About Us
Actuarial, Rewards and Analytics (ARA) Practice

Deloitte’s Global ARA practice is one of the largest worldwide insurance actuarial practice with over 1,500 practitioners across 43 countries. In Canada, our ARA practice consists of over 40 actuarial practitioners.

Our ARA practice provides comprehensive actuarial, risk management, and advanced analytics services for Life and P&C insurance companies, reinsurance companies, pension plans, captives, and other organizations.

Our practice supports many of the world’s leading organizations. We form partnerships with clients who recognize that keeping up with ever-changing regulatory environments, evolving customer and market needs, and emerging new technologies are an everyday challenge given the realities of their already demanding businesses.

We help our clients assess their strategic priorities and then work together with them in order to maximize their efforts to increase economic value, reduce operating costs, improve processes and controls, optimize capital, and drive organizational performance.

Arthur da Silva
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Current Insurance Landscape

Key Challenges & Applications in Data Science / Predictive Analytics

**Highlights of key challenges**

- Access to data
- Absence of historical data or abundance of poor quality data
- Acquiring applicable skillset and expertise

**Examples of current applications of predictive analytics**

- Customer/Policyholder Behaviour Analytics
- Cross-selling, Targeted Lead Generation
- Accelerated and/or Automated Underwriting, Application Triage
- Distribution Channel Productivity and Optimization
- Fraud Detection and Prevention
Next steps
What is the next frontier?

**Expand** current use cases with latest developments in machine learning, AI, etc. For example, can RL be investigated for use in customer or advisor behaviour modelling

Develop proof of concepts for eventual implementation into Production

**Expedite** current processes by leveraging AI techniques with the use of NLP, NLG, Cognitive Automation, etc.

For example, Deloitte is currently developing PoCs in automation of review and validation processes.

**Explore** new use cases, demonstrate feasibility, develop proof of concepts

CIA & SOA often puts out calls for research papers on specific topics or any topic of choice

Newer areas of exploration include text/speech analytics on customer interactions, image analysis, etc.
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Fairfax

FairVentures Data Lab
WHO IS FAIRFAX?

ABOUT FAIRFAX FINANCIAL HOLDINGS

$57B IN TOTAL ASSETS
$21B IN CAPITAL
$16B OF SHAREHOLDERS’ EQUITY
$13B GROSS PREMIUMS WRITTEN

Information as of 3.31.2017; GPW as of 12.31.16; proforma including Allied World.

7TH LARGEST
NORTH AMERICAN RE/INSURER WITH A STRONG GLOBAL REACH

Based on market capitalization

TOP 5 BUSINESS IN THE U.S. EXCESS & SURPLUS LINES MARKET

12,000 EMPLOYEES STRONG

24 GLOBAL BRANDS

OPERATIONS SPANNING
Fairfax Insurance Structure

- **Allied World**
  - World-class specialty insurance and reinsurance franchise
  - 67% ownership
  - Added to the portfolio July 2017

- **Fairfax Financial Holdings Limited**
  - $13 Billion in GWP

- **Northbridge Insurance**
  - $0.9b
  - Major Cdn commercial P&C insurer
  - 100% ownership

- **Crum & Forster**
  - $1.8b
  - Major U.S. commercial P&C insurer
  - 100% ownership

- **TheZenith, A Fairfax Company**
  - $0.8b
  - Leading workers comp insurer in U.S.
  - 100% FFH ownership

- **OdysseyRe**
  - $2.1b
  - Global insurer and reinsurer.
  - 100% FFH ownership

- **BRIT**
  - $1.5b
  - Leading Lloyd’s market operation
  - 73% FFH ownership

- **Fairfax Asia**
  - $0.3b
  - Significant presence in Asia
  - 73% FFH ownership

- **RiverStone**
  - $0.5b
  - Manager of global runoff business
  - 100% ownership
  - US runoff / European runoff

- **Insurance & Reinsurance Other**
  - Strategic growth in attractive markets
Fairfax Restaurant Business

- Prime Restaurants
  - Purchase Price: $57
  - Ownership: 82%

- Merger of Cara/Prime
  - Investment: $100
  - Prime Contribution: $57

- Keg Restaurants
  - Purchase: $85
  - Ownership: 51%

- Cara IPO
  - Fairfax MV: $458
  - Ownership: 41%

- Cara Purchases St-Hubert

- Cara Purchases 89% of Original Joe’s

- (Cdn$ millions)

