

02/07/2002

To Whom It May Concern:

Thank you for taking the time to review my curriculum vitae. My research and programming background makes me uniquely qualified in the areas of computer vision and numerical optimisation. This background, together with my programming skills, makes me ideally suited to a research & development environment, particularly one involving my above mentioned specialities. I also have extensive experience in the areas of artificial intelligence (including neural networks), data & image compression, and computer graphics.

Having only recently completed my studies, I am looking for a stimulating job that will frequently present challenges requiring novel solutions.

If you are interested in some of my previous work, both my M.Sc and Ph.D theses are available on-line at <http://www.cs.up.ac.za/~fvdbergh/publications.html>.

I look forward to hearing from you.

Sincerely,

Frans van den Bergh

Curriculum Vitae

1 Summary

1.1 Personal Details

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|---------------------|---|
| Surname | van den Bergh |
| First names | Frans |
| ID number | 7703015029087 |
| Date of birth | 1 March 1977 |
| Residential address | 521 Bosvink street Magalieskruin 0150 |
| Postal address | P.O. box 14160 Sinoville 0129 |
| Home Tel. | (012) 548 0373 |
| Cellphone | 083 380 3649 |
| e-mail | fvdbergh@cs.up.ac.za |

1.2 Education

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|-----------|--|-------------------|
| 2000–2001 | University of Pretoria Ph.D Computer Science | (Pretoria) |
| 1999 | University of Pretoria M.Sc. Computer Science <i>Cum laude</i> | (Pretoria) |
| 1998 | University of Pretoria B.Sc. (Hons) Computer Science <i>Cum laude</i> | (Pretoria) |
| 1995–1997 | University of Pretoria B.Sc. Computer Science <i>Cum laude</i> | (Pretoria) |
| 1989–1994 | Extracurricular Centre for Gifted Children Specialising in Computer Science | (Pretoria) |
| 1993–1994 | Hoërskool Montana Senior Certificate (Grade 12) Distinctions in Mathematics, Science, Computer Science and English (2nd language) | (Pretoria) |
| 1990–1992 | Hoërskool Louis Trichardt | (Louis Trichardt) |
| 1986–1989 | Laerskool Krugerpark | (Potgietersrus) |
| 1983–1985 | Laerskool Unika | (Randburg) |

1.3 Language Skills

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|------------------------|---|
| Natural (fluent) | Afrikaans, English |
| Programming (fluent) | BASIC, Pascal, Assembler, C, C++, Smalltalk, Java, HTML, \LaTeX , UNIX shell programming, AWK, Python, OpenGL |
| Programming (exposure) | Tcl/Tk, ABAP/4, LISP, Prolog, Scheme, C# |

1.4 Professional Experience

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|---------------|---|
| 1998–2001 | University of Pretoria (Pretoria) Part-time Lecturer. Undergraduate courses lectured include <i>Data Structures and Algorithms</i> , <i>Computer Architecture</i> , <i>Programming Languages</i> and <i>An Introduction to Programming in C</i> . Also lectured a postgraduate course in <i>Data Compression</i> |
| 2000 | Bond University (Sandton) Part-time Lecturer for a first course in programming (in Java). |
| 1997 | EPI-USE systems (Pretoria) UNIX system administrator |
| December 1996 | High-Performance Systems (Midrand) Lectured a C++ programming course. |

1.5 References

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| <ul style="list-style-type: none">• Prof A.P. Engelbrecht, University of Pretoria. Ph.D supervisor. Tel. (012) 420 3578.• Prof D.G. Kourie, University of Pretoria. Head of Computer Science Department. Tel. (012) 420 2361.• Mr. A. Kieser, Bond University. Tel. (011) 783-7086.• Mr. D. Behr, EPI-USE systems. Tel. (012) 348 2700. |
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2 Details

2.1 Education and Research Background

2.1.1 B.Sc degree

A B.Sc Computer Science degree, with specialisation in Information Science. Final year subjects include Software Engineering, Artificial Intelligence, Concurrent and Distributed Systems, Computer Networks, Programming Languages, Compiler Construction, Trends in Information Technology, Discrete Structures (applied maths) and Algebra. Other undergraduate courses include Mathematical Statistics and numerous Maths and Applied maths courses.

The Computer Society of South Africa (CSSA) prize for the best final year Computer Science student was further received for this degree.

