The University of Western Ontario

Abort, Retry, Fail?

Why Computer Science is an Essential Part of Every Science Education

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Western

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Research published in a recent edition of Nature brought to light something disturbing, yet widely known and accepted

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Scientists are often woefully unprepared for the rising use of computing in their work[1]

PEBKAC

[1] Merali, Z. 2010. Computational Science:...Error...why scientific programming does not compute. Nature 467, 775-777.

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Survey results illustrate this rising use:

- 45% of scientists spend more time developing computer software as part of their work than five years ago
- 38% of all scientists now spend at least one fifth of their time developing software

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This is only natural, as computers are needed to assist in many things …

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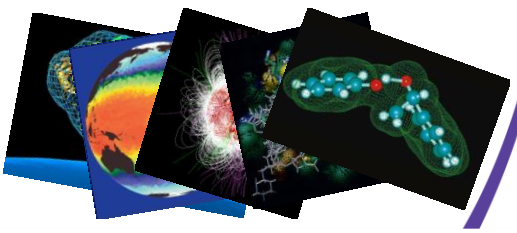
- Modeling



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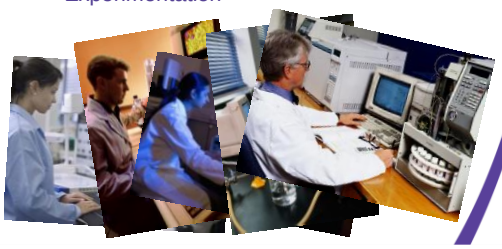
- Experimentation



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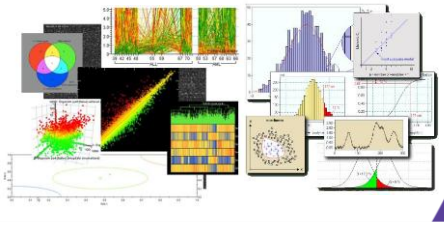
- Data collection and analysis



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This is only natural, as computers are needed to assist in many things …

- Presentation and visualization

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The frightening parts?

- Nearly all of what these scientists know of computing and software is self-taught
- They often lack even the basic skills, background, and understanding to realize just how bad they are at it

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The frightening parts?

- Formal computer science training was simply not a part of their education
- Only 34% of scientists surveyed think that such training is important though, so the lack of background and skills is unsurprising

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The frightening parts?

- As problem complexity and the sheer volume of data continues to increase at an alarming rate, we are left with a growing and rather substantial skills gap

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The results?

- Work is riddled with errors and inaccuracies

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The results?

- Precious time and valuable resources are lost

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The results?

- Project maintainability becomes impossible

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The results?

- Publications are retracted and proven wrong

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The results?

- The costs are staggering and only getting worse with time …

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So what can we do about this?

- Peer review of software is advocated by some, but this is imperfect and does not prevent problems from happening in the first place

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So what can we do about this?

- Trained computer scientists can be integrated into research groups, but they often lack domain-specific knowledge and background

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So what can we do about this?

- The best solution is to make computer science an integral part of every science education

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Doing so is not without its challenges …

- Existing computer science courses are often made for computer scientists and are not always applicable to other sciences

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Doing so is not without its challenges …

- Specific adaptations and tailoring may be needed for each scientific discipline to make things most relevant and engaging to students

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Doing so is not without its challenges …

- Squeezing computer science into already full science curricula is not an easy matter

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Doing so is not without its challenges …

- Instructional resources are already stretched thin, and adding more strain can be something difficult to support

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What are we doing at Western?

- New computer science courses aimed at the life sciences and physical sciences
- New program modules designed to integrate with other science degrees
- New lines of communications between departments

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In summary …

- Computer science provides an understanding of the fundamental tools to work with technology and information in the modern world

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In summary …

- Educating and graduating students from science programs without this is an increasingly dangerous proposition, and does no service to the students or the scientific community at large

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In summary …

- Efforts to increase the presence of computer science within broader scientific study must continue