- The McEwan Group
  - Ownership: 45%

➢ 3rd largest restaurant group in Canada
Retail Companies

**WILLIAM ASHLEY**
- Founded in 1947 it is Canada’s largest prestige retailer of exclusive tableware & gifts.

**SPORTING LIFE**
- Sell high-end sports merchandise & leading edge fashion apparel.

**PERFORMANCE SPORTS GROUP**
- Sports apparel company that owns Bauer, Easton & Cascade brands.

**GOLF TOWN**
- Specialty golf retailer in Canada offering a broad selection of the best brands in golf.
Technology and Media

- **Boat Rocker Media**: Creates, produces and distributes content and brands for all platforms.

- **Blue Ant Media**: Content producer, distributor and channel operator company.

- **Fair Ventures**: Innovation initiative of Fairfax Financial Holdings.

- **Quess**: Owned by Thomas Cook, it’s India’s leading integrated business services provider.

- **Rouge Media Group**: First media company in North America to bring large format murals and digital screens to strategic indoor spaces.
Many of the Fairfax companies are in industries which have been insulated from ‘disruption’ due to institutional hurdles and high barriers of entry.

However, many of those barriers are being eliminated through the use of new technologies and business models, resulting in unprecedented disruption to the incumbents.

How can we capitalize on these same opportunities to enhance/extend our value?
To accomplish our mandate, we have created four tracks for the Lab that define our areas of focus.
DATA & ANALYTICS MATURITY CURVE

Cognitive / AI
Deep Learning and human-like Interaction

Prescriptive / Prevention
What action can be prescribed?

Simulation
Most likely based on what if?

FV Lab is looking to reduce complexity
Innovate
Leverage new data sources and tools to create predictive insights that influence profitability and growth

Who
Pricing, Actuaries, Analytics, BI, Claims, Sales & Distribution, Marketing

Renovate
Leverage scalable storage and tools to consolidate data and decommission legacy systems to reduce costs

Who
IT, Architecture, Systems developers

Cloud Infrastructure
Unlock Data
In Progress...
Analytic Blue Prints
Share Experiences

FOSP
RESEARCH IDEAS

Department of Statistics and Actuarial Science

Research Ideas:

1. **Catastrophe** - Could sensor data /IoT be leveraged in combination with artificial intelligence methods to support in cat event prediction, prevention, processing, and payment?
   - Better predict the frequency and severity of weather related events and understand our exposure in specific regions.
   - Provide prescriptive analytics / alerts to customers to prevent or reduce losses.
   - Expedite claims processing and payouts to those in need during extreme weather events.
   - Leverage new insights to develop entirely new insurance concepts to wider coverage for weather-based events.

2. **Cyber** - Would real-time data collection in combination with artificial intelligence methods provide lift in Cyber Exposure Management?
   - Methods for data-driven underwriting of new cyber risks.
   - Continuous monitoring of new cyber risk policies.

3. **Social Data** - Can available social, open, 3rd party, and subjective data be used to determine a profile of a business owner or employee to score for use in:
   - Overall sentiment on the relationship between employee and employer in the context of workers compensation insurance.
   - Overall risk of small to medium business owner / operator where little structured data is available.
• Thanks!
  • sbradwell@fairventures.ca
Who We Are

• CleanTech Company
• Membrane Manufacturer (Wastewater Treatment)
• Founded in 2010
• North American Membrane manufacturing.
• Novel and patented configuration based on proven industry membrane chemistry.
• +25 people based in Hamilton, ON
• Scalable automated manufacturing can triple production at current location.
What We Do

• Develop Hybrid Membrane – FibrePlate

• Design Membrane Bioreactors (MBRs)
Our Challenge

• Membrane Operating Costs and Energy
  • Aeration energy
  • Pumping energy
  • Cleaning frequency (offline capacity)
  • Labour
  • Chemical

• Current Strategy = Manual, Reactive, Delayed
  • Aeration rates.
  • Returned Activated Sludge rates.
  • Time to get lab data: Often trends not reviewed.
  • Maintenance Cleaning = small frequent cleans.
  • Recovery Cleaning = larger offline deep cleans.