2.1.2 B.Sc (Hons) degree

A B.Sc (Hons) Computer Science degree, with a moderate bias toward Computer Networks. Subjects include Computer Networks, High Speed Computer Networks, and a research project concerning variable bit rate (VBR) traffic on ATM networks. Other subjects include Graphics, The Theory of Programming Languages, Knowledge Representation & Machine Learning and Pattern Recognition.

2.1.3 M.Sc degree

An M.Sc in Computer Science, with a thesis entitled 'A Device-free Locator using Computer Vision Techniques'. The abstract of the thesis follows:

Device-free locators allow the user to interact with a system without the burden of being physically in contact with some input device or without being connected to the system with cables. This thesis presents a device-free locator that uses computer vision techniques to recognise and track the user's hand. The system described herein uses a video camera to capture live video images of the user, which are segmented and processed to extract features that can be used to locate the user's hand within the image. Two types of features, namely *moment based invariants* and *Fourier descriptors*, are compared experimentally. An important property of both these techniques is that they allow the recognition of hand-shapes regardless of affine transformation, *e.g.* rotation within the plane or scale changes. A neural network is used to classify the extracted features as belonging to one of several hand signals, which can be used in the locator system as 'button clicks' or mode indicators. The Siltrack system described herein illustrates that the above techniques can be implemented in real-time on standard hardware.

2.1.4 Ph.D degree

A Ph.D degree in Computer Science, with a thesis entitled 'An Analysis of Particle Swarm Optimizers'. The thesis presents several novel numerical optimisation algorithms. The abstract of the thesis follows:

Many scientific, engineering and economic problems involve the optimisation of a set of parameters. These problems include examples like minimising the losses in a power

grid by finding the optimal configuration of the components, or training a neural network to recognise images of people's faces. Numerous optimisation algorithms have been proposed to solve these problems, with varying degrees of success. The Particle Swarm Optimiser (PSO) is a relatively new technique that has been empirically shown to perform well on many of these optimisation problems. This thesis presents a theoretical model that can be used to describe the long-term behaviour of the algorithm. An enhanced version of the Particle Swarm Optimiser is constructed and shown to have guaranteed convergence on local minima. This algorithm is extended further, resulting in an algorithm with guaranteed convergence on global minima. A model for constructing cooperative PSO algorithms is developed, resulting in the introduction of two new PSO-based algorithms. Empirical results are presented to support the theoretical properties predicted by the various models, using synthetic benchmark functions to investigate specific properties. The various PSO-based algorithms are then applied to the task of training neural networks, corroborating the results obtained on the synthetic benchmark functions.

This degree was supported by an NRF Prestige bursary.

3 Professional Experience

3.1 Publications

The following papers, based on research performed during the period 1998-2001, have been published, or are currently under review. Several of the publications were also presented at conferences.

3.1.1 Peer-reviewed Conference papers

1. F. van den Bergh, J. Roos, and J. Botha, Improving ABR Flow Control. In *Proceedings of SATNAC98*, pages 18–25, University of Cape Town, South Africa, 1998.
2. F. van den Bergh, J. Roos, and J. Botha, Enhancing ABR Flow Control through an Improved Communications Infrastructure. In *Proceedings of ICCCN'98*, pages 746–750, Lafayette, Louisiana, USA, 1998.
3. F. van den Bergh. Particle Swarm Weight Initialization in Multi-layer Perceptron Artificial Neural Networks. In *Development and Practice of Artificial Intelligence Techniques (ICAI)*, pages 41–45, Durban, South Africa, September 1999.
4. F. van den Bergh and A. P. Engelbrecht. Effects of Swarm Size on Cooperative Particle Swarm Optimisers. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO)*, pages 892–899, San Francisco, USA, July 2001.
5. F. van den Bergh and A. P. Engelbrecht. Training Product Unit Networks using Cooperative Particle Swarm Optimisers. In *Proceedings of the International Joint Conference on Neural Networks (IJCNN)*, pages 126–132, Washington DC, USA, July 2001.
6. F. van den Bergh and A. P. Engelbrecht. A New Locally Convergent Particle Swarm Optimiser. To appear in the *Proceedings of the IEEE International Conference on Systems, Man and Cybernetics*, Hammamet, Tunisia, October 2002.

7. R. Brits, A. P. Engelbrecht and F. van den Bergh. Solving Systems of Unconstrained Equations using Particle Swarm Optimization. To appear in the *Proceedings of the IEEE International Conference on Systems, Man and Cybernetics*, Hammamet, Tunisia, October 2002.
8. R. Brits, A. P. Engelbrecht and F. van den Bergh. A Niching Particle Swarm Optimizer. To appear in the *Proceedings of the Conference on Simulated Evolution And Learning*, Singapore, November, 2002.

