong Kong. It makes use of the publicly available network and analysis web site, http://cs.sci.usq.edu.au/netml3_5, which was developed at USQ. The aim is to develop tools which can model, analyse, visualise, and design, networks which include layers for optical fibers, wave-division multiplexing, ethernet, SDH, IP, and potentially other technologies. The way these different technologies work together is described in a generic manner in the analysis and design tools. These can then be used to undertake case studies which allow future scenarios in which traffic is much greater and technologies have different cost parameters to be visualised and explored.</p> <p>Title: Performance analysis of systems with long-range-dependent traffic.</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Traditional methods for performance analysis are limited due to the difficulty of mathematical and simulation analysis. In particular, it is very difficult to analyse systems with <i>long-range-dependent</i> traffic. However, this is the main type of traffic in the networks of today. New methods have been developed by the supervisor which enable systems with long-range-dependent traffic to be analysed. The simulation method is called <i>snapshot simulation</i>. The mathematical method makes use of the <i>consistent group method</i>. These new techniques are being developed in conjunction with the City University of Hong Kong.</p> <p>Http://www.sci.usq.edu.au/staff/addie, http://cs.sci.usq.edu.au/netml4</p>	<p>A/Prof Ron Addie</p>	<p>ron.addie@usq.edu.au</p>
<p>Title: Identifying the key factors that influence academic success: An individual differences approach</p> <p>Area of Interest: Psychology; Higher Education; Learning and Teaching; Individual Differences</p> <p>Project Description/ Direction(s)/ Information:</p> <p>(a) Key variables: personality (big five), learning approaches (deep, shallow, strategic), age (mature-age versus school leaver), career decidedness/efficacy, study mode (on campus,</p>	<p>Assoc Prof Lorelle Burton</p>	<p>lorelle.burton@usq.edu.au</p>

<p>distance, online), Faculty (five USQ Faculties) and academic performance (e.g., GPA, 2006 - 2008).</p> <p>(b) The aim of this research is to examine the relationships between personality, learning approaches, career decidedness/efficacy and academic performance.</p> <p>(c) Particular theories that the student would expected to draw upon or theories that have been used to develop the proposed project: Learning theories, individual differences (personality), career literature, predictors of academic success.</p> <p>(d) This research will extend work previously covered on this topic (i.e., predictors of academic success, personality, and learning approaches) by the Supervisor, by tracking a cohort over time.</p>		
<p>Title: The Faint Young Sun Problem</p> <p>Areas of Interest : Astrophysics; Space Science; Remote Sensing; Instrumentation; Physics; Renewable Energy; Solar Energy; Solar UV Measurements.</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The “faint young Sun” problem refers to a longstanding contradiction between evidence for above freezing conditions early in the earth's climate history, and an astrophysical expectation that the sun's luminosity was much lower compared to today (down by 25% at 1 Gyr) during the early history of the Sun and Earth. The project will examine published evidence for and proposed solutions to the faint young Sun problem, before focusing on a study of early solar history using young stars as proxies. The project will test the hypothesis that the standard model of early solar evolution is supported by observations of young Sun-like stars.</p>	<p>Dr Brad Carter</p>	<p>brad.carter@usq.edu.au www.usq.edu.au/users/carterb</p>

<p>Title: Improving frost tolerance in cereals</p> <p>Areas of Interest : Plant Biotechnology and Bioinformatics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Frost damage is a potential major problem in cereals, particularly in spring wheat. Conventional breeding for improved frost tolerance over many years has generally not proved successful, suggesting little natural variation in the existing germplasm. We have recently developed genetically modified wheat which contains a synthetic anti-freeze protein (AFP) gene and are currently evaluating this material for both its the <i>invitro</i> and <i>invivo</i> (whole plant) performance. This involves studying gene expression, gene stability and overall performance of the construct in whole plants and the initial results have been promising. However, given the issues surround the deployment of genetically modified (GM) crops a critical question has arisen as to whether natural proteins exist in cereals have the potential to perform a similar function to the synthetic APF we have developed. The proposed study would involve bio-informatics based investigation of a wide range of plant genes with a view to identifying potential candidates that may possess “AFP like activity” which could subsequently form the basis for a search for natural gene variation that could be incorporated in traditional breeding programs to improve cereal frost tolerance.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Prof Grant Daggard</p>	<p>grant.daggard@usq.edu.au</p>
<p>Title: The use of arbuscular mycorrhizal fungi to improve drought tolerance of Australian crops</p> <p>Areas of Interest : Molecular Ecology and economic uses of Australian fungi</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Details can be provided on request.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters (prepared to take on one of each)</p>	<p>Dr John Dearnaley</p>	<p>dearns@usq.edu.au</p>
<p>Title: The impacts of Lantana camara on soil fungal communities</p> <p>Areas of Interest : Molecular Ecology and economic uses of Australian fungi</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Details can be provided on request.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters (prepared to take on one of each)</p>	<p>Dr John Dearnaley</p>	<p>dearns@usq.edu.au</p>
<p>Areas of Interest : Indigenous Health. Mental Health. Rural Health.</p>	<p>Prof Don Gorman</p>	<p>don.gorman@usq.edu.au</p>