When and How much/often?
Why We Are Here

• Develop a predictive controls package for Wastewater MBR operations
  • Use online data collection as well as lab data inputs
  • Analyze current conditions and longer term trends
  • Optimize and adjust plant operating setpoints
  • Predict cleaning protocol and frequencies.
  • Provide proactive alerts and recommendations
  • Provide regular performance summaries and recommendations
THANK YOU
Our Purpose

To enable and empower individuals and organizations to find and realize their core purpose – to flourish
Positive Organizations

Catalyst for Powering Virtuous Cycle of Whole-System Flourishing
Work & Life Flourishing Insight Assessment

- Research-based
- Validated results
- Insights far beyond employee engagement
- Examination of key factors where organizational change efforts need to be directed

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Whole-Person Flourishing

Work Flourishing Domains:
- Employee-organization fit
- Justice climate
- Supervisor support
- Balance at work
- Co-worker civility

Additional Work Flourishing Insights:
- Hours of work
- Commute length
- Purpose-vision-values alignment
- Productivity
- Goal-setting and performance management
- Organizational innovation
Whole-Person Flourishing

Life Flourishing Domains:
- Psychological flourishing
- Social flourishing
- Physical flourishing
- Financial flourishing

Additional Life Flourishing Insights:
- Sleep quantity
- Time spent on household tasks and childcare
- Time spent on leisure activities and relaxation
Organizational Impact

- Work
- Social
- Psychological
- Physical
- Financial

- Employee-Organization Fit
- Justice Climate
- Supervisor Support
- Balance at Work
- Coworker Civility
- Job Performance
- Job Satisfaction
- Turnover Intentions
- Anxiety Symptoms
- Depressive Symptoms
- Stress
Augmented Intelligence Model

Collective Human \times\text{Conscious Artificial Intelligence} = \text{Emergent/Exponential Intelligence}

- Agent (Employee) Based Model
- Cooperative/Coalitional Game Theory
- Graph Theory
- Predictive/Prescriptive Analytics Model of Performance, Retention, and Innovation
Our Team & Advisory Board

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CEO

Ben Gottlieb, PhD.
Social Psychologist

Katya Pogrebtsova,
MA
PhD. Candidate (IO)

Alexander Chris, MA
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Powering Higher Performance™
Manulife Financial is a leading Canadian-based financial services group. Operating as Manulife Financial in Canada and Asia, and as John Hancock in the US.

- Over 150 years in the US, 125 years in Canada, 115 years in China
- Global workforce of over 28,000 employees. 12,000 employees in Asia, 16,000 in North America & Europe
- Recognized as a best employer in several categories
- ~ 85 people across the company working in Data Science
  - We are working to embed machine learning across every aspect of our business
Some of the problems we are looking to solve

Technical:
- Rare Event Detection – working with unbalanced data to predict outcomes
- Speech & Text analytics – reducing time investment and improving the quality of results

Business:
- Measuring & predicting employee performance & potential
Data Science & Predictive Analytics
Academic-Industry Partnering Forum

University of Waterloo

April 27, 2018
Integrated Analytics
Accelerated Underwriting

Predictive models:
1) screen
2) risk selection
3) smoker

Rules-based Automated UW

Manual UW

Risk Class

traditional data:
Medical Lab Results
Attending Physician Statement
Income & financial info

Application & Tele-Interview
Insurance History
Prescriptions
Driving Record
Credit
Electronic health records
Lifestyle / Social
Wearables

Accelerated Underwriting

Integrated Analytics
Topics

- Predictive modeling for Accelerated UW when applicant characteristics and misrepresentation rates change
  - Modeling the future population of applicants
  - Model to estimate the likelihood of UW class as a function of time, due to underlying population changes
  - Cost benefit model from using such model

- Modeling/forecasting term structure of mortality
  - Multiple predictors are available
  - Not enough data/resources to apply Lee-Carter to separate segments

- Other rare events modeling, e.g. claims fraud
Illustration

Accelerated Underwriting: non-disclosure

- Currently all applicants are sent for fluid tests; extra mortality is 0%
- The larger the population routed to AUW without fluids, the larger the extra mortality cost
- As non-disclosure increases, one needs to address changes in the future population of applicants, adjust the predictive model and cost benefit analysis

### Fluid Test | Non-disclosure | Extra Mortality*
---|---|---
I | All | 25% | 0%
II | None | 25% | 12%
III | None | 50% | 21%
IV | None | 100% | 40%

*Extra Mortality refers to the increased mortality cost due to non-disclosure or fluid tests not being performed.
PEER Group

Data Science & Predictive Analytics Opportunities
Leading supplier of Smart Manufacturing software for the semiconductor and related industries

