VIDEO AS A SENSOR

From Discovery to Applications

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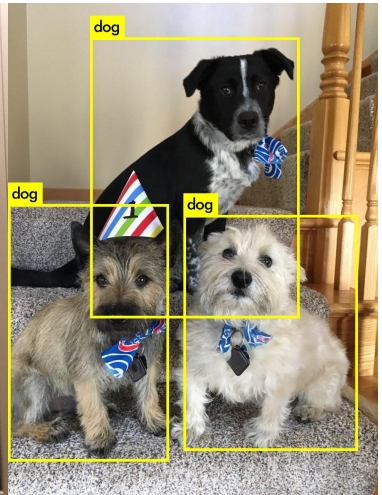
About Me

Sophomore; Mathematics & Computer Science



Illinois Geometry Lab Team Leader

HackIllinois Director of Experience

ACM Social Chair

CS 125 Course Developer

Reflections | Projections Operations

Avid ‘hat guy’

