

Resume of:

Scott L. Williams
Santa Fe, New Mexico

Born: 1955, San Francisco, Ca.

Education:

Current	Ph.D. Candidate in Plant and Environmental Sciences (Agronomy and Elect. Engineering)	
1985	M.Sc. Mathematics	(Numerical Analysis)
1981	B.Sc. Agricultural Engineering	(Power and Machinery)
	New Mexico State University, Las Cruces, New Mexico	
1978	B.A. Philosophy	(Empiricism)
	University of Guelph, Guelph, Ontario	
1975	B.A. (Licenciatura) Estudios Latinoamericanos	(Antropología e Historia)
	Universidad de las Américas, Cholula, Puebla	

Professional Experience:

2008-2012	Satellite Ground Station Administrator	
	Center for Applied Remote Sensing in Agriculture, Meteorology and Environment Department of Entomology, Plant Pathology and Weed Science, NMSU	
2001-2002	Consulting Systems Analyst	
	Planetary Imaging, Sole Proprietor	
2000	Senior Application Systems Analyst	
	Planetary Image Research Lab / Lunar and Planetary Lab University of Arizona, Tucson, AZ	
1991-1999	Founder, President, Head Engineer.	
	Vioneering Research Laboratory, Sole Proprietor & Inc., Las Cruces, NM	
1990	Staff Programmer, Computational Biology Laboratory	
	Cold Spring Harbor Laboratory, Cold Spring Harbor, NY	
1985-1989	Computer Specialist, Principal Investigator	
	Computing Research Laboratory, NMSU	
1984-1985	Software Programmer	
	Department of Mathematical Sciences, NMSU Agrineering Software, Sole Proprietor	
1982-1984	Irrigation Specialist, Software Programmer, Teaching Assistant	
	Department of Agricultural Engineering, NMSU	

Background:

Raised mostly in Latin America (Puerto Rico, Colombia, Venezuela, México) with a few years in California.

Description of Current Projects:

I am finishing a Ph.D. program in Agronomy with a minor in Electrical Engineering. My research interest is in remote sensing for agricultural and water resources purposes. The core studies have focused on atmospheric and plant physiology, combined with signal processing courses. My dissertation proposes a new method for the radiometric separation of land cover temperatures in a mixed pixel using two different satellite views and a novel algebraic inversion method involving differential equations. The application goal is for better evapo-transpiration estimates used in irrigation and water management.

In addition, I established and currently administer a satellite ground station for NMSU's College of Agriculture, where NOAA weather satellites are read and made available over the web. Current attention is to the integration of real-time weather data into weather forecasting models for the purpose of estimating evapo-transpiration on a local scale. All post-acquisition processing and weather forecasting is open source, with one station (of four) using an open source FPGA receiver and Gnuradio.

Computing Skills:

Object-oriented software developer with a strong mathematical, signal processing, and computer systems background specializing in parallel programming, robotics, imaging, and remote sensing applications. Since 1976, I have worked with numerous computer platforms and languages (APL, Assembler, AUX, BASIC, BSD, C/C++, CPM, DOS, F77, GNU/Linux, JCL, Pascal, Modula, OpenBSD, Python, R, Ruby, SAS, SCO, SOLARIS, SYSV, TSO, UCSD, Visual C++, VAX, VM, VMS, WATBOL, WATFOR, WIN3.1, WINNT, XENIX and many forgotten ones) but, since 1983, I have made some flavor of UNIX the main platform of choice. Currently, I use GNU/Linux and program mostly in Python with Emacs. I also maintain programs written in Fortran, C/C++, and Java. I prefer to work with open source systems.

My current software project is the development of the Python On-line Imaging (POLI) package to facilitate my research. POLI is a server-client image processing package based on NumPy, specializing in multi-spectral imaging, where operators and images are served locally or remotely over the internet. The design is stream oriented, much like a UNIX filter pipe scheme, where users can mix and match imaging operators served to a client system for local processing. Filter operators can be developed independent of the display application and dynamically load them into the application. Batch and non-GUI implementation are implicit. Parallel computing implementations have been developed as well. This is an open-source project and is used in my own research.

Past programming projects include agricultural modeling, 20+ imaging card UNIX device drivers, image processing packages, and numerous robotic and vision packages for research and industry. Some of the skills exercised in these projects include parallel and multi-threaded design, instrumentation, hardware kernel interfacing, real-time programming, AI programming, self-correcting robotic positioning methods, image information extraction, microscopy, hyper-spectral imaging, and GUI interfaces.

For the last four years, I have constructed, installed, administered, and programmed High Performance Computers (parallel) for climate modeling and weather forecasting using Land Information System (from Goddard Spaceflight Center) and Weather Research and Forecasting (from National Center for Atmospheric Research) programs.

