



### In this issue

- Page 1. Knowledge discovery in databases
- Page 2. Evolutionary computing: Ruxandra Gorunescu, Craiova, Romania
- Page 3. Modelling survival in long-term care Haifeng (Kevin) Xie, London
- Page 4. Electronic records: the debate continues – chicken or egg
- Page 5. OECD survey 20 governments plan; Best or better practice
- Page 6. A sting in the tale; Forthcoming conference and 80:20 rule?

Nosokinetics is the science/subject of measuring and modelling flow in health and social care systems. Nosokinetics News is the newsletter of the Nosokinetics group. The group was formed in April 2004. Our goal is the introduction on a worldwide basis of scientifically valid methods of measuring and modelling the process of health and social care.

Like an oak tree, the methods we use are slowly evolving. Considerable progress has been made in the development, validation and testing of new approaches to measuring occupancy time. We are also keen to promote other approaches as well.

An international conference is being planned and it is expected that it will be held in Adelaide at the end of April 2006. Then the constitution and aims of the group will be formally ratified.

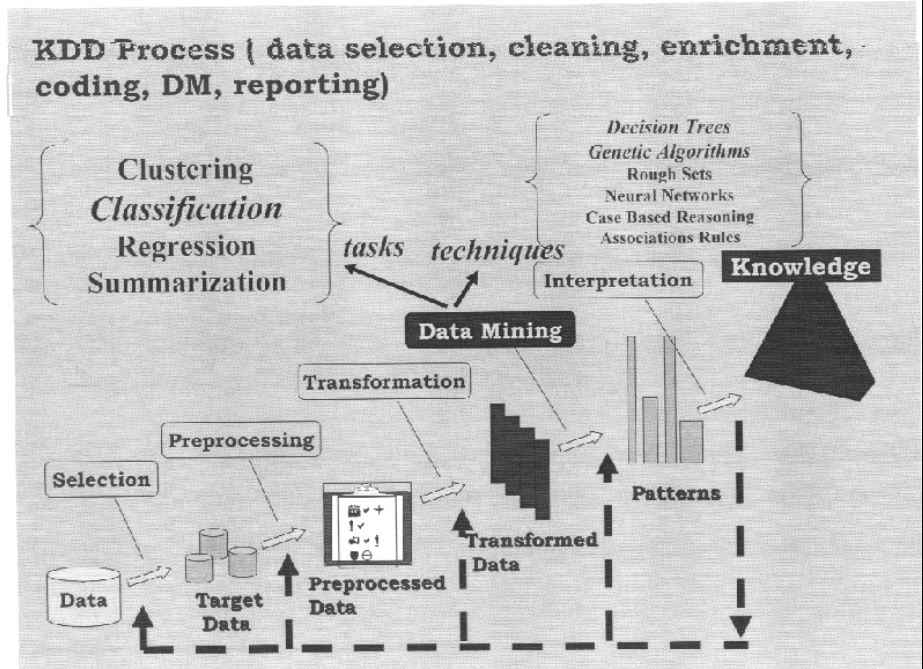
### Data Mining (DM) for Knowledge discovery in databases (KDD)

At the Beirut ECCO2004 conference, I was surprised to discover there are at least nine different computational and mathematical approaches to data mining for knowledge discovery in databases. Each group has its own terminology, heroes and language, so understanding is difficult, but there is a common process.

Prof Abel-Badeeh M. Salem (Head of the Faculty of Computer & Information Science, Abbassia, Cairo, Egypt) kindly gave us permission to use a slide of his that aided my understanding.

Apologies for the quality. It makes the common process clear.

Incidentally, Dr [Ibrahim Osman](#) organiser ECCO2004 has issued a [general call for papers](#) in three journals : Computers & Operations Research; Discrete Optimization; and Journal of Enterprise Information Management. Deadline November 30<sup>th</sup> 2004.



In Knowledge Discovery and Data Mining (1996), U. M. Fayyad, G. Pastetsky-Shapiro, P. Smyth and R. Uthurusamy (eds), page 10. Copyright © 1996 American Association for Artificial Intelligence.