<p>http://www.usq.edu.au/users/gorman/</p>		
<p>Title: Evaluation of grapevine rootstocks best suited to the Queensland viticultural environments</p> <p>Areas of Interest : Plant Science and Agriculture (Viticulture and Wine Production)</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Queensland is a relatively new player in the Australian wine industry and as such research into best viticultural practice for the state is limited. This combined with the threat of future climate change and the risk of soil borne pests becoming resident in Queensland vineyards means that research is necessary to determine which grapevine rootstocks are best suited to the growing conditions and soil types in wine growing regions of Queensland. This project is intended to be out in collaboration with the Queensland Vine Improvement Association, the timeline of set up projected to be in 2010.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): Masters</p>	<p>Ms Ursula Kennedy</p>	<p>Ursula.Kennedy@usq.edu.au</p>
<p>Title: Characterising the ultra violet light environment of grapevine canopies</p> <p>Areas of Interest : Plant Science and Agriculture (Viticulture and Wine Production)</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Ultra violet light exposure has implications for grape chemical composition and therefore fruit and wine colour and aromatic compounds. This project uses new simple technologies for measuring ultra violet light exposure to assess the ultra violet light penetration into a number of different common grapevine canopies, the findings being important for manipulating the vine to maximise fruit and wine quality.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): Masters</p>	<p>Ms Ursula Kennedy</p>	<p>Ursula.Kennedy@usq.edu.au</p>
<p>Title: Improved test after pretest</p> <p>Areas of Interest : Statistics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The idea of using non-sample prior information in the form of pre-testing for improving properties of estimators is applied in the testing regime to achieve better power of the ultimate test in this paper. For example, to test the intercept of a simple regression model, prior information from previous investigations or expert knowledge on the suspected value of the slope is potentially beneficial. Any uncertainty on the value of the slope is removed by performing a pre-test before testing the significance of the intercept. The impact of the pre-test on the performance (power and size) of the ultimate test is studied. Defining unrestricted test (UT), restricted test (RT) and pre-test test (PTT) corresponding to the unrestricted (UE), restricted (RE), and preliminary test estimators (PTE) in the estimation</p>	<p>Assoc Prof Shahjahan Khan</p>	<p>shahjahan.khan@usq.edu.au</p>

<p>case, the critical region and power functions are derived. Analytical and graphical comparisons of the three tests are obtained by studying the power functions with respect to size and power of the tests. It is shown that PTT achieves a reasonable dominance over the others asymptotically.</p> <p>The problem can be addressed for both parametric and non-parametric set ups. Robust procedure based on M-estimator can also be used to formulate a test and deriving its power function. In comparison to the other non-pre-test based test, the PTT based on pre-test performs better and its power function behaves similar to the quadratic risk function of the preliminary test estimator (PTE). Guidelines in choosing appropriate value of nominal sizes of pre-test for appropriate value of size of the PTT subject to the values of the slope can also be investigated.</p> <p>Core web site at: http://www.sci.usq.edu.au/staff/khans/ResFlyer%200908.pdf</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>		
<p>Title: Predictive Inference</p> <p>Areas of Interest : Statistics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Prediction distribution is the basis for many predictive inferences. Unlike the common practice of estimating parameters of a model or performing tests of hypotheses regarding the parameters involved, often the aim of a researcher/practitioner is to predict the value of a (or a set of) future response(s) from a given model. The technique of prediction is used in many real world situations as it has a common sense appeal and simple interpretation. The prediction distribution is the probability distribution of one or more future (unobserved) responses, conditional on a set of observed responses from the same model. The method is useful in both univariate and multivariate problems. Predictive inference is possible for models with independent as well as dependent and correlated responses. Bayesian and other approaches are adopted for the purpose of predictive inference. Available methods can handle the conventional normal model and non-normal robust models. Application of predictive inference includes problems in areas such as tolerance regions, model selection, process control, optimisation, perturbation and many others.</p> <p>Core web site at: http://www.sci.usq.edu.au/staff/khans/ResFlyer%200908.pdf</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Shahjahan Khan</p>	<p>shahjahan.khan@usq.edu.au</p>

<p>Title: Meta-analysis</p> <p>Areas of Interest : Statistics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This is a statistical method to combine data from several independent studies conducted using randomised control trails for making inferences. Analyses are done for relative risks and odd ratios for binary data, and weighted mean difference, using precision as weight, for continuous variables. Both classical and Bayesian approached can be used. Forest plots and funnel plots are used to study the outcome variables. Issues such as study bias and heterogeneity of outcome measures are required to be handled properly. Although initially used in the clinical studies involving randomised control trials, the methods are now being used in many areas of education, criminology, psychology, pharmacy and business. The combination of data from independent studies is likely to provide better quality of inference due to increased sample size.</p> <p>Core web site at: http://www.sci.usq.edu.au/staff/khans/ResFlyer%200908.pdf</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Shahjahan Khan</p>	<p>shahjahan.khan@usq.edu.au</p>
<p>Title: Improved estimation</p> <p>Areas of Interest : Statistics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Traditionally the unknown population mean is estimated by the sample mean. Improved estimators, in the sense of admissibility, accuracy and efficiency are recent phenomenon in statistical inference. Improved estimators such as the preliminary test, shrinkage and positive-rule shrinkage estimators, perform better than the traditional estimators based on normal models. When a number of alternative estimators are available to estimate an unknown parameter (scalar or vector) a natural question is, which one should be used and why? The choice obviously depends on the objective of the study and some appropriate criteria to judge the relative performance of the estimators. Generally, in the classical theory of statistics several criteria are employed to judge the characteristics of good estimators. Most common/popular of these criteria include <i>unbiasedness</i>, <i>mean squared error</i> (mse), and <i>quadratic risk</i>. Although the level of emphasis on these criteria varies from application to application, it is desirable that a good estimator will meet the most important/appropriate criterion determined by the researcher, and over perform the rest.</p> <p>Core web site at: http://www.sci.usq.edu.au/staff/khans/ResFlyer%200908.pdf</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Shahjahan Khan</p>	<p>shahjahan.khan@usq.edu.au</p>

