Agile For Data Science Teams

MAKING AI TEAMS WORK IN THE REAL WORLD

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More about me:

• Currently Expert Network @ IIA
• Previously Chief Data Scientist @ Atlassian
• Used to managed Applied Data Science Research in the Search team @ Walmart Labs
• Have built and scaled data science & cross-functional teams in large and small companies
Our Mission

To empower data scientists to train, test, and tune machine learning for a human world
Agenda

THE SECRETS OF MAKING A DATA SCIENCE TEAM HIGHLY EFFICIENT

1. What is Agile?
2. Why Agile for Data Science?
3. An Agile Methodology for Data Scientists
4. The Agile Organization
What is Agile?

THE AGILE METHODOLOGY
The Agile Methodology

The Epiphany of Software Development

Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan

That is, while there is value in the items on the right, we value the items on the left more.

Kent Beck
Mike Beedle
Arie van Bennekum
Alistair Cockburn
Ward Cunningham
Martin Fowler
James Grenning
Jim Highsmith
Andrew Hunt
Ron Jeffries
Jon Kern
Brian Marick
Robert C. Martin
Steve Mellor
Ken Schwaber
Jeff Sutherland
Dave Thomas
The Agile Manifesto

NEW RULES, NEW PROCESS

Individuals and interactions ............... over processes and tools
Working software .................. over comprehensive documentation
Customer collaboration ................. over contract negotiation
Responding to change .................. over following a plan
Agile Methodology Types

Many Agile methods have been developed

Agile Methodologies
- Scrum
- Kanban

Testing Methods
- Behavior Driven Development (BDD)
- Acceptance Test Driven Development (ATDD)
- Exploratory Testing
- Session Based Testing
The Kanban Methodology

PRIORITIZATION WITHOUT TIME BOUNDING

• Best suited for:
  • small teams
  • teams that don’t produce features for external audiences
  • teams that don’t have clear deadlines

• Best choice for teams focused primarily on work that requires research to resolve (like maintenance or research)
The Roles in Scrum

- Business Owner
- Stakeholder
- Product owner
- Scrum master
- Team
The Roles in Scrum

- **Product owner**
- Scrum master
- Business Owner
- Stakeholder
- Team

The “sponsor” of the project
The Roles in Scrum

- Business Owner
- Stakeholder (The “customers”)
- Product owner
- Scrum master
- Team

Stakeholders include the Business Owner and the “customers,” who are external to the Scrum Team. The Product owner represents the stakeholders’ interests, prioritizing and approving Product Backlog items. The Scrum master facilitates the Scrum process and helps ensure that the Scrum rules are followed.
The Roles in Scrum

- Communicates vision to team
- Provides guidance and clarification when needed
- Represents users of system
- Shields team from stakeholders
- Maintains the product backlog
- Prioritizes work for team
- Sets acceptance criteria
- Establishes release plan
- Communicating changes to stakeholders
- Attends the daily standup to LISTEN and provide feedback

"The Interface"
The Roles in Scrum

- Encourages communication
- Promotes transparency
- Facilitates meetings
- Removes obstacles proactively
- Help team report to mgmt
- Help team reflect continuously
- Ensure team adhere to process
- Encourages team take pride in what was delivered
- Gives feedback to team
- Protect team from “outside”
- Resolve conflicts

“The Catalyzer”
The Roles in Scrum

"The Doers"

- Prioritize backlog
- Split projects into tasks
- Estimate effort for tasks
- Complete tasks to achieve sprint goal
- Identify & raise obstacles to Scrum Master
- Self-organize
- Communicate work status on daily basis
Sprints

What is a “Sprint”?  
A sprint is a set period of time during which specific work has to be completed and made ready for review.

• **Length:** a sprint lasts anywhere between 1-4 weeks, depending on velocity  
  o Research projects usually have longer sprints, or use Kanban

• **A Sprint:**  
  o start with a Planning Session  
  o end with a Demo/Review Session, and  
  o is cadenced with regular check-ins called Stand-Ups
The Scrum Methodology

Input from end user

Features

Prioritized list of features, bugs, etc.

Product backlog

Adaptation to change and continuous improvement

Sprint Planning

Tasks

Sprint 1-4 weeks

Daily Scrum Meeting

Review / Demo

Potentially Shippable Product Increment

Retrospective

Product owner

Scrum Master

Team

24h

Sprint 1-4 weeks

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Epics, Stories: What’s That About?

- **Themes**: large focus areas that **span the entire organization**
- **Initiatives**: collections of epics that drive toward a **common goal**
- **Epics**: large bodies of work to be **broken down into smaller tasks**
- **Stories**: short requests written from a **user’s perspective**
- **Tasks, Bugs**: **small pieces** of work to be completed by the team

**Interesting observations:**
- **User-centric** terminology
- **Ties** the output of the team to the overall **company**’s goals
Lean & Minimum Viable Products (MVP)

Goal: Build just enough functionality to get customers’ feedback

- Determine requirements at beginning of project (prioritization)
- Work with product manager

Requirements

<table>
<thead>
<tr>
<th>#</th>
<th>Title</th>
<th>User Story</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Facebook</td>
<td>As User, I want to post my data from the application to Facebook</td>
<td>PX-5 TO DO</td>
</tr>
<tr>
<td>2</td>
<td>Product X</td>
<td>As User, I want to sync all the posts related to my Facebook account into my dashboard</td>
<td>PX-6 TO DO</td>
</tr>
<tr>
<td>3</td>
<td>Product X</td>
<td>As User, I want to access the application using my Facebook account</td>
<td>PX-7 TO DO</td>
</tr>
<tr>
<td>4</td>
<td>Product X</td>
<td>As User, I want to be able to like a post or comment from my dashboard</td>
<td>PX-8 TO DO</td>
</tr>
</tbody>
</table>

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Benefits of Agile

• Predictability
• Adaptability
• Transparency
• Accountability
Why Agile for Data Science?