**What is Evolutionary Computation? Ruxandra Gorunescu, Craiova University, Romania** [mailto: ruxandra.gorunescu@inf.ucv.ro](mailto:ruxandra.gorunescu@inf.ucv.ro)

Evolutionary computation draws its roots from the principles of evolution and heredity. The biological analogy explains the search and optimisation strategy using biological terms: chromosomes, genes, mutation, selection and survival of the fittest.

There are four existing mainstreams:

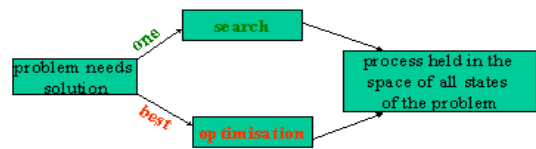
Evolutionary Programming (EP) L. Fogel, 1966

Genetic Algorithms (GAs) J. Holland, 1975

Evolution Strategies (ESs) I. Rechenberg, 1971

Genetic Programming – (GP) J. R. Koza, 1992

### Optimising decision making



*"How do I work? I grope"*

Albert Einstein

Figure 1. Seeking the best solution

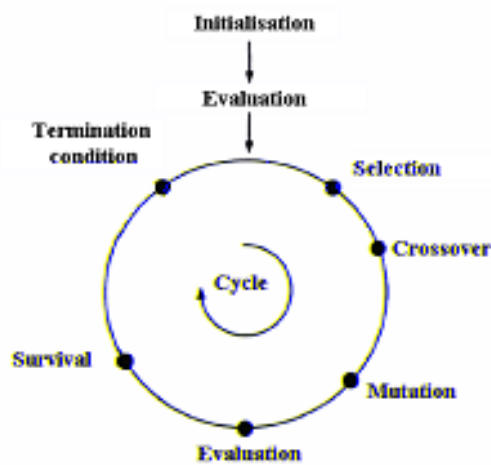


Fig 2. Cycle of a general evolutionary heuristic

Controlled trials are the gold standard of medicine. The problem with this single cause and effect approach is that it discounts other solutions, takes time, and ignores the wealth of information stored in electronic databases.

Figure 1 illustrates the difference between a one-hypothesis search for the way forward and search and optimisation techniques that seek the best solution.

Figure 2 shows the cyclical search process of a general evolutionary heuristic. Heuristic means to find out. As in education, an important point is that expert advice is needed at the start to guide the pupil, computer programme.

Given starting parameters, a randomly generated **population** of initial solutions called **chromosomes** (vectors of components called **genes**) goes through a process of modification by the use of **biological operators**. **Selection** offers more chances of reproduction to the **fittest** chromosomes in the population at each generation.

A mating pool is obtained to which **crossover** is applied. A crossover probability decides whether individual chromosomes will undergo recombination. If so, the genetic material (vectors) of the resulting parents is combined. After crossover, for each chromosome and all genes, a **mutation** probability decides whether the genes will be mutated. **Evaluation** decides whether offspring replace parents, and a competition for survival is held between the two. The new population of chromosomes totally (or partially) replaces the old population in the stage referred to as **survival**.

This modification process encourages the appearance of **fitter** solutions. As each generation passes the system evolves to the optimum. The best chromosome(s) obtained after a number of generations is (are) the solution to the problem.

The methods can be applied to practical problems where sometimes one cannot find an explicit form of the criterion function, but each potential solution can be qualified, possibly through simulation.

In the December issue of Nosokinetics News the results of an evolutionary computational analysis of placement data to a local authority panel will be described.

### Modelling survival and cumulative cost of placement of elderly people in long-term care: Haifeng (Kevin) XIE, PhD. University of Westminster, London

Local authorities in Great Britain are under increasing pressure to deliver long-term care (LTC) with limited budgets. Financial control concerns who goes into care, where they go (i.e., residential or nursing), how long they stay (survival), and ultimately, how much they cost.