<p>Title: The Multivariate Student-t and Elliptic Distributions</p> <p>Areas of Interest : Statistics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The customary use of the normal model is under serious question when the population distribution is symmetric but have heavier tails than the normal distribution. Also, the normal model fails to incorporate dependent but uncorrelated responses. In such cases the multivariate Student-t distribution provides an appropriate model for the population. Such a model can be viewed as a mixture of normal and inverted gamma distributions. Using this result we obtained the maximum likelihood estimators of the mean and scale parameters of multivariate Student-t distribution. The model has been used to find appropriate test statistic to test the mean vector. The non-null distribution of the test statistic has been derived. The distributions of the sum of squares and product matrix for the multivariate Student-t model as well as the predictive distribution of future model have been proposed. Similar results for the matrix T model are also obtained. The studies can be extended to the wider class of elliptically contoured distributions.</p> <p>Core web site at: http://www.sci.usq.edu.au/staff/khans/ResFlyer%200908.pdf</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Shahjahan Khan</p>	<p>shahjahan.khan@usq.edu.au</p>
<p>Title: Construction and evaluation of a virus like particle expressing <i>Streptococcus pneumoniae</i> epitopes for human vaccine purposes</p> <p>Areas of Interest : Infectious diseases, inflammation, sepsis, recombinant DNA technology, vaccinology</p> <p>Project Description/ Direction(s)/ Information:</p> <p>We have previously expressed bacterial epitopes on HBsAg virus like particles (VLPS) and tested them in animal challenge models. We have been able to demonstrate that this novel mode of vaccine delivery does confer a degree of protection against wild type challenge with the bacterial pathogen. This project will use recombinant DNA technology to construct an HBsAg VLP which expresses putative protective epitopes of the human respiratory pathogen <i>S. pneumoniae</i> and test the efficacy of the vaccine in protecting against wild type challenge in a mouse model. The candidate will use recombinant DNA technology, as well as conventional examinations and assays such as histopathology, immunochemistry and serology.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Michael Kotiw</p>	<p>kotiw@usq.edu.au</p>

<p>Title: The use of novel antagonists in a mouse lung model of inflammation</p> <p>Areas of Interest : Infectious diseases, inflammation, sepsis, recombinant DNA technology, vaccinology</p> <p>Project Description/ Direction(s)/ Information:</p> <p>We have experience in the molecular characterisation and quantification of antagonists against pro-inflammatory cytokines such as TNFα. We have explored the efficacy of these antagonists in a rat pouch model of inflammation and are currently using a mouse model of lung inflammation to determine the effect of the antagonists on inflammatory and pathological markers in a mouse model of lung inflammation. In this project the candidate will undertake a study in examining the efficacy of inflammatory antagonists in the mouse model. Procedures to be used may include molecular techniques, microsurgery, histopathology (including immunochemistry) and conventional serological techniques.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Michael Kotiw</p>	<p>kotiw@usq.edu.au</p>
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<p>Title: Development of Depth of Anaesthesia Monitoring Techniques</p> <p>Areas of Interest : Artificial Intelligence, Signal and Image Processing, EEG Research and Network Communications</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The aims of this project are to extract anaesthetic related data from frontal electroencephalograph (EEG) signals, to establish higher level-of-consciousness model from induced physiological changes, to develop model based novel algorithms to assess the DoA precisely and reliably, and in long term to improve the current clinical practices in depth of anaesthesia assessment.</p> <p>Title: Analysing EEG Signals using Wavelet based Independent Component Analysis</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project aims to develop a software tool to automatic detect and predict problematic signals and patterns from specific brain disorder diseases (such as epilepsy and dementia etc) from EEG recordings and help neurologists to diagnose the diseases using wavelet based independent component analysis (ICA). The approach merges the advantages of wavelet decomposition and ICA. Wavelet decomposition projects EEG signals into a high-dimensional orthogonal basis where the ICA performance is significantly improved. This project will improve the quality of life of brain disorder patients through accurate diagnoses and early intervention.</p> <p>Title: The Auto-Reconstruction of Realistic Head Modelling of EEG</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The objective of this project is to reconstruct a geometry model (3D) of the human head from Magnetic Resonance Images (MRI). This work is a part of a large research program that aims to develop better diagnostic tools for predicting the electroencephalograph (EEG) signal at any point on the scalp as a function of the source locations and blood flow within the cortex. It is envisaged that this will help achieve a better understanding of the structure and functions of the brain.</p>	<p>A/Prof Yan Li</p>	<p>liyian@usq.edu.au</p>
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Title: Adaptive Speech Separation Using Hybrid Techniques

Project Description/ Direction(s)/ Information:

Hearing aids, video conferencing *etc* should disentangle one sound from other sounds as human beings do. However, current techniques simply amplify the desired signal and the competing noise without discrimination. The problem involves multiple signals and multiple sensors, and each sensor receives a mixture of the source signals. Blind signal separation is a technique to retrieve these source signals from observed mixed data when the transmission channels and original sources are unknown. This project is to develop an adaptive algorithm using hybrid techniques for applications in hearing aids, video conferencing, noise cancellation, and speech enhancement.

Title: An Intelligent Technique for Intrusion Detection in Computer Networks

Project Description/ Direction(s)/ Information:

Computer security is now becoming a major concern of modern society as a large fraction of information flows through computer networks. Standard protection mechanisms, such as user authentication, service control, and traffic filtering cannot guarantee from the risk of computer attacks.

