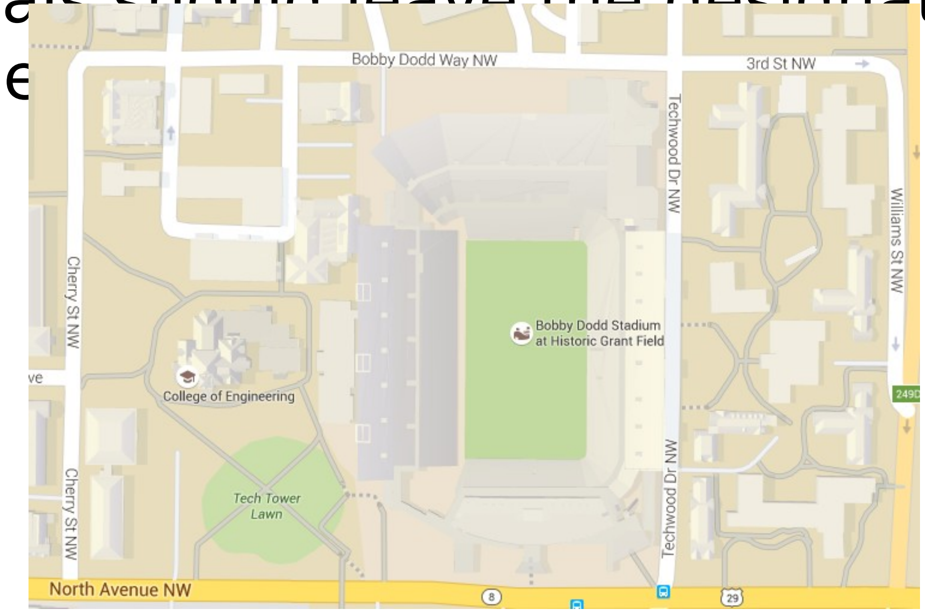
Project 1 Description

Goal

- Simulate people leaving Bobby Dodd Stadium area after football game.
- Minimize total egression time
  - i.e. all individuals should leave the designated area surrounding the



Assumptions and Simplifications

- Pedestrians should obey traffic lights and stay on sidewalks
- Main roads should stay open and contain traffic
  - Smaller roads may be closed off
- Stadium should be at near capacity
- Etc…

Optimizing over what?

- Desire is to decrease time for people to leave designated area
- Develop a (parametric) strategy for the departure.
- Parameters may include:
  - Closing certain (small) streets (which ones?)
  - Route people to leave area in certain paths (changes based on closed streets)
  - Have traffic cops “take over” some of the traffic lights
    - Makes for more efficient flow
    - Don’t want to keep cars waiting too long though --> Added feature in optimization

Where will people go?

- Pedestrians will tend to go to
  - Marta Station (i.e. exit to top right of map)
  - Car Parking (located ones outside designated area)
  - Home on foot (if they live close by)
- Each person knows this **before** leaving the stadium
  - Develop distributions for how many come by car, Marta, …
  - Friends that exit stadium together may go in same direction

Model of Choice

- Cellular Automata (CA)
- Time-stepped model (i.e. simulation advances every *one* time unit)
- Great for capturing local relationships among individuals
- Easy to model and implement (relatively)

What does a CA look like?

- Lay a 2D grid over your map
- How big should a grid cell be?
  - Depends on how many individuals can fit in a cell
    - Typically one person per cell
- Cell shape?
- Cells that lie outside the sidewalks are “invalid”

Local Relationships

- At each time-step, the value of a cell is determined by it’s neighbors
- E.g. suppose rule is that cell is
  - 1 if more than 1/3 of its neighbors are 1,
  - and 0 otherwise

At time *t*

1	0	1
0		1
0	1	1

Update Middle Cell

At time *t+1*

1	0	1
0	**1**	1
0	1	1

CA for Pedestrian Simulation

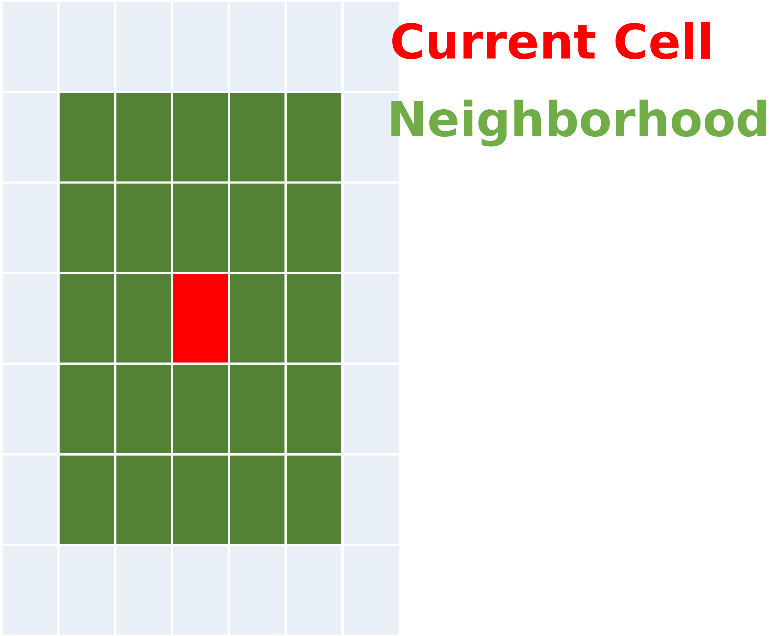
- Friends (intra-group relationships)
  - Groups/Friends tend to walk together
  - Use local relationships to keep individuals together
- How about inter-group relationships?
  - Crowds tend to take similar paths
    - Especially people coming from out of town who may not know the area well
  - Groups may be several grid cells apart from each other..
    - Can we

Too far apart!

	G1	G1				G2	G2	
G1	G1	G1				G2	G2	
	G1	G1				G2	G2	

CA for Long-Distance Interactions

- Basic method
  - Extend cell “neighborhood”



- Give cells “memory”
  - How many people passed through this cell?
  - The larger the number, the more “attractive” the cell is to new crowds
  - Memory should “decay” over time… How?

Stochastic Process!

- What should be probabilistic?
  - Target destination for each individual (drawn from distributions)
  - Speed of each individual (from single distribution derived from data or literature)
  - Behavior of individual (or even group)
- Stochastic…. and reproducible!

Where to get Data!

- Collect some 😀
  - How fast does a typical person walk in a crowd?
    - Time your friends in walking Klaus at 12:01
- Look at the literature
  - Tons and tons and tons of it!
  - Building evacuations, pedestrian simulation, group dynamics …
- Don’t forget to make your map accurate (and to scale)!
  - Use Goog/**App**-le **Maps**!
  - Go and measure for yourselves! (don’t take a ruler)

Speaking of Literature…

- … **Assignment!!**
- Prepare literature review for next Friday
- No formal report
  - we’ll ask each group to give several interesting ideas they came across
- Typically one or two papers per team member (for now at least)

Logistics (check Syllabus for details)

- Project Checkpoint: Friday February 5
  - Problem description, literature review, conceptual model, simulation model
  - Basic version of (operational) simulator
  - Written report (will be part of your final report, so do it well)
- Final Report: Friday February 26
  - Final version of report and working source code
- Poster Session: Friday February 26
  - Prepare 5 minute presentation
  - Get ready for some Q&A!