Fig. 1 shows the continuous-time Markov model used to model the movement of older people in institutional LTC, with short-stay, long-stay and discharge as state space. The actual states are not observable. For example, we observe that a person is in residential care (RC) but we do not know whether they are in a short-stay ( $S_1$ ) or long-stay ( $S_2$ ) state. This is an aggregated Markov process (Fredkin and Rice, 1986),

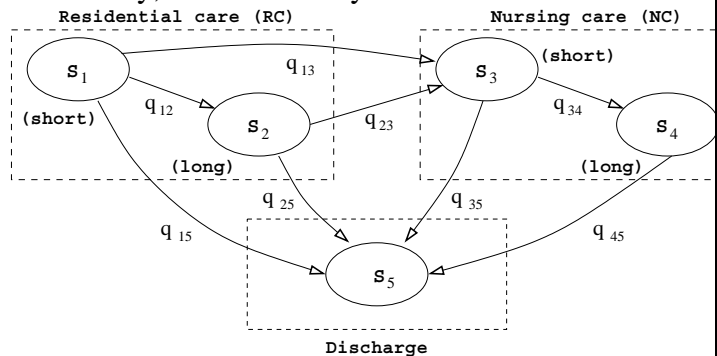


Fig 1: Continuous-time Markov model for movement in LTC.

i.e., a Markov process in which system states are aggregated into a number of super-states called classes. Ultimately, discharge from residential and nursing care is usually by death.

Four-years admission, transfer, discharge (still in) data (1997-2001) was provided by the Social Services Department of the London Borough of Merton. A two-stage fitting procedure was used.

The first stage fitting procedure showed one state in RC and two states in NC. The results (Fig. 2) suggest:

- Residential care, average stay two and a half years: one in five transfer to NC.
- Nursing care: one in four (26%) stay two months (59 days); three in four stay 2.1 years (784 days).

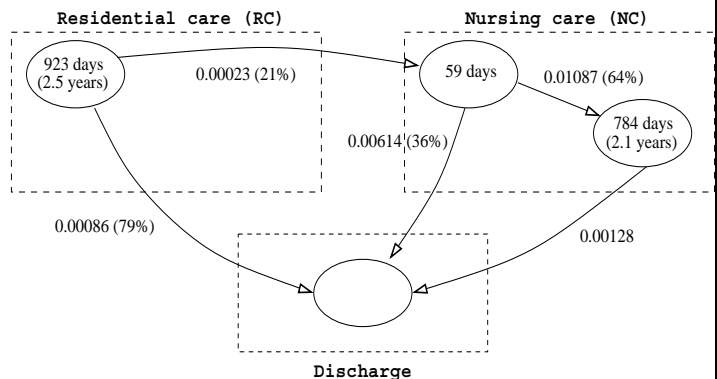


Fig 2: Markov survival model fitted with Merton data.

The fitting procedure of the survival model was extended to take into account left truncated as well as right censored observations.

Figure 3 shows the predictive capability of the model. Based on the survival model, a costing framework that “translates” survival and unit cost of care into total cost was developed. Based on the national average fees at year 2001 level multiplied by the London weighting, we estimated that the (life-time) expected cost for new admissions is:

- Residential home care £44,044
- Nursing home care £31,551

i.e., the average cost of placement in RC is 40% more expensive than placement in NC.

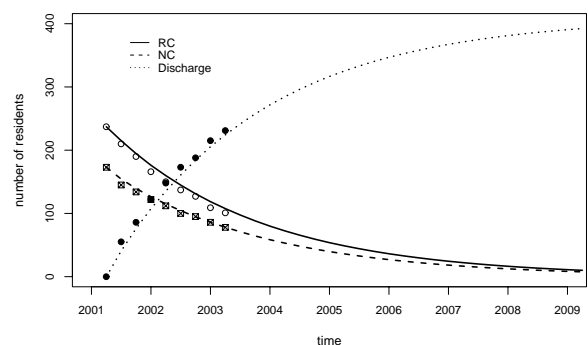


Fig 3: Predictive capability of model: actual observation (data points) vs. predicted by the model (lines)

Contact [Kevin](#) for more information and full paper.





### Letters. Electronic Records: The debate continues

#### Christine Pelletier writes: Doctors are becoming mechanics

Editor: Underpinning the debate on the development of electronic records, medical doctors have turned their back to the “handcraft” “patient centred” dimensions of their profession to focus more on “patient as case”, “design of procedures” and “standardization” to support them in their task. Now patients have become cases to enter into categories, and the clinical focus has changed from patient as person, to patient as “disease”.