The main reason of the weakness of computer networks lies in the large variability of network traffic, and in the so-called "bugs" always contained in systems and application softwares, and complex unforeseen interactions between software components and/or network protocols. The objective of computer attacks is to obtain unauthorized access to the information stored in computer systems and/or to cause a temporary unavailability of its services. Intrusion Detection Systems (IDSs) are a fine grain filter placed inside the protected networks, that look for known or potential threats in network traffic and/or in audit data recorded by hosts.

Neural networks have been used for the improvement of network intrusion detection systems based on searching for attack-specific keywords in network traffic. Neural networks provide a solution to the problems of modelling the users' behaviours in anomaly detection because they do not require any explicit user models. In addition they can automatically learn attack signatures from attack samples.

In this project, we will develop a neural approach for intrusion detection in computer networks.

<http://www.sci.usq.edu.au/staff/liyan/>

<p>Title: Influencing factors to the binocular rivalry rate among university students and people with psychiatric conditions</p> <p>Areas of Interest : Human Brain Function, The relationship between binocular rivalry and inter-hemispheric functional switch</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The cerebral hemispheres alternate functionally from side to side. The temporal pattern of alternation can be measured using a perceptual rivalry, whose switches have been shown to be mediated by interhemispheric switches. This project aims to learn more about the purported link between the perceptual rivalry and interhemispheric switches. The focus of the investigation is the discovery that the major psychoses are associated with striking alterations of the timing of these switches. In euthymic subjects with bipolar disorder the switch rate is slow compared to controls. In schizophrenia there is evidence of an extremely fast component of rivalry. The research result will help elucidate the mechanisms and influencing factors underlying the interhemispheric rhythms and their relationship with certain psychiatric disorder. Long term this research will also provide experimental evidence for selection of potential drugs, which might be used for euthymic subjects.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Dr Guang Bin Liu</p>	<p>liu@usq.edu.au</p>
<p>Title: Mathematical surface fitting for biological applications</p> <p>Areas of Interest : Mathematical Surface Fitting with Biological Applications; Emerging Technologies for Learning and Teaching</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project builds on existing research in Australia and at institutes such as INRA in France on creating mathematical representations of biological surfaces such as leaf surfaces. These leaf representations form part of virtual plants, computer models of plants. Simulations based on virtual plants can replace the need for field experiments, and outcomes may lead, for instance, to an increased knowledge base of optimal nozzle speed and orientation during spraying processes.</p> <p>Mathematical techniques used in previous research conducted in Australia include interpolation via piecewise linear fits, piecewise cubic Clough-Tocher fits (both on triangulations), and Radial Basis Function approaches.</p> <p>Growth of leaf surfaces and recovery from damage are two of a number of new directions that would be suitable for investigation.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Dr Birgit Loch</p>	<p>Birgit.Loch@usq.edu.au</p>
<p>Title: How do emerging technologies enhance student learning?</p>	<p>Dr Birgit Loch</p>	<p>Birgit.Loch@usq.edu.au</p>

<p>Areas of Interest : Mathematical Surface Fitting with Biological Applications; Emerging Technologies for Learning and Teaching</p> <p>Project Description/ Direction(s)/ Information:</p> <p>A number of projects in this area are available and further details will be provided upon request. They have an educational technology focus and investigate the impact on student learning and on learning outcomes when emerging technologies are introduced into learning and teaching. These technologies include but are not limited to:</p> <ul style="list-style-type: none"> • Tablet technologies (tablet PCs, graphics tablets, UMPCs, tablet netbooks, other electronic writing implements) • Web 2.0 technologies (podcasting, screencasting, social networking, Wikis etc) • Mobile learning devices (iPod, mobile phone, smart phone etc) <p>Data collection would take place at the candidate’s workplace or in the USQ context. Both a student and a teacher focus may be investigated.</p> <p>Depending on the candidate, the project can also take a more computing orientated direction and include software development, or focus on technology supported mathematics education.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>		
<p>Title: Factors that contribute to employee engagement in professional development, emotional self-regulation, and organizational citizenship behaviours</p> <p>Area of Interest: Organisational psychology with a focus on maximising employee engagement through positive psychological approaches</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This area of research focuses on the factors that encourage employees to actively participate in their own professional development, to manage their psychological well-being and to go above and beyond their prescribed role requirements. The theoretical base for much of this research is a positive psychological approach known as self-determination theory. The project would involve working in an organization and collecting staff survey data. There is the potential to compare the contributing factors between cultures or organisations if a sufficient sample is obtained from multiple organisations.</p> <p>Core web site http://www.usq.edu.au/sciences/psychology/core/default.htm</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Prof Tony Machin</p>	<p>Tony.Machin@usq.edu.au</p>
<p>Areas of Interest : Genome mapping, marker-assisted selection, plant pathology, population genetics</p>	<p>Dr Anke Martin</p>	<p>anke.martin@usq.edu.au</p>