Description of Some Professional Projects:

2000-2002

Senior Systems Analyst and programmer for a NASA funded project at the Planetary Imaging Research Lab, part of the Lunar and Planetary Lab (LPL) at the University of Arizona. This project developed a method for the rapid identification of planetary surface features using an unsupervised, self-organizing neural network on hyper-spectral images. I cleaned up the inherited code and continued its development. When the project moved to Rice University, Planetary Imaging sub-contracted through Rice University, Houston, Texas.

1995-1999

Designer and engineer for the Probe Mark Analyzer (PMA) produced by Visioneering Research Laboratory, a company I founded. The PMA system is used to inspect integrated circuit (IC) wafers for quality assurance and is an integration of a robotic wafer handler and machine vision using microscopy. The system automates the metrological inspection of marks left by the probing process on the wafer. The data is then used to monitor prober behavior in the sort process. This system is used by Intel and Hewlett-Packard in semi-conductor fabs around the world, currently numbered at 14 with a retail price up to (US)\$225K. Given the usual library routines I authored all of it: design, integration, robotics, imaging and GUI. The algorithmic design used for the metrology has been adopted as a standard in the semiconductor industry for probe mark analysis.

Brief Description of Past Projects:

- 1997** Designed and wrote a robotic inspection system called MSI for an IC fab process. This system is used by Hewlett-Packard to measure wafer anchor holes for bump placement.
- 1996** Designed and wrote a vision guided robotic ceramic-fabric puncher for micro-capacitors. Used by AVX, Colorado Springs, Co., a supplier to the electronics industry.
- Designed and wrote a template recognition watch-dog system library. This system is used by EWD, Juarez, Mexico to inspect fuses used in cars and trucks.
- 1995** Designed and wrote a crack following system for Sandia National Laboratories, Albuquerque, New Mexico. The system follows, in real time, ceramic cracking under microscopic conditions and is used to research the properties of different ceramics.
- Designed and wrote systems (PMA/WPC) for inspection of wafer integrated circuits.
- 1994** Designed the "Imaging Machine", first image processing server for the world wide web which won many web awards. Retired from the web in 1999.
- Founded Visioneering Research Laboratory, Inc. (15 person outfit, dissolved in 1999)
- 1993** Designed and wrote an alpha particle counting system for radiation monitoring. Used by the Marshall Islands for assessing the habitation of nuclear-bombed islands.

- 1991-1992** Developed the robotic, imaging and GUI for the Optical Trapping Workstation and the Fluorescence Spectral Image Microscope (FSIM). Optical trapping is a technique using focused lasers for the non-contact levitation of cells and cell organelles. The FSIM is a technique for spectral separation using a high speed Fourier Transform spectrometer and a real time parallel processor that generates spectrally resolved images when using multiple fluorochromes for tagging cell components. The overall systems were designed by Cell Robotics, Inc., Albuquerque, NM.
- 1990** Computer Lab Manager and initial staff for the Computational Biology Group at Cold Spring Harbor Laboratory, a molecular biology research institute.
- 1989** Instructor, Department of Mathematics, NMSU.
- 1985-1989** Principal Investigator / Computing Specialist with the Vision and Robotics Group at the Computing Research Laboratory, (CRL) at NMSU. Responsibilities included:
- Project leader and main author of the Streamed Image Transformation Editor (SITE), an image processing research and development tool. Duties included UNIX kernel programming, systems interfacing, and administration of vision software. Some research projects using SITE with my participation include:
 - crop canopy insect identification (CRL).
 - automated archaeological cataloging (CRL).
 - space debris inspection for the space shuttle (NASA).
 - nuclear safeguard (LANL).
 - electrophoresis gel imaging (LANL).
 - aerial agricultural monitoring (CRL).
 - edge detection theory (CRL).
 - Project leader and main author of an aerial agricultural monitoring system. The system monitored agricultural areas from overflights and was used to advise land managers on irrigation practices, soil variation, crop canopy stress and growth areas. This system was used by Verde Technologies, Inc., a Geonix company. Other projects with Verde included real-time imaging for multi-spectral registration and principal component recognition.
 - Project leader for the initial development of a cotton grading system using machine vision, in conjunction with Southwest Cotton Ginning Research Lab, USDA.
 - The installation and administration of SUN-Intel-Hypercube interface, and development of parallel image processing programs.
 - Principal Investigator for GIGS, a project with Los Alamos National Labs (LANL) to develop imaging techniques to aid in genomic sequencing of the DNA molecule. New image warping (morphing) and rectification techniques were developed to analyze

electrophoresis gels. Funded by the Genome Project.

- 1985** Founded Agrineering Software to develop software for irrigation models, and was awarded contracts from the New Mexico Water Resources Research Institute, and from Earth Resource Data Corporation.
- 1982-1984** Employed by the Agricultural Engineering Department, NMSU, as a teaching assistant and software programmer. Maintained and developed software for time-stepped irrigation models, including drip systems. Developed a graphical rendering model of irrigation sprinkler systems, using catch-can data. Later, employed as an irrigation specialist evaluating the energy efficiencies of sprinkler and well pump systems in the field (eastern New Mexico) funded by the USDA Cooperative Extension Service.