By being sold modern medicine in some precise way, “effective in the computer” “miracle of modern technology” plus “patient = case”, patients have moved from the “patient position” to “client / customer” and started to refuse the “shared risk” taken by the medical doctor and the patient.

By externalising their knowledge in order to build IT support tools, doctors forgot that decisions remain a human responsibility: the role of a tool is to advise and propose not to decide. By forgetting that the very particular object of their decision is not a disease, nor a case, but a human patient with a history, living in a particular context, medical doctors are now not more than “mechanics” specialised in human anatomy.

Is it worthwhile to study so long to be a technician? What remains for humanisms needs?

[Christine Pelletier, PhD](#)

Research Assistant, Department of Mathematics, University of Westminster

#### David Horn replies: Government was forced to change

Editor: Christine’s argument appears to assume that government and the medical profession share an agenda. She is correct in her analysis of the effect of the process, but is misguided with respect to causality. Margaret Thatcher kick-started the social re-engineering process that empowers individuals, but makes them accept downstream responsibility for exercise of their choice. Teaching was similarly hit, only the law largely escaped.

The change agenda is a response to changing social expectations and the anticipated financial burden of “baby boomers” ceasing contributions to the social security system, but increasingly drawing upon it. “No change” was not an option for government, charged with financial husbandry. It is forced to seek greater productivity at the expense of quality. However, the profession is charged with popular medical well being alone, and opposes the degradation in service.

Process standardisation and increased patient risk acceptance, leads to their greater operation within the “zone of comfort” and less so within the “zone of uncomfortable decision-making”, resulting in medical advance being ham strung and phenomena such as litigation and “free loader” behaviour with respect to vaccinations. As a result of the profession being emasculated of powers to administer the common good, we see the pathetic sight of government prostituting itself to medical causes, such as MMR immunisation.

It is only a matter of time until medical advance demonstrates such a government promoted cause as inappropriate: How will the public feel, when it finds out that it can not sue a government? The pendulum will swing. Patients are the same voters who created the governments who emancipated them from this medical tyranny. They have only themselves to blame if the “tyranny” from which they fled, turned out to be the haven they now seek.

[David Horn, FRCS](#)

Consultant in Healthcare Business Change Strategy

**What has gone wrong with medical care? Clinical Medicine 2004; 4 (4) 343-4**

“Like the first tentative spluttering flames of a rekindled early morning fire” Professor Dame Margaret Turner Warwick, Past President of the Royal College of Physicians London welcomes the “renewed and growing recognition of how much the so-called humanities contribute to good medical practice”. She argues “Our new scientific knowledge assumes that nurture of the spiritual in sickness and in health is unimportant or at least not relevant to modern medicine. Sadly, this is an understatement of the serious situation we are in.”

Criticising protocol driven, evidence based medicine; she states “It is even believed it is possible to make decisions about ‘best’ practice We may have information allowing us to suggest ‘better’ practice under some circumstances, but to use the word ‘best’ as a universal and abiding truth demonstrates the extent of the distortion of understanding.”

She concludes “The NHS is at a cross roads. Not because there are financial difficulties or nursing shortages, although these are indeed grave limitations, but because unless it realises that much of medicine depends on professional doctors – working in partnership with many other splendid professions –trained to understand the total care of patients then the whole system will in the long term collapse. The recipe is simple and there are no compromises. Modern aids and short cuts can do much to help but they cannot substitute.

Editor’s comment: Christine will say “Amen” to that.

**Electronic records: What do the politicians think?**

Supporting David’s version of events, a June 2003 Washington conference presentation [Reforming Health Care Systems in OECD countries](#) by Elizabeth Docteur, Principal Health Policy Analyst at the Organisation for Economic Cooperation and Development, gives useful insight into the political agenda. Slide 38 of her presentation lists the reforms that 20 governments are following to increase effectiveness.

**Reforms to increase effectiveness**

1. Move to greater involvement by governments, move away from dependence on professional self regulation
2. Investments in performance measures and health information systems to track system performance
3. Development of clinical practice guidelines and performance standards, accreditation systems.
4. Experimentation with changes in organisation and delivery of health care, redesign of payment systems to reward quality
  - US managed care innovations

Editor’s comment: If that’s the problem, what’s the way forward?