<p>Project Description/ Direction(s)/ Information: http://www.usq.edu.au/csbi/researchprograms/cropbiotech</p>		
<p>Title: Development of a technique to determine the damaging and beneficial solar UV exposures to office workers in an urban environment</p> <p>Areas of Interest : Solar Ultraviolet Radiation Physics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The incidence rates of skin cancer and sun-related eye diseases can be reduced by the minimization of UV exposures. Reduction in UV exposures during occupational activities could substantially reduce the risk of developing skin cancers and sun related eye disorders. On the beneficial side, sub-erythral exposure to UVB is necessary to initiate the conversion of 7-dehydrocholesterol to pre-vitamin D₃ that plays an important role in calcium metabolism and is essential for good bone development, prevention of rickets in children and osteoporosis, osteomalacia, and fractures in the elderly. Other reported health effects include prevention of insulin dependent diabetes, cancer (e.g. prostate, breast and colorectal cancer), autoimmune diseases, and multiple sclerosis, which show geographic distributions in rate and mortality that may be negatively correlated with the body's vitamin D levels and exposure to solar radiation. Consequently, it is essential to optimise solar UV exposures. This is important for office workers that would spend a large proportion of their time indoors with any possible exposure to UV radiation during breaks outdoors. This project will develop a technique to measure and model the damaging and beneficial solar UV exposures to office workers on anatomical sites of the human body under any given vegetation canopy in an urban environment.</p> <p>http://www.usq.edu.au/sciences/studyareas/astronomy/solar/research/default.htm</p>	<p>Prof Alfio Parisi</p>	<p>alfio.parisi@usq.edu.au</p>
<p>Area of Interest:</p> <ol style="list-style-type: none"> 1. Adoption (especially search, reunion, and issues facing adult adoptees, though other topics would be considered). 2. Interpersonal relationship issues (especially friendship, loneliness, attachment, parental bonding, marital satisfaction, online relationships and social networking). 3. Positive psychology (especially hope, forgiveness, and gratitude). 4. Integration of psychology and Christian issues. <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Assoc Prof Nola Passmore</p>	<p>nola.passmore@usq.edu.au</p>
<p>Title: Impact of Climate Processes on Future Rainfall and Agricultural Production Systems in Southeast Asia and Australia</p> <p>Areas of Interest: Global environmental changes; Ocean and climate dynamics; Australian rainfall variability; physical</p>	<p>Assoc Prof Joachim Ribbe</p>	<p>Joachim.Ribbe@usq.edu.au</p>

modeling of ocean and climate processes; interannual and decadal variability; the circulation and variability of the South Pacific Ocean and water mass formation processes in the Southern Ocean; physical oceanography, ocean modelling, and climate processes. The ocean's role in climate and climate change. Mid-latitude convection and the formation mechanisms of sub-Antarctic Mode and Antarctic intermediate water; modelling pollution dispersion in the upper and deep oceans; radiocarbon dating of oceanic ventilation; sediment transport processes and internal waves.

Project Description/ Direction(s)/ Information:

This project explores the impact of climate drivers such as the El Nino Southern Oscillation, Indian Ocean Dipole, Southern Annular Mode, Interdecadal Pacific Oscillation on future rainfall. The project involves the dynamic downscaling of data from coarse resolution climate models. It contributes to the assessment of the next generation of climate models. It investigates the role of local processes and orographic features in the context of large scale climatic change. Climatic changes and variability are also impacting on the large scale monsoon circulations of southeast Asia and Australia and future changes are likely to lead to impacts on agricultural productivity.

The project is suitable for students with a solid background in the physical sciences (physics, maths), climatology, meteorology, and computing.

Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters

References:

Shi, G., **Ribbe, J.**, Cai, W., Cowan, T. 2008. Interpretation of Australian summer and winter rainfall projections. *Geophysical Research Letters*. 35, L02702, doi:10.1029/2007GL032436.

Shi, G., Cai, W., Cowan, T., **Ribbe, J.**, Rotstayn, L., Dix, M. 2008. Variability and trend of the northwest Western Australia Rainfall: observations and coupled climate modelling. *Journal of Climate*. 21, 2938-2959.

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Donald, A., Meinke, H., Power, B., Wheeler, M. C., Maia, A. De H. N., Stone, R. C., **Ribbe, J.**, White, N. 2006. Near-global impact of the Madden-Julian Oscillation on rainfall. *Geophysical Research Letters*, 33, L09704,

