

Constructing a
Knowledge
Base on Aging

Mark Farrell

About Me

Understanding
Aging

Knowledge
Extraction

What Next?

Constructing a Knowledge Base on Aging

An Automated Approach

Mark Farrell

Bioinformatics Researcher

Center for Research and Education on Aging
Lawrence Berkeley National Laboratory
University of California, Berkeley

September 4th, 2014

Outline

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Who I am

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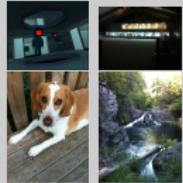
What Next?



Constructing a Knowledge Base on Aging

- └ About Me

- └ Who I am



I'm going to start off by introducing myself. This is my first time being here in person, so I doubt many of you know who I am. I've lived most of my life in Canada's East Coast. I was back home again this summer, working as a co-op student for Defence R&D Canada.

Where I'm from

Atlantic Canada

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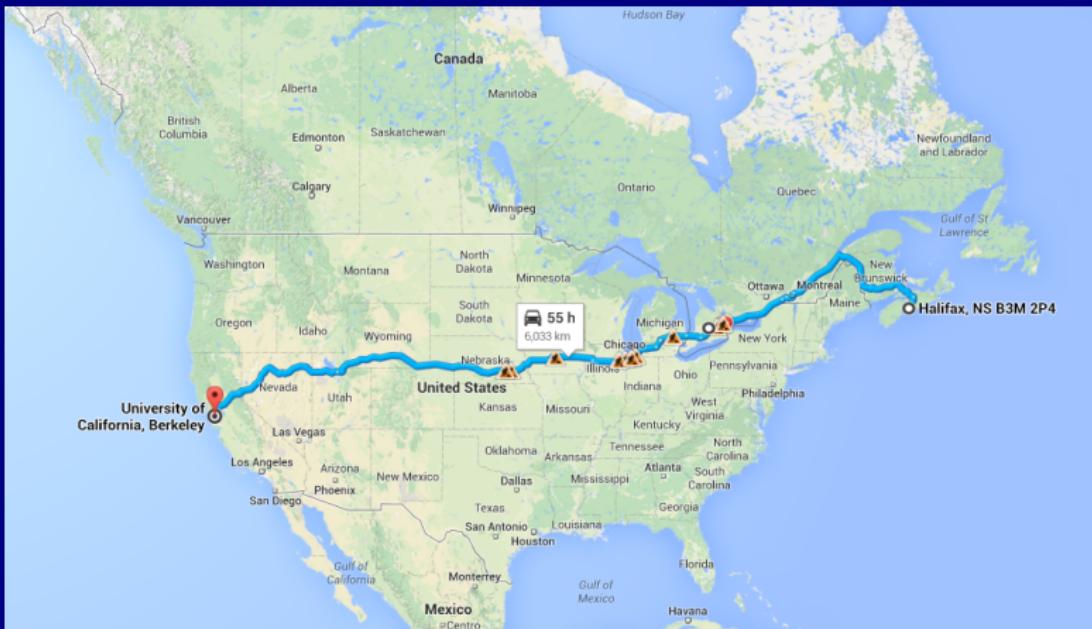
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- └ About Me

- └ Where I'm from

Where I'm from
About Me



So, I've had to travel quite a bit over the past few days in order to arrive here at Berkeley.

What I'm Studying

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What Next?

Year 2

Program Bachelor of Computer Science

Faculty Mathematics

Institution University of Waterloo

Location Waterloo, Ontario, Canada



Constructing a Knowledge Base on Aging

└ About Me

└ What I'm Studying

What I'm Studying

Year 2
Program Bachelor of Computer Science
Major Mathematics
Institution University of Waterloo
Location Waterloo, Ontario, Canada



And in case you're wondering, I'm going into my second year of undergraduate studies at the University of Waterloo, majoring in Computer Science.

How I Became a Researcher at CREA

Prof. Garan Emailed the University of Waterloo Computer Science Club

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└ About Me

└ How I Became a Researcher at CREA

How I Became a Researcher at CREA
by Steve Garan, University of Waterloo Computer Science



That's all very well and good: I haven't explained how I got involved with research at CREA. Steve Garan (you might know him) emailed the University of Waterloo Computer Science Club back in January, looking for current members interested in an AI internship; he used to be President back in the 80s. It looked interesting, so I began working with him, meeting weekly on Skype to discuss progress.