- Photovoltaic, Flat panel, LED, MEMS

- Canadian-owned, established in 1992
- Factory automation software solutions: products and services
  - 60,000 active equipment connections
  - 80+ tool platforms automated
  - 100+ factory acceptances
- **We believe every computer chip on the planet has been processed by equipment with our software on it**
Automation and Control

- Tool, line, or station control
- Functionality
  - Device drivers
  - Workflow management (lot, job)
  - Scheduling / dispatching
  - Standards compliance
  - Extensible HMI screens
- Flexible / extensible framework
  - Run-time discoverable behavior
  - Object oriented: control and data collection
  - Encapsulation of logical layers
Common Equipment Model

- Structured representation of entity
  - tool, line, factory
- Pluggable adaptors – multi-client support
- Integrated model creation
- Data collection
  - Generic schema
  - Time-series data w/ context correlation
Remote Connectivity

- Secure, remote access to equipment and data
- Cloud (or local) deployment
Data Science / Predictive Analytics Opportunity #1

- Predictive Maintenance
  - Time trends
  - Aggregation / comparison
  - Problem isolation
- Deployment opportunities
  - On tool
  - Fleet level (OEM, 3rd party supplier)
  - Factory
Data Science / Predictive Analytics Opportunity #2

- Improved Scheduling
  - Interested in RL (reinforced learning) algorithms
  - Extensible metadata for scheduling decisions
  - Movement of multiple material types
  - Cloud-based computing?
Invitation to Connect

• Mike Thiessen
  – Product Engineering Manager
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• Sara Stairs
  – Development Manager
  – 519-749-9554 (x123)
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Who are we? Roche is a leading pharmaceutical company providing life saving and life changing medicines to patients.
Biometrics @ Roche supports phases 1-4 clinical trials bringing novel medicines to patients
Clinical Trials and Drug Development must evolve. Personalized Healthcare (PHC) is about providing the right treatment for the right group of patients

- Personalized Healthcare
  - Precision medicine is the customization of healthcare, with medical decisions, practices, or products being tailored to the individual patient

<table>
<thead>
<tr>
<th>Pre-PHC</th>
<th>PHC Today</th>
<th>PHC Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>One drug fits all</td>
<td>One patient segment, one biomarker, one drug</td>
<td>Single patient, comprehensive molecular profile, individualized treatment</td>
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</table>
PHC 2.0: How will we get there?

- Real world data (Big Data?)
  - Availability, transparency of data changes the way we develop drugs
  - More questions to be asked
PHC 2.0: How will we get there?

- Randomized Controlled Trials (RCTs) are evolving
  - Synthetic control arms
  - Bayesian approaches to decision making
  - Oncology approaches are shifting: tumour agnostic and biomarker specific treatments

- Limitations
  - Data wrangling
  - Patient reported outcomes (technology is lagging)
PHC 2.0: How will we get there?

Collaboration
Doing now what patients need next
Academic Resources

• Software
• Teaching Resources
  • Training
  • Books & Curriculum Content
• Student Resources
  • E-learning
  • Certifications
  • Competitions
Research & Partnerships

• Research Platform
  • Heath Sciences at UW
• Letters of Support
SAS Partnership

Waterloo AI

Long Term Focus
Focus on In Kind
Small Amounts of Cash

Biz Development
Access to Customers
Bring Customers to you

AI into Marketplace
Waterloo as AI Leader
Graduates in Market
Appendix
SAS Software

- SAS University Edition
  - Free downloadable version of SAS
  - Works on all OS formats

- SAS OnDemand for Academics
  - Free
  - Runs locally or in the cloud via AWS Marketplace

- University Licenses
SAS Integrates with Open Source

- SAS Training for R Users: Live web training
- SAS Programs in Jupyter Notebook
- Jupyter and SAS University Edition
- Calling R Procedures from SAS/IML Software
- 10 Tips for Simulating Data with SAS
- Using R in SAS Enterprise Miner
- Intro to SASPy (for SAS 9.4 – and now in UE!)
  - More on SASPy from SAS Tech Support

- View the Open Integration Webinar for Learning
E-Learning Courses
Student & Faculty Training Opportunities

• Education Analytic Suite License
  • 12 courses -- Programming & Statistics

• Enterprise Miner License
  • 3 courses in data mining

• E-Learning site -- [Https://support.sas.com/edu/viewmyelearn.html](https://support.sas.com/edu/viewmyelearn.html)