<p>doi:10.1029/2005/GL025155.</p> <p>Cai, W., Shi, G., Cowan, T., Bi, D., Ribbe, J. 2005. The response of the southern annual mode, the East Australian Current, and the southern mid-latitude ocean circulation</p>		
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<p>Title: Impact of Climate Processes On Coastal Ocean Circulation in Southeast Asia and Australia.</p> <p>Areas of Interest: Global environmental changes; Ocean and climate dynamics; Australian rainfall variability; physical modeling of ocean and climate processes; interannual and decadal variability; the circulation and variability of the South Pacific Ocean and water mass formation processes in the Southern Ocean; physical oceanography, ocean modelling, and climate processes. The ocean's role in climate and climate change. Mid-latitude convection and the formation mechanisms of sub-Antarctic Mode and Antarctic intermediate water; modelling pollution dispersion in the upper and deep oceans; radiocarbon dating of oceanic ventilation; sediment transport processes and internal waves.</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project explores the impact of climatic changes on coastal ocean circulation. Some recent work indicates that drying trends lead to increased coastal ocean salinity impacting on marine environmental conditions and productivity of local fisheries. A combination of field measurements using conductivity depth temperature probes and acoustic Doppler current profiles as well as coastal ocean circulation models and climatological data bases (e.g. from remote sensing) is used to investigate coastal ocean processes in a variable and changing climate.</p> <p>This project is suitable for students with an engineering and/or physical sciences background with interest in computational modelling and application to climate/ocean processes.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p> <p>References:</p> <p>Ribbe, J., 2009. Observing Climate Trends and Hypersalinity in an Australian Coastal Bay. In: <i>Climate Alert: Climate Change Monitoring and Strategy</i> (Ed. You & Henderson-Sellers). Sydney University Press. Accepted June 15.</p> <p>Gräwe, U., Wolff, J.-O., Ribbe, J., 2009: Mixing, Gradients and Hypersalinity in Hervey Bay, Australia. <i>Ocean Dynamics</i>. 10.1007/s10236-009-0195-4.</p> <p>Ribbe, J. 2006. A study into the export of saline water from Hervey Bay, Australia. <i>Estuarine, Coastal and Shelf Science</i>. 66, 550-558. doi:10.1016/j.ecss.2005.10.012.</p> <p>Ribbe, J., Wolff, J.-O., Staneva, J., Gräwe, U. (2008). Assessing Water Renewal Time Scales for Marine Environments from Three Dimensional Modelling: A Case Study For Hervey Bay, Australia. <i>Environmental Modelling and Software</i>. 23(10), 1217-1228, 10.1016/j.envsoft.2008.02.007.</p>	<p>Assoc Prof Joachim Ribbe</p>	<p>Joachim.Ribbe@usq.edu.au</p>
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<p>Title: Issues in Cross-Cultural Assessment: Examining the Validity of the Minnesota Multiphasic Personality Inventory (MMPI-2) in Different Countries</p> <p>Area of Interest: Psychological Assessment; Neuropsychology; Forensic Psychology; Psychometrics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The MMPI-2 is the most widely used personality inventory in the world today and has been translated into more than 20 different languages. The emphasis in the development of these versions of the test has focused on the accuracy of item translation with relatively little work done on verifying the applicability of the item content to the measurement of psychopathology. In our earlier research in Singapore we found that one in three normal Singaporeans would generate elevated scales suggestive of psychopathology when scored using US norms. Similarly, evaluating the MMPI-2 protocols of psychiatric patients in Singapore revealed base rates of elevations which were approximately 30% higher than a comparative US sample. These findings suggest that while the translations may be accurate, that cultural differences impact upon the base rates of inferred psychopathology when the US normative data is used to score protocols. This project seeks to examine the base rates of the MMPI-2 and the newly developed MMPI-2-RF in both normal and clinical cases with the ultimate goal of developing local and culturally-appropriate normative data for scoring and interpreting these tests. This project can be run in parallel in different countries (i.e. can accommodate multiple PhD students) and is best suited for countries where the MMPI-2 is already being employed as a measure of psychopathology.</p> <p>Core web site at: http://www.usq.edu.au/users/senior/Theses.html</p>	<p>Assoc Prof Graeme Senior</p>	<p>graeme.senior@usq.edu.au</p>
<p>Title: Developing More Robust Statistical Procedures for Analysing Psychological Test Data</p> <p>Area of Interest: Psychological Assessment; Neuropsychology; Forensic Psychology; Psychometrics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Clinicians are constantly challenged with the difficult task of administering psychological tests to clients in an effort to better understand their cognitive and psychosocial strengths and weaknesses. In making clinical inferences, the practitioner must be ever mindful of the influences that the psychometric properties and test-operating characteristics of the tests have upon their decisions. All psychologists are taught about the importance of reliability and validity in interpreting psychological tests and are admonished to incorporate measurement error in their interpretations. Few, however, have the explicit training or knowledge to actually achieve this goal. The current project is part of an ongoing series of studies designed to develop a systematic approach to directly incorporating measurement error into the statistical analysis and</p>	<p>Assoc Prof Graeme Senior</p>	<p>graeme.senior@usq.edu.au</p>

<p>interpretation of psychological test data. A number of approaches are used in combination including classical test theory in incorporating reliability and validity into the decision-making process as well as discriminant function analysis and cluster analysis to explore hypotheses customarily beyond the reach of most clinicians. The challenge in this research is not to create new statistical procedures but rather to adapt existing multivariate methods in integrated software to provide the power of these statistical procedures for clinical use in a seamless fashion. This project is statistically intensive. Familiarity with computer programming is not required but would be beneficial.</p> <p>Core web site at: http://www.usq.edu.au/users/senior/Theses.html</p>		
<p>Title: Zonal dispersion of contaminants in turbulent boundary layer: theory and applications</p> <p>Areas of Interest : Mathematical or Environmental Modelling</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The project is focused on the dispersion of contaminants in turbulent boundary layer using centre manifold technique. The method describes long-term asymptotical dynamics of the contaminant concentration as it becomes spread across the entire layer and is weakly distorted by the velocity shear. The project aims to deduce a partial differential equation for the depth-average concentration for a two-zone power-like velocity profile according to a recent theory of turbulent boundary layer.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Assoc Prof Dmitry Strunin</p>	<p>dmitry.strunin@usq.edu.au</p>
<p>Title: Phase dynamics in nonlinearly excited active systems</p> <p>Areas of Interest : Physical Modelling</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Phase equation describing oscillators weakly coupled by diffusion successfully models various physical and biological systems. The equation generally contains infinite number of terms but allows a variety of dynamic balances between only a few of them. Of particular interest for this project is the balance based on nonlinear excitation as opposed to linear excitation, which has been well studied before. The project is focused on possible truncations of the phase equation and the resulting regular and irregular dynamics.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Assoc Prof Dmitry Strunin</p>	<p>dmitry.strunin@usq.edu.au</p>