3.1.2 Peer-reviewed Journal papers

1. F. van den Bergh and V. Lalioti, Software Chroma Keying in an Immersive Virtual Environment. *South African Computer Journal*, (24):155–162, November 1999.
2. F. van den Bergh and A. P. Engelbrecht. Cooperative Learning in Neural Networks using Particle Swarm Optimizers. *South African Computer Journal*, (26):84–90, November 2000.
3. F. van den Bergh and A. P. Engelbrecht. A cooperative approach to particle swarm optimisation. *IEEE Transactions on Evolutionary Computation*. Submitted December 2000.
4. F. van den Bergh, A. P. Engelbrecht, and D. G. Kourie. A convergence proof for the particle swarm optimiser. *IEEE Transactions on Evolutionary Computation*. Submitted September 2001.

3.1.3 Planned/Working papers aimed at journals

The following papers are currently being written and will be submitted to the relevant peer-reviewed journals upon their completion:

- F. van den Bergh, A. P. Engelbrecht, Convergence speed vs. Optimality: An analysis of PSO parameter settings.
- F. van den Bergh, A. P. Engelbrecht, Extending the PSO to locate global extrema.
- F. van den Bergh, A. P. Engelbrecht, New insights into the behaviour of the PSO.

3.2 Participation in the Academic peer-review process

- Regular participation in the review process for the *South African Computer Journal* (SACJ), totalling 9 reviews in the last two years alone.
- Participation in the review process for the *The International Journal of Computers, Systems and Signals* (IJCSS), totalling 3 reviews in the last year.

3.3 Postgraduate Supervision

Currently busy supervising the following honours research projects:

1. Eric Clements, with a project titled *Artificial Intelligence Visualisation of Music*.

Currently busy co-supervising the following M.Sc students:

1. Riaan Brits, with a thesis titled *Solving Systems of Equations using Particle Swarm Optimisers*.
2. Nico Gerber, with a thesis titled *Dynamic Control of Particle Swarm Optimiser Parameters*.
3. Edwin Peer, with a thesis titled *Optimal Workload Distribution for Multicomputer Systems*.
4. James Pun, with a thesis titled *Gesture Recognition using Artificial Intelligence Techniques*.
5. Dylan Scott-Dawkins, with a thesis titled *Niching Particle Swarm Optimisers*.

3.4 Professional Memberships

- A member of the *South African Institute of Computer Scientists and Information Technologists* (SAICSIT).
- A member of the IEEE and IEEE Computer Society.

3.5 Contract Research

A three-month research contract was successfully completed for Raptor Technologies, during the period December 2000 through February 2001.

3.6 Contract Programming

1. A three-month Java programming contract was successfully completed for EPI-USE systems during the period November 1996 through January 1997.
2. A one-month Java programming contract (PBMR simulation applet) was successfully completed for IST during the period November 1998 through December 1998.

3.7 Skills

Skills can be classified under three categories:

3.7.1 Teaching Skills

The design and implementation of undergraduate and postgraduate tertiary-level courses. Undergraduate courses lectured include *Data Structures and Algorithms*, *Computer Architecture*, *Programming Languages* and *An Introduction to Programming in C*. A postgraduate course in *Data Compression* was presented in 2001, and is currently being presented again.

3.7.2 Programming Skills

Experienced C/C++ programmer (6 years experience), with strong Assembly language skills. Previous experience includes Assembly language programming of Intel x86 chips, PICs, Intel 8051 microcontrollers and Mitsubishi M16C microcontrollers.

Further technical skills include a thorough knowledge of GPS systems, including previous experience with both Trimble and Motorola GPS receivers.

3.7.3 Research Skills

Research skills, as evidenced by the publications listed above. Skills include experimental design and statistical interpretation of the results.

3.8 Miscellaneous

Participated as a judge in the Eskom Science Expo for Young Scientists during the period 1999–2001, acting as convener for the Computer Science category in 2001.

Acted as chief judge for the Southern African ACM programming contest. Duties involved the setting and verification of various programming problems to be solved by the competing student teams.

3.9 Interests

In no specific order, interests include:

- Computer graphics and visualisation, but not user interfaces.
- Artificial Intelligence, with specific interests in Computer Vision and Pattern Recognition (*e.g.* Target Recognition). This interest also includes Neural Networks.
- Numerical Optimisation, specifically in continuous domains.
- Data compression.