ADAPTING THE AGILE METHODOLOGY FOR DATA SCIENCE TEAMS
Why Does Data Science Need Agile?

• Hard to Align with Company Goals
• Little Transparency
• Little Predictability
Data Science: To Agile or Not to Agile?

Cross-Functional Teams

Why?

Small Teams

Why?

Cross-Department Dependencies

Exploratory Work

Continuous delivery not realistic

High Uncertainty

Why not?
Improving Over Time: a Few Agile Metrics

**Burn Down Chart**

- **Epic Burn-Down**
- **Sprint Burn-Down**

**Velocity Chart**

- **Epic Burndown**
  - 15% completed issues, 12 remaining story points

- **Sprints**
  - Sprint 1
  - Sprint 2
  - Sprint 3
  - Sprint 4
  - Sprint 5

- **Velocity**
  - Expected
  - Actual
Agile for Data Scientists

ADAPTING THE AGILE METHODOLOGY FOR DATA SCIENCE TEAMS
Different Types of Data Scientists

Data Engineer

Business Analyst

ML Engineer

Research Scientist
Different Types of Data Teams

NOT ALL DATA SCIENCE TEAMS ARE CREATED EQUAL

• **Team Structure:**
  - Standalone or dependent on cross-functional help?

• **Skillset:**
  - Multidisciplinary?
  - Specialized?

• **Output:**
  - Analytics-based
  - Algorithm-based
Effort Evaluation & Spiking

What is “Pointing”? Pointing means estimating the amount of effort required to complete a specific task.

- Story Points vs. Due Dates
- All tickets need to be pointed prior to going into the sprint
- Tickets in the sprint should be completed by the end of the print
- What to do when effort can’t be estimated?
  - Spiking
Definition of Done

TO BE DONE OR NOT TO BE DONE: THAT IS THE QUESTION...

“Definition of Done”

A Definition of Done is a clear and concise list of requirements that software must adhere to for the team to call it complete.

- Establish “Definition of Done” when creating ticket
  - Typically, this is a list of criteria
- DoDs are project-dependent and dynamic
  - Practices more stringent over time
- **Definition of Done vs. Acceptance Criteria**
  - Definition of Done is technical, Acceptance Criteria are customer-driven
Incremental Delivery

Potentially Shippable Increments for **Software Development**

- Insights (plots, metrics, etc.)
- Documentation
- Code
- Research Plan
- ...

Potentially Shippable Increments for **Data Science**?
Use Case: Figure Eight ML Agile Planning

CUSTOMER PROJECTS

2-week Scrum

DEVELOPMENT PROJECTS

2-week Scrum

RESEARCH PROJECTS

Kanban
Use Case: Figure Eight ML Agile Planning

- **CUSTOMER PROJECTS**
  - 2-week Scrums
  - 1-week Scrums

- **DEVELOPMENT PROJECTS**
  - 2-week Scrums

- **RESEARCH PROJECTS**
  - Kanban
  - Spikes
The Agile Organization

WHY ML TEAMS CAN’T BE AGILE IN A VACUUM
With all this data, we will prevail and conquer the world!!!

But Sir, you do realize that we are collecting marketing data exclusively... right?
Data Science R.O.I

Building the Foundations
Basic ML and heuristics
A.I. Differentiation

Return on Investment

Time
Prerequisite #1: DS Hierarchy of Needs

- **Pioneer**
  - AI, Deep Learning, automation

- **Learn**
  - Experimentation, baseline ML algorithms

- **Prepare**
  - Analytics, data aggregation, feature engineering, metrics

- **Transform**
  - Data cleaning, anomaly detection

- **Organize**
  - Infrastructure, data pipelines, data storage

- **Collect**
  - Instrumentation, logs, third-party data, user-generated content
Organizational Considerations

**IT-Supported**
- CAO
  - IT
    - ML-as-a-service
    - IT infrastructure + deployed model
    - Data Collection + analytics

**Specialized**
- CAO
  - Data Science
    - ML-as-a-service
    - IT infrastructure + deployed model
    - Data Collection + analytics

**Comprehensive**
- CAO
  - Data Science
    - ML-as-a-service
    - Custom ML platform
    - IT infrastructure + deployed model
    - Data Collection + analytics
Data Product Management

• **Data munging/SQL proficiency**
  - Data product managers need to be able to extract their own insights

• **“No assumptions” mindset**
  - They never jump to conclusions, accept to be challenged

• **Focus on problem-solving rather than solution-building**
  - A bit at odds with the traditional Product Management roles!
Extreme Agility: Platform Teams for DS

A MODEL FOR EFFECTIVENESS

\[ E = (N_t - N_p)(1 + bN_p^s) \]

Effectiveness (workpower)

Total number of employees (workforce)

# of employees on Platform team

Boost factor
(increase in effectiveness of product eng. brought by platform eng.)

Effectiveness penalty
(models lower perf. when more eng. added to platform team)

Credit: Peter Seibel, Twitter
A MODEL FOR EFFECTIVENESS

\[ N_t = 10, b = 0.02, s = 0.7 \]

\[ N_t = 1500, b = 0.02, s = 0.7 \]
Conclusions

BEFORE WE PART WAYS...
Conclusions

WHAT YOU SHOULD REMEMBER FROM THIS SESSION

• Agile Highly Successful for Software Development Projects

• Agile Data Science:
  • Yes, it can be done
  • But it needs adjustments!

• Agile Data Science Team can’t survive in a vacuum
Thank You

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