<p>Title: Dispersion of contaminants in turbulent boundary layer: theory and applications</p> <p>Areas of Interest : Mathematical or Environmental Modelling</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The project is focused on the dispersion of contaminants in turbulent boundary layer using centre manifold technique. The method describes long-term asymptotical dynamics of the contaminant concentration as it becomes spread across the entire layer and is weakly distorted by the velocity shear. The project aims to deduce a partial differential equation for the depth-average concentration for different velocity profiles.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Assoc Prof Dmitry Strunin</p>	<p>dmitry.strunin@usq.edu.au</p>
<p>Title: Regular and chaotic dynamics in nonlinearly excited active systems</p> <p>Areas of Interest : Physical Modelling</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Generalized nonlinear phase equation describes oscillators weakly coupled by diffusion. Such system of oscillators successfully models various bio-physical systems. The equation generally contains infinite number of terms and allows a variety of dynamic balances between them. The project is focused on a truncated version of the equation and the resulting dynamics produced by the nonlinear excitation mechanism.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Assoc Prof Dmitry Strunin</p>	<p>dmitry.strunin@usq.edu.au</p>
<p>Title: Zonal dispersion of contaminants in turbulent boundary layer: theory and applications</p> <p>Areas of Interest : Mathematical or Environmental Modelling</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The project is focused on the dispersion of contaminants in turbulent boundary layer using centre manifold technique. The method describes long-term asymptotical dynamics of the contaminant concentration as it becomes spread across the entire layer and is weakly distorted by the velocity shear. The project aims to deduce a partial differential equation for the depth-average concentration for a two-zone power-like velocity profile according to a recent theory of turbulent boundary layer.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Assoc Prof Dmitry Strunin</p>	<p>dmitry.strunin@usq.edu.au</p>

<p>Title: Biology of root diseases in wheat and barley</p> <p>Areas of Interest : Crop Science</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Our research group is actively engaged in research into host-pathogen interactions in cereal root diseases, particularly crown rot and common root rot. Potential PhD projects exist based on molecular and microscopic analyses of infected tissues which would involve both laboratory and field-based activities. In addition we have developed molecular markers for genes conferring partial resistance to this disease and are keen to engage PhD students to assist us to identify the function of these genes using both fine mapping and bioinformatics approaches.</p> <p>Core web site at: http://www.usq.edu.au/csbi/researchdivisions/cropimprovement/default.htm</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Prof Mark Sutherland</p>	<p>Mark.Sutherland@usq.edu.au</p>
<p>Title: Effect of climate change on foliar pathogens of barley</p> <p>Areas of Interest : Crop Science</p> <p>Project Description/ Direction(s)/ Information:</p> <p>We are investigating the effects of climate change on several fungal pathogens of barley with respect to their incidence and severity. PhD students are being sought to conduct population studies using molecular techniques to assess the potential for increased disease, especially those involving the net blotch(<i>Pyrenophora teres</i>) and spot blotch (<i>Cochliobolus sativus</i>) pathogens.</p> <p>Core web site at: http://www.usq.edu.au/csbi/researchdivisions/cropimprovement/default.htm</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Prof Mark Sutherland</p>	<p>Mark.Sutherland@usq.edu.au</p>
<p>Title: Host-specific toxins produced by <i>Pyrenophora teres</i></p> <p>Areas of Interest : Crop Science</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Our team is commencing a collaborative study with two other research groups to examine toxins produced by the net blotch pathogen which are specific to barley. We are seeking a PhD student to examine toxin gene variability in <i>Pyrenophora teres</i> and to measure toxin gene expression during infection using quantitative PCR technology.</p> <p>Core web site at: http://www.usq.edu.au/csbi/researchdivisions/cropimprovement/default.htm</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	<p>Prof Mark Sutherland</p>	<p>Mark.Sutherland@usq.edu.au</p>

<p>Title: Mood and sport performance in Malaysia</p> <p>Area of Interest: Sport Psychology</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project will investigate relationships between mood responses and sport performance among Malaysian athletes. It will include three studies. Study 1 will investigate psychometric properties of a Malay/Chinese translation of the Brunel Mood Scale (Terry et al., 1999, 2003), focusing on factorial validity, among a sample of approximately 300 Malaysian athletes. Study 2 will investigate factorial validity of a revised version of this scale (if revision is required, based on the results of Study 1) and will assess other aspects of psychometric integrity, such as concurrent validity, among a second sample of 200-300 Malaysian athletes. Study 3 will used the validated scale to test a model of mood-performance relationships proposed by Lane and Terry (2000, 2005), among a sample of 100-150 Malaysian athletes. This project requires excellent English-language skills and access to adequate numbers of Malaysian athletes. A copy of the User Guide for the Brunel Mood Scale (in English) is available.</p> <p>References</p> <p>Lane, A. M., & Terry, P. C. (2000). The nature of mood: Development of a conceptual model with a focus on depression. <i>Journal of Applied Sport Psychology</i>, 12, 16-33.</p> <p>Lane, A. M., & Terry, P. C. (2005). Test of a conceptual model of mood-performance relationships with a focus on depression: A review and synthesis five years on. In T. Morris, P. Terry et al. (Eds.), <i>Promoting Health and Performance for Life: Proceedings of the ISSP 11th World Congress of Sport Psychology</i>. Sydney: International Society of Sport Psychology.</p> <p>Terry, P. C., Lane, A. M., Lane, H. J., & Keohane, L. (1999). Development and validation of a mood measure for adolescents. <i>Journal of Sports Sciences</i>, 17, 861-872.</p> <p>Terry, P. C., Lane, A. M., & Fogarty, G. J. (2003). Construct validity of the POMS-A for use with adults. <i>Psychology of Sport and Exercise</i>, 4, 125-139.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Prof Peter Terry</p>	<p>peter.terry@usq.edu.au</p>
<p>Title: Limiting disclosure of private information in relational database systems</p> <p>Areas of Interest : Data management; Access Control; Security, Data Mining, Data Engineering</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Enterprises are deeply concerned about customers' privacy issues and try to build solid trust to attract customers. This project continues development of new purpose-based frameworks and private information assurance requirements in relational database systems. The frameworks will identify and address issues of protecting private information; and to specify</p>	<p>Assoc Prof Hua Wang</p>	<p>hua.wang@usq.edu.au</p>