**Getting the big picture: the macro-politics of information system development (and failure) in a Canadian hospital. Balka E Methods Inf Med. 2003;42(4):324-30**

Balka considers the problems faced by a Vancouver hospital in developing Patient Care Information systems. The case study situates micro activities (local endeavour) within the broader context of macro events (Federal and Provincial decision making). It indicates the gulf that has to be crossed between global actors invested with structural power and the clinical, technical and managerial staff who have to implement change to achieve the new policies. Often the macro context changes in unplanned and unexpected ways that limit local decision makers ability to achieve desired goals.

### Health Application Section of INFORMS

The Health Applications Section of the American Institute for Operations Research and the Management Sciences INFORMS is <http://www.trinity.edu/aholder/HealthApp/>. The section sponsors the [Journal of Health Care Management Science](#). Their aims are: to identify current and potential research questions concerned with operations research and health care applications, to disseminate solutions to the above questions, and to advance the basic and applied research technologies of health care applications.

### A sting in the tale; Clinical case: joined up working, a long way to go

**Community Care:** Stephen Aitken's active 83 year old mother bumped her leg in a supermarket. A large wound bled profusely. At the hospital a consultant considered a skin graft might be necessary and gave special instructions for care of the wound. At home, the visiting district nurses refused to follow the consultant's instructions for daily wound dressings and use of prescribed medicines, which his mother had already obtained via her GP. They contacted the hospital staff, but still felt unable to follow the instructions. So Stephen's mother changed her own dressings. One month later her wound was healing nicely and she began to rush around again doing her part as an unrecorded volunteer in the primary care system!

Stephen asks is their training deficient or is there no agreed standard for dressing this condition?

P.S. A full recovery has now occurred.

Forthcoming conferences: also see <http://www2.wmin.ac.uk/coiec/nosokinetics.htm>

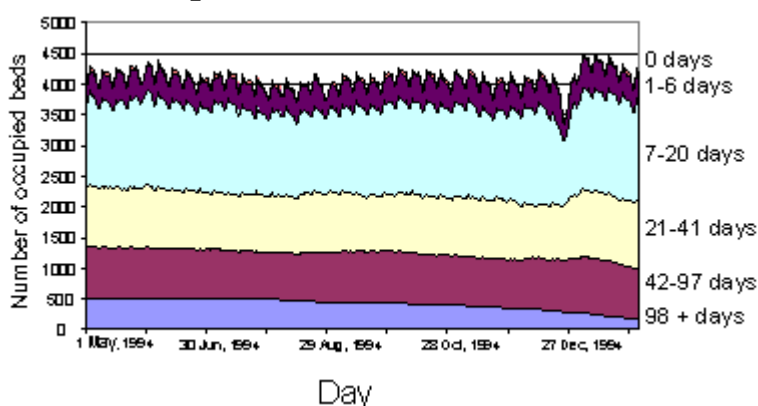
25<sup>th</sup> Conference on Applied Statistics in Ireland, 18<sup>th</sup>-20<sup>th</sup> May 2005. Abstracts due 31<sup>st</sup> March 2005. Venue Enniskillen. Contact [Adele Marshall](#)

IFORS Hawaii 2005, Hawaii, July 11-15, 2005. [Website](#)

### Does an 80:20 rule apply in hospital medical practice?

Salesmen know that 80% of their sales come from 20% of their customers. The contour plot of bed occupancy time by stroke patients comes from [Christos Vasilakis](#) PhD research. More than 80% of the beds are occupied by patients who stay 7 days or more. The "cardiac arrest" in the cyclical weekly pattern is caused by Christmas.

Thinking about government plans to speed up hospital treatment by preventing admissions and early discharge, I can't help thinking of "Constipation and spurious diarrhoea"



Bed usage by stroke patients in English Hospitals; Hospital Episode Statistics Data 1<sup>st</sup> May 1994 to 31<sup>st</sup> January 1995

For earlier editions <http://www2.wmin.ac.uk/coiec/nosokinetics.htm>

Editor: Prof Peter H Millard