Faculty Training

• Provide Discounts to Faculty – minimum 50%, often 100%

• Training Schedule

• Example Courses:
  • Structured Equation Modeling with Proc Calis
  • Live Web
  • On Site (not discounted)
  • SAS Canada Office
Curriculum Content
Teaching Resources

• Free Course Material:
  • Course Notes from 95% of our courses (*Business Knowledge Series excluded*)
  • Instructor Presentation Slides
  • Assignments and Labs with Data Sets and Solutions
  • Case Studies

• Examples from multiple business areas:
  • Data Mining
  • Risk Analysis
  • Text Mining

• Click here [http://support.sas.com/learn/ap/tkit/list.html](http://support.sas.com/learn/ap/tkit/list.html) for more info
SAS Publications
Teaching & Learning Resources

• Publications
  • [http://support.sas.com/publishing/survey/evalcopy_07.html](http://support.sas.com/publishing/survey/evalcopy_07.html)
  • 2 per semester
  • Faculty Only

• 20% Academic discount for students via the SAS bookstore
SAS Certification
Students & Faculty

• SAS Certification
  • E.g.) Base Programming Certification
  • Provide students with discounted voucher to take exam
  • Sample exams via this link – [http://support.sas.com/certify/creds/samples/](http://support.sas.com/certify/creds/samples/)

• Joint Certificate
  • Informal agreement with University
  • Provide students with signed SAS/Western certificate
  • Requires 12 credit hours of instruction in subject area
    - E.g.) Queen’s Community Health & Epidemiology
    - Schulich School of Business
Social & Online Resources

Learning Resources

- SAS Analytics U Blog
- Community Forums
- SAS Blogs Site
- Lexjansen.com
- @SASAcademicCA
  - #sastip – twitter aggregation
- SAS Canada Academic Program website
Networking Opportunities
Students & Faculty

• **SAS User Groups** (mini-conferences)
  • Over 20 user groups for over 10 years
  • Free registration
  • E.g.: Toronto Data Sciences Forum (May 2, 2018)

• **Friends of SAS**

“For me, the best experience with SAS has been meeting many people during the TASS meetings...I have had the opportunity to meet experts from Toronto and learn from their experiences. At my level as a student, I look forward to such experiences and learnings.”

- Sunny Giroti, Schulich MBAN 2017
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• SAS Canada Academic Program
1958: Sputnik (USSR)

1959: Explorer-1 (USA)
The Past

The Future
1000x lower launch costs
100x smaller satellites
100x lower sensor costs
500,000x lower data costs
Historically, data acquisition and preparation has been very painful.
We believe that everyone on the planet should benefit from satellite data
Flooded Homes: Hurricane Harvey
August 31st 2017 - Houston, Harris County, TX

Source: Planet
At least 158 buildings destroyed in Myin Hlut Ywar Thit village, Burma
Satellite image recorded on September 8, 2017

Source: Human Rights Watch
Our Data Sciences Challenges
Machine learning for multi-mission capture optimization
Primitive Feature Classification and Prediction
Coverage prediction
Thank You!
We are a full service real estate firm offering:

Commercial services
- Office
- Industrial
- Investment
- Redevelopment
- Multi-residential

Residential services
- 2 Residential Agent’s
- We consider our business a one-stop shop for companies as they grow or come into our region
So, what’s going on in the real estate market?
Q1 2018

- Office Vacancy Rate **18.60%**
- Up from 17.69% in 2017
- Total Available Space 2,085,261 SF
WATERLOO OFFICE OPPORTUNITIES
EVOLV1 – CANADA’S FIRST ZERO CARBON OFFICE BUILDING
In early 2014 BlackBerry divested their real estate holdings. This saw 2.815M SF of space coming back to the Waterloo & Cambridge markets. Today BlackBerry remains a tenant in Waterloo with space totaling 715,000 SF.
120 Victoria Street South
345 King Street West
85 Charles Street West
137 Glasgow Street
1.3 Million SF Transit Hub
Predicting growth and expansion within our client companies and target companies
Accurate and informative data to assist Investors with acquisition and disposition decisions
Predicting market changes and trends ahead of time
The World’s Trusted Currency Authority
xe.com

275M annual unique visitors
XE currency app

XE money transfer app

XE travel app

65M downloads

$222B transferred

Just Launched
Is there a relation between currency volatility and money transfer activity?