<p>and enforce privacy rules to support identified issues. It aims to develop techniques for purpose-based usage control and detecting possible conflicts between obligations. The approach leads to a great understanding of advocating limited disclosure in usage control systems. The project develops fundamental enabling methodologies for the information and communication industry.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>		
<p>Title: Privacy preserving data sharing in data mining environments</p> <p>Areas of Interest : Data management; Access Control; Security, Data Mining, Data Engineering</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Preserving privacy in data mining among various enterprises and organisations is essential for many real world applications in areas like health surveillance, business analysis, fraud detection and terror protection. Efficient and effective techniques are badly needed to protect privacy in data sharing and data mining. The developed cutting-edge techniques in this project will be implemented in freely available open source software tools, empowering Australian organisations to utilise the techniques to develop intelligent systems in data sharing environments. These techniques will ultimately lead to better utilisation of the information available in many enterprises and organisations.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Hua Wang</p>	<p>hua.wang@usq.edu.au</p>
<p>Title: Protect information sharing within distributed collaborative environment</p> <p>Areas of Interest : Data management; Access Control; Security, Data Mining, Data Engineering</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Information sharing on distributed collaboration usually occurs in broad, highly dynamic network-based environments, and formally accessing the resources in a secure manner poses a difficult and vital challenge. This project develops a systematic methodology for information sharing in distributed collaborative environments. It will ensure sensitive information and information assurance requirements, and incorporate new security constrains and policies raised by emerging technologies. We will create a new rule-based framework to identify and address issues of sharing in collaborative environments; and to specify and enforce security rules to support identified issues while minimizing the risks of information sharing through the framework.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD</p>	<p>Assoc Prof Hua Wang</p>	<p>hua.wang@usq.edu.au</p>

<p>Title: Data mining from data streams</p> <p>Areas of Interest : Data Mining, Bioinformatics, Database, Information Privacy and Security, Social Network, Web technology</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project will investigate data mining techniques used to discover useful patterns and knowledge from data streams.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	Dr. Ji Zhang	Ji.Zhang@usq.edu.au
<p>Title: Knowledge mining from biological and medical data</p> <p>Areas of Interest : Data Mining, Bioinformatics, Database, Information Privacy and Security, Social Network, Web technology</p> <p>Project Description/ Direction(s)/ Information:</p> <p>This project will apply data mining techniques in biological and medical data to unveil useful patterns and knowledge.</p> <p>Research program(s) in which able to take on additional students (PhD and/or Masters): PhD or Masters</p>	Dr. Ji Zhang	Ji.Zhang@usq.edu.au
<p>Title: Data Safety and Privacy Study on Wireless Sensor Networks Deployed in Medicine and Healthcare Domains.</p> <p>Area of Interest: Computer Networking and Security Research; Performance Analysis and Modelling of Wireless/Mobile Networks; E-Commerce System; Application of Artificial Intelligence Technology in Bioinformatics</p> <p>Project Description/ Direction(s)/ Information:</p> <p>The security and energy constraints are regarded as the key challenges for Wireless Sensor Networks to offer economically viable solutions for a variety of applications, protecting the data safety and preserving privacy have been identified as two major hurdles in advocating the wide use of WSNs in medicine and healthcare.</p> <p>To address these challenges, this project aims to develop new efficient protocols and techniques to streamline the large quantity data gathered by sensor nodes. The approach is to utilise data aggregation technology and collaborative data management strategy in combining with wireless network clustering technique. This research differs from the traditional ones as the data aggregation will be executed prior to data storage and communications over the WSNs.</p> <p>Title: Modelling IEEE 802.15.4 MAC Layer Protocols with Retransmission</p> <p>Project Description/ Direction(s)/ Information:</p> <p>Many industrial standards such as ZigBee adopt the data link and medium access control protocols of the IEEE 802.15.4. IEEE 802.15.4 is a default specification for low-power and low-rate embedded networks which can often be seen in hospitals or</p>	Dr Zhongwei Zhang	zhongwei.zhang@usq.edu.au

<p>health care environment. The behaviour of the slotted CSMA with collision avoidance (CSMA/CA) in an IEEE 802.15.4 network is the key to the successful system deployment. This research focus on the performance of the IEEE 802.15.4 MAC protocol, investigating the networking metrics of IEEE 802.15.4 nodes under typical operating conditions, with possible packets retransmissions.</p> <p>The approach of this project is to use MATLAB to simulate the workflow of IEEE 802.15.4 MAC protocol as a Markov Chain Process. The model of IEEE 802.15.4 MAC protocol can be verified by implementing on NS2.</p> <p>Title: Information Fusion Algorithms on TinyOS-Based Wireless Sensor Networks</p> <p>Project Description/ Direction(s)/ Information:</p> <p>TinyOS-based wireless sensor networks are one of the primary Mobile Ad Hoc NETWORKS. The research on the multihop routing protocols and the lifetime of WSN has been dominating ever since the advent of WSNs ; one approach is to incorporate the information fusion mechanism in the router nodes and base station among the underlying WSN.</p> <p>In this project, we first scrutinize a selection of information fusion strategies and elaborate the features of the TinyOS based WSNs. The objectives of the project include implementing the information fusion algorithms into a WSN making up of medium number of Motes, and then the analysis of the overall performance of WSNs in terms of routing and security, lifetime, and Quality of Services.</p>		
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