Publication and Papers Presented:

Williams, S.L., (1995) "**Probe Mark Analyzer.**" Presented at the *IEEE Southwest Test Conference*, 1995, San Diego, California.

Buican, T., Williams, S.L., et al., (1992) "**FT-1000: A Fluorescence Spectra Imaging Microscope.**" Presented at the *International Society for Analytical Cytology (ISAC XVI)*, 1993, Colorado Springs, Colorado.

Buican, T., Williams, S.L., et al., (1992) "**The Optical Trapping Workstation: Complementary Technologies.**" Presented at the *International Society for Analytical Cytology (ISAC XVI)*, 1993, Colorado Springs, Colorado.

Williams, S.L., (1990) "**Imaging for the Human Genome Project.**" *Advanced Imaging, Vol. 5, Number 7*, PTN Publications, July 1990.

Williams, S.L., (1990) "**Image Analysis of Gel Pattern.**" Presented at the Banbury Center meeting on *Electrophoresis of Large DNA Molecules: Theory, Practice and Future*, 1990, Cold Spring Harbor Laboratory, Cold Spring Harbor, New York.

Williams, S.L., and Bertini, A., (1989) "**A Graphical Interface for Genomic Sequencing (GIGS).**" *Memoranda in Computer and Cognitive Science, Computing Research Laboratory MCCS-89-170*, New Mexico State University.

Williams, S.L., et al., (1989) "**The Human Genome Information Resource.**" Presented at the U.S. *Department of Energy Human Genome Contractors Workshop*, 1989, Santa Fe, New Mexico.

Marr, T.G., Williams, S.L., et al., (1989) "**Coping with Data from Large-Scale Mapping Efforts: Automating the Lab Notebook.**" Presented at the *Genome Mapping and Sequencing Meeting*, 1989, Cold Spring Harbor Laboratory, Cold Spring Harbor, New York.

Williams, S.L., (1988) "**Streamed Image Transformation Editor.**" Presented at the *American*

Mathematics Society 100th Anniversary Meeting, 1988, at New Mexico State University, Las Cruces, New Mexico.

Sammis, T.W., Smeal, D., and Williams, S.L., (1987) "**Predicting Corn Yield Under Limited Irrigation Using Plant Height.**" *American Society of Agricultural Engineers Journal* 31(3):830-838.

Williams, S.L., (1987) "**Fractals: An Introduction.**" Presented at the *Computing Research Laboratory Mathematics Seminar on Fractals*, 1987, New Mexico State University, Las Cruces, New Mexico.

Sammis, T.W., Williams, S.L., and Jernigan, D., (1987) "**Development of a Drip Irrigation Scheduling Model.**" *New Mexico Water Resources Research Institute, New Mexico State University, Report #224*

Williams, S.L., Dunning, T.E., and Harris, J., (1987) "**Streamed Image Transformation Editor (SITE).**" Memoranda in Computer and Cognitive Science, *Computing Research Laboratory MCCA-87-64*, New Mexico State University.

Sammis, T.W., Williams, S.L., et al., (1986) "**Effects of Soil Moisture Stress on Leaf Area Index, Evaporation and Modeled Soil Evaporation and Transpiration.**" *American Society of Agricultural Engineers Journal* 29(4):956-961.

Sammis, T.W., Riley, W., and Williams, S.L., (1985) "**Pecan Nut Yield and Tree Growth as Influenced by Irrigation.**" *New Mexico Water Resources Research Institute, New Mexico State University, Report #196.*

Phillips, K., Williams, S.L., et al., (1984) "**Edge Analysis and Algorithms for Computer Vision.**" *Battelle Columbus Laboratories Technical Report Series.*

Lansford, R.R., Williams, S.L., et al., (1983) "**Irrigated Agricultural Decision Strategies for Variable Weather Conditions.**" *New Mexico Water Resources Research Institute, New Mexico State University, Report #170.*

Williams, S.L., and Freeburg, R.S., (1983) "**Computer Representation of Radiation Loads on Plants.**" Presented at the *National Meeting of the American Society of Agricultural Engineers*, 1983 Bozeman, Montana.

Williams, S.L., (1983) "**Microcomputers in Agricultural Engineering.**" Presented at the *New Mexico State Meeting of the American Society of Agricultural Engineers*, 1983, Albuquerque, New Mexico.

Williams, S.L., Freeburg, R.S., (1982) "**Solar Flux on Irregular Surfaces.**" Presented at the *Rocky Mountain Regional Meeting of American Society of Agricultural Engineers*, 1982, Fort Collins, Colorado.