Real-time Decisions on Big Data

Leonard Newnham
Overview

- Causata data platform
- Automated Decisioning objectives
- Challenges
What We Do and Where We Fit

**Data Sources**
- Website Behavioural Data
- Email
- CRM Database
- Data Warehouse
- Etc…

**Touchpoints**
- Website CMS
- Call Centre
- Campaign Management
- Mobile App
- Etc…

- Storage and Assembly
- Predictive Modelling + Analysis
- Real-time Provisioning

causata
Customer Interactions

- Website Session
- Call Center Question
- Website Session
- Loyalty Card Promo Email
- Website Session
- Loyalty Card Sign Up
- Major Product Purchase in Store
Total spend in past month

Select purchase events over past month and extract price

Purchase: Music CD $13.99 SKU 87645727
Purchase: Sports Golf Clubs $259.99 SKU 76329489

Apply sum calculator

13.99 + 259.99 = 273.98
Large Number of Variables

- Everything known about the visitor across multiple channels
  - Web data – page view history
  - Call centre data
  - Online accounts
  - Product holdings
  - geo-demographic data
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  - Browser language, timezone, etc.
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- Typically 500+
Requirements

- Gathering data
  - Structure data by individual customer. Assemble all interactions, from many channels, into a complete customer record
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  - Visualisation and explanation
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- Optimise on goals that matter to customer
Optimise on Goals that Matter

Visit website from online banking → Research credit cards → Request application form → Speak to advisor in branch → Sign agreement → Ongoing relationship
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With all the data, can optimize over true long term business goals.
Why Next Best Action May Not Always be Best

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- Or a deferred selling opportunity:
  - restricted number of offers made after sale, eg
    - upgrades options after airline ticket purchase
    - extended warranty
    - Insurance

- determine best time to send email
Reinforcement Learning

- Choose the actions which will yield the greatest long-term reward
- Reward can be any function we wish to optimize
- Rewards may be deferred to some time in the future
Challenges

- Big Data is not so big sometimes
- Concurrent customer interactions
- Speed of learning
- Visualisation
- Scalability
Big Data is not so Big Sometimes

- Learn objective functions that matter to client (part 2)
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  - Optimise multiple objectives
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  - Marketing campaigns are frequently limited in time
  - May change due to seasonal variation – eg summer sales
  - May change due to external factors – eg change of interest rate
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- -> We would like to not learn from scratch with every action change
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  - Data becomes stale
  - It may be gradual
    - Popularity of product may wane
  - This may be abrupt
    - Summer heat-wave, Interest rate changes
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  - Learn from data up to that point and no more
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- -> smart counting is not sufficient
Concurrent Customer Interactions

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- Time between each interaction is highly variable
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- Need to avoid long delays to learning
Concurrent Customer Interactions

- Need mechanism where:
  -
  -
Concurrent Customer Interactions

- Need mechanism where:
  - Learning can be transferred as quickly as possible to other concurrent customers

Visit website from online banking → Research credit cards → Request application form → Speak to advisor in branch → Sign agreement → X
Need mechanism where:
- Learning can be transferred as quickly as possible to other concurrent customers
- Without waiting for next interaction or end of sequence
Speed of Learning

- Experience replay
- Regularisation
- Adaptive learning rate, eg IDBD
- Weight initialisation
- Improved Exploration
  - E-greedy
    - Simple but can perform badly when more exploration is required
  - UCB type exploration
Visualisation and Explanation

- How can I trust the system will work?
- What has the system learned?
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  - Not easy with complex internal representation
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- Encourage operator engagement
Scalability and Redundancy

- Multiple learning agents
Scalability and Redundancy

- Multiple learning agents

- Regular dissemination of learning to other agents
THANK YOU

Leonard Newnham
leonard.newnham@nice.com