ORIE 3120: Practical Tools for OR, ML & DS

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Lecture 1: Course Intro

This lecture

- Overview of topics in the course
- Continuous improvement
- Details on course logistics

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We'll cover these topics in ORIE 3120: Practical Tools in OR, ML & DS

1. Software tools:
   SQL; GIS; VBA; R

2. Mathematical methods:
   inventory and production optimization; statistics and machine learning

3. How these tools/methods are used today in practice

4. How to use these tools/methods in your summer internship,
   jobs after graduation, and in interviews to get these internships and jobs

We'll talk about the manufacturing industry

Corvette Plant in Bowling Green, Kentucky

We'll talk about the manufacturing industry

Zume Pizza in Mountain View, California

We'll talk about retail and e-commerce

Stitch Fix Warehouse in San Francisco, California

We'll talk about transportation

Truck operated by Schneider National,
based in Green Bay Wisconsin

We'll talk about transportation

Uber Headquarters in San Francisco, California

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Successful companies in these industries continuously improve their operations using this approach

- <u>Measure</u> the current performance of the system
- <u>Analyze</u> the current system and identify ways to improve it
- <u>Act</u> on the improvement ideas by implementing them
- <u>Measure</u> the new performance of the system
- <u>Repeat</u> the cycle

This is also called the "operational improvement cycle"
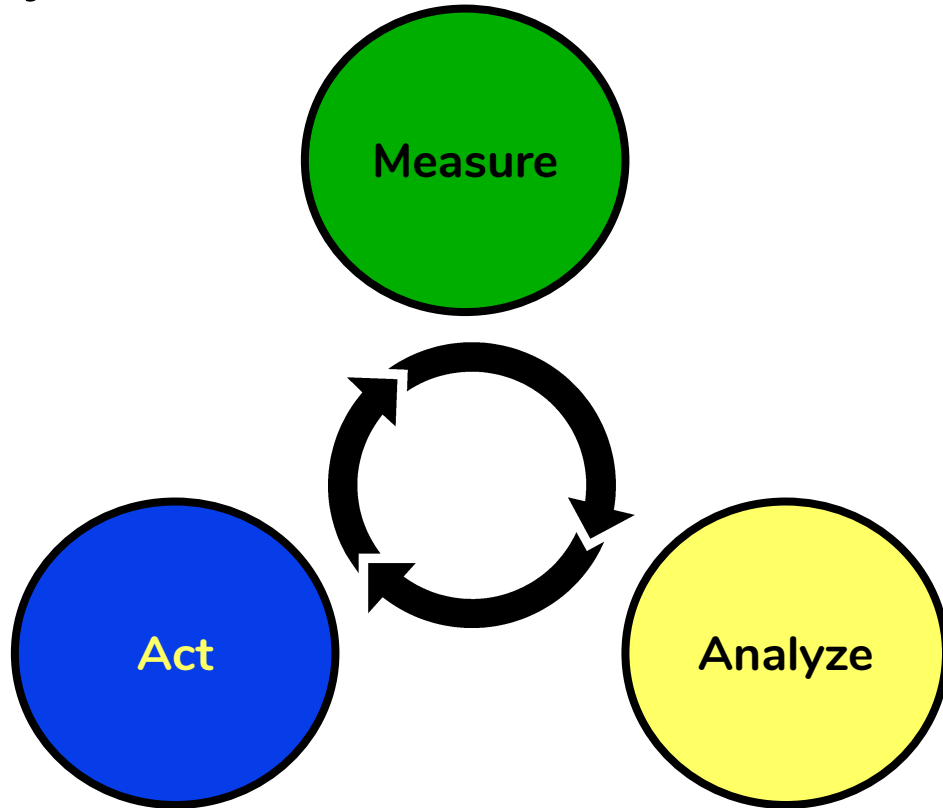
- <u>Measure</u>
- <u>Analyze</u>
- <u>Act</u>
- <u>Measure</u>
- <u>Repeat</u>

Here are two important milestones in the development of this continuous improvement approach

- **Lean manufacturing** and the concept of *kaizen* (continuous improvement) pioneered by Taiichi Ohno (1912 – 1990), a Toyota production executive.

- **Six sigma**, an aggressive campaign to drastically reduce the number of defects to very low levels, was made famous by Motorola in the 1980s.

Here's an example of continuous improvement,
And how it relates to what we'll learn in this class

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- <u>Measure</u> the system
- <u>Analyze</u> the system & identify improvements
- <u>Act</u> on the improvements
- <u>Measure</u> the new system
- <u>Repeat</u> the cycle

Measure the system by collecting data through the rider and driver app, and by listening to feedback from riders and drivers

- **Measure** the system
- Analyze the system & identify improvements
- Act on the improvements
- Measure the new system
- Repeat the cycle

Analyze the system by

1. Using <u>logistic regression</u> to predict the impact of inconveniences (squish, time inconvenience, interleaving events, backtracking, …) on whether a POOL rider will re-request.
2. Use <u>simulation</u> to understand how eliminating different kind of inconveniences will increase costs.
3. Use a cost-benefit analysis to recommend new constraints in the matching algorithm.

- <u>Measure</u> the system
- **<u>Analyze</u>** the system & identify improvements
- <u>Act</u> on the improvements
- <u>Measure</u> the new system
- <u>Repeat</u> the cycle

Act & **Measure** by launching an A/B test that measures how rider re-request and cost changes when we add the new constraints. After the experiment's results confirm that the change is good, put the change in place permanently.

- Measure the system
- Analyze the system & identify improvements
- **Act** on the improvements
- **Measure** the new system
- Repeat the cycle

Repeat by looking for the next issue we can improve

- <u>Measure</u> the system
- <u>Analyze</u> the system & identify improvements
- <u>Act</u> on the improvements
- <u>Measure</u> the new system
- **<u>Repeat</u>** the cycle

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Please read the course policies

- Course website: https://people.orie.cornell.edu/mru8/orie3120

Quiz: course policies

When I have a question about grades, I should

a)   Email the instructor
b)   Ask the instructor in person after class
c)   Email one of my section TAs
d)   Ask one of my section TAs in person
e)   Ask in office hours
 f)   Post a question on piazza
g)   Email the head TA

Answer: d

Quiz: course policies

When I have a question about homework, I should

a) Email the instructor
b) Ask the instructor in person after class
c) Email one of my section TAs
d) Ask one of my section TAs in person
e) Ask in office hours
f) Post a question on piazza
g) Email the head TA

Answer: e (for detailed help), f (for high-level questions of general interest)

Quiz: course policies

If I notice a few minutes after the homework deadline that I accidentally uploaded the wrong files to Canvas, I should

a) Upload the correct files (using one slip day)
b) Accept a lower grade on that homework
c) Submit files earlier and triple check my work next time
d) Email the correct file to my section TA

Answer: a-c are fine; d is not

Quiz: course policies

I have a job interview scheduled on the same day as the final exam! I should

a) Email the head TA
b) Ask for a different interview date
c) Skip the exam and accept that my final course grade will be reduced by 25%

Answer: b-c are fine; a is not

Quiz: course policies

I suffered a concussion a few weeks before the end of the course, and my college advisor issued a "request for academic consideration". I might damage my brain further by working on homework or studying for the final exam. I should

a) Email the head TA
b) Ask for a different interview date
c) Skip the exam and accept that my final course grade will be reduced by 25%

Answer: a

What next?

Right now:

- Register for the course
- Register an iClicker on Canvas

Upcoming

- Download and install SQLite
- No section this week; section starts next week
- HW1 due Wednesday Jan 30