Why was I Interested in Research at CREA?

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What Next?

Hobby	CREA Research
Reverse Engineering	Natural Language Processing
Game Development	Artificial Intelligence
Health	Bioinformatics

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What does CREA want to do?

CREA Wants to Understand Aging and Increase Human Lifespan

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Why is it Difficult to Understand Aging?

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NCBI Resources How To Sign in to NCBI

PubMed aging RSS Save search Advanced Search Help

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[Proteostasis: Bad news and good news from the endoplasmic reticulum.](#)
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Swiss Med Wkly. 2014 Aug 21;144:w14001. doi: 10.4414/smw.2014.14001. eCollection 2014.
PMID: 25144910 [PubMed - as supplied by publisher] [Free Article](#)
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[The Experiences of Making Infant Feeding Choices by African, Caribbean and Black HIV-Positive Mothers in Ontario, Canada.](#)
2. Kapiriri L, Tharao WE, Muchenje M, Masinde KI, Siegel S, Ongoba F.
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3. Sheardova K, Laczó J, Vyhalek M, Andel R, Mokrisova I, Vicek K, Amlerova J, Hrt J.
PLoS One. 2014 Aug 21;9(8):e105623. doi: 10.1371/journal.pone.0105623. eCollection 2014.
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[Amyloid- \$\beta\$ induces NLRP1-dependent neuronal pyroptosis in models of Alzheimer's disease.](#)
4. Tan MS, Lan L, Jiang T, Zhu XC, Wang HF, Jia CD, Yu JT.
Cell Death Dis. 2014 Aug 21;5:e1382. doi: 10.1038/cddis.2014.348.
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Why is it Difficult to Understand Aging?

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How can CREA Understand Aging?

Build a Knowledge Base that Describes and Reasons about Aging

Constructing a
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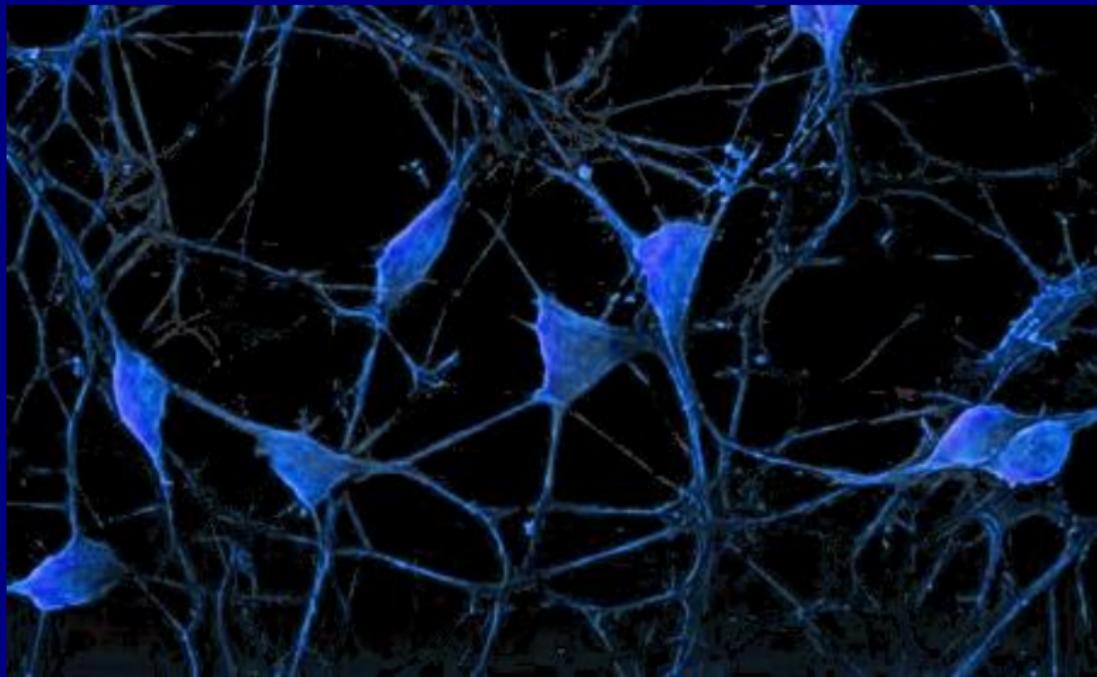
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How can CREA Understand Aging?

Build a Knowledge Base that Describes and Reasons about Aging

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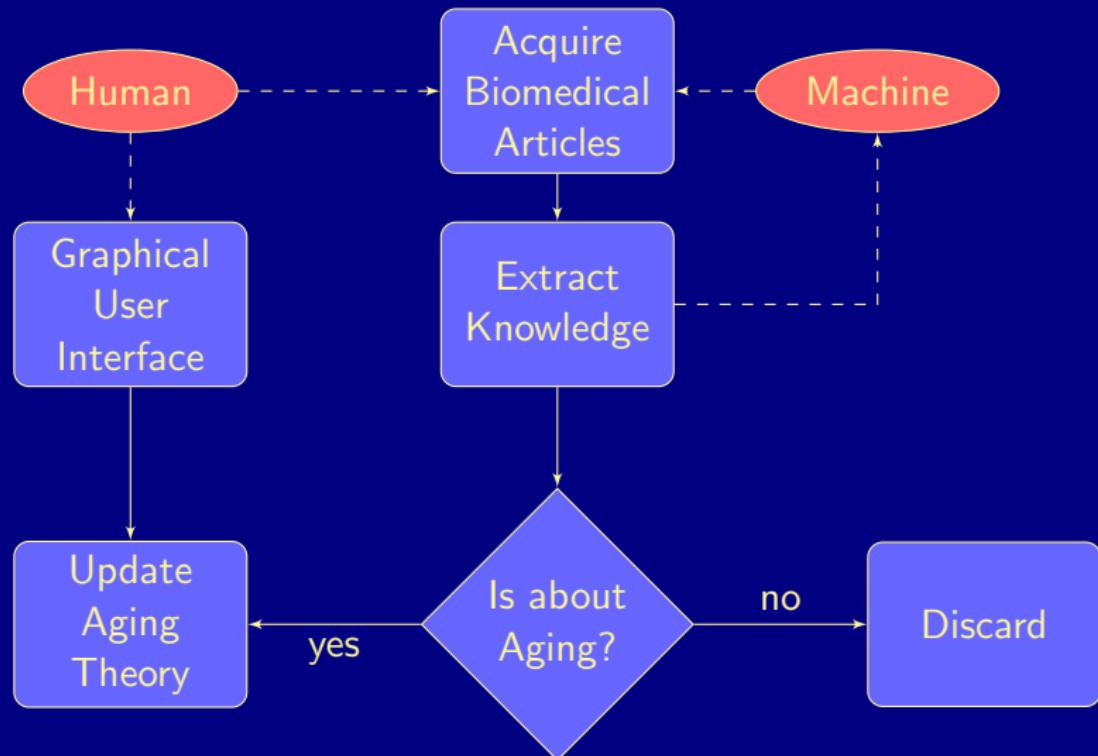
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Knowledge Extraction

Overview of Progress

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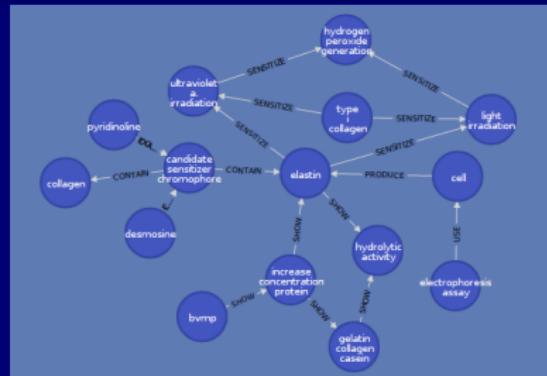
Knowledge
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What Next?

Input

... The pyridinoline and desmosine were examined as candidate sensitizer chromophores contained in collagen and elastin, respectively. ...

Output



Knowledge Extraction

Method

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What Next?

Tokenization Input a text document and read it, one sentence at a time.

Knowledge Extraction

Method

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What Next?

Tokenization Input a text document and read it, one sentence at a time.

Parsing For each sentence, generate a constituent tree that describes its phrase structure.

Knowledge Extraction

Method

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What Next?

Tokenization Input a text document and read it, one sentence at a time.

Parsing For each sentence, generate a constituent tree that describes its phrase structure.

Compilation Extract facts by pattern matching on each constituent tree.

Constituent Tree Tags

Word Level

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Tag	Meaning	Example
DT	Determiner	the
IN	Preposition	of
JJ	Adjective	blue
RB	Adverb	quickly
CC	Coordinating Conjunction	and
NN	Singular Noun	monkey
NNS	Plural Noun	monkeys
VB	Base Verb	fall
VBD	Singular Present Verb	falls
VBN	Past Tense Verb	fell
VBN	Past Participle Verb	fallen
VBG	Gerund Verb	falling
...

Constituent Tree Tags

Phrase Level

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Tag	Meaning	Example
NP	Noun Phrase	the woman
VP	Verb Phrase	calls the man
PP	Prepositional Phrase	from the store
ADVP	Adverb Phrase	quickly and quietly
ADJP	Adjective Phrase	blue and red
CONJP	Conjunctive Phrase	as well as
...

Constituent Tree Tags

Clause Level

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Tag	Meaning	Example
S	Declarative Clause	the dog walks
SBAR	Conjunction + Clause	that the dog walks
...

Knowledge Extraction

Example

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Input Token

The man walks the dog.

Knowledge Extraction

Example

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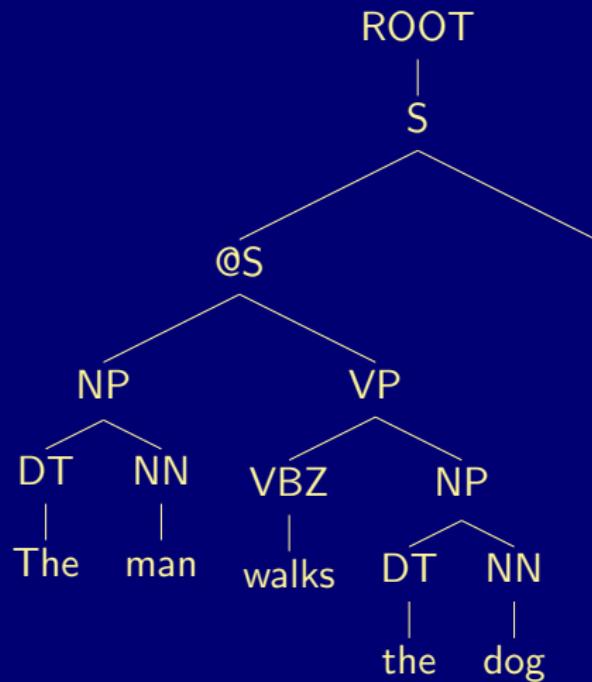
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Parse Token



Knowledge Extraction

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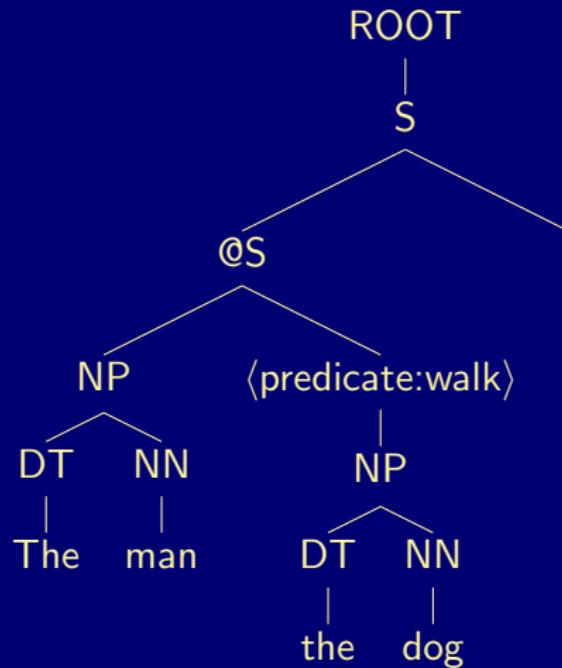
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Compile Token



Knowledge Extraction

Example

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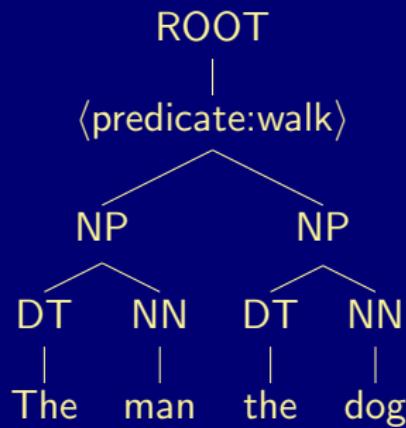
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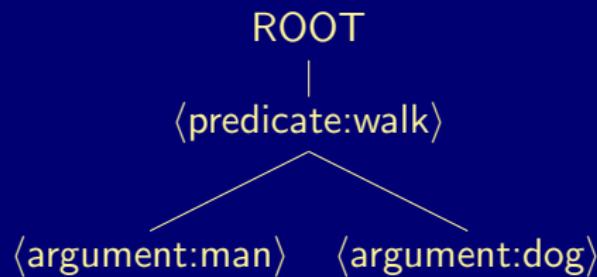
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Knowledge Extraction Example

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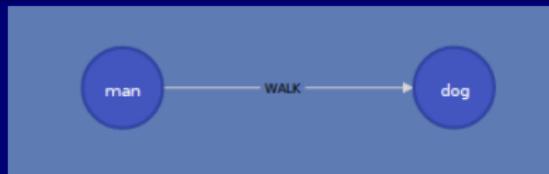
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Output Fact



Software Demonstration

A preview of CREA's knowledge base, compiled from PubMed abstracts.

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High Performance

Knowledge can be extracted from many sentences at the same time.

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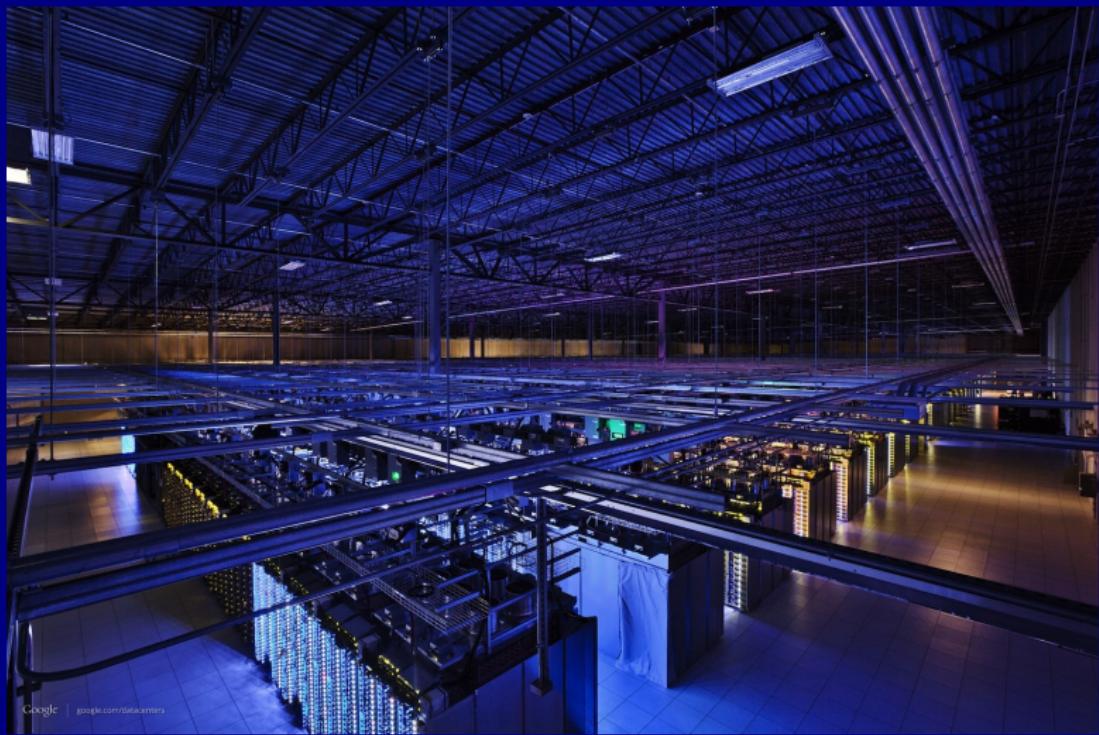
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What Next?

Task	Assignees
Research Direction	Steve Garan
Knowledge Extraction	Mark Farrell
Text Article Retrieval	Grace Park, Jeremy Wan
Knowledge Visualization	Mark Farrell
Graphical User Interface	Mark Farrell
Biomedical Spam Filtering	—
Automated Reasoning	—

Get Involved

Contact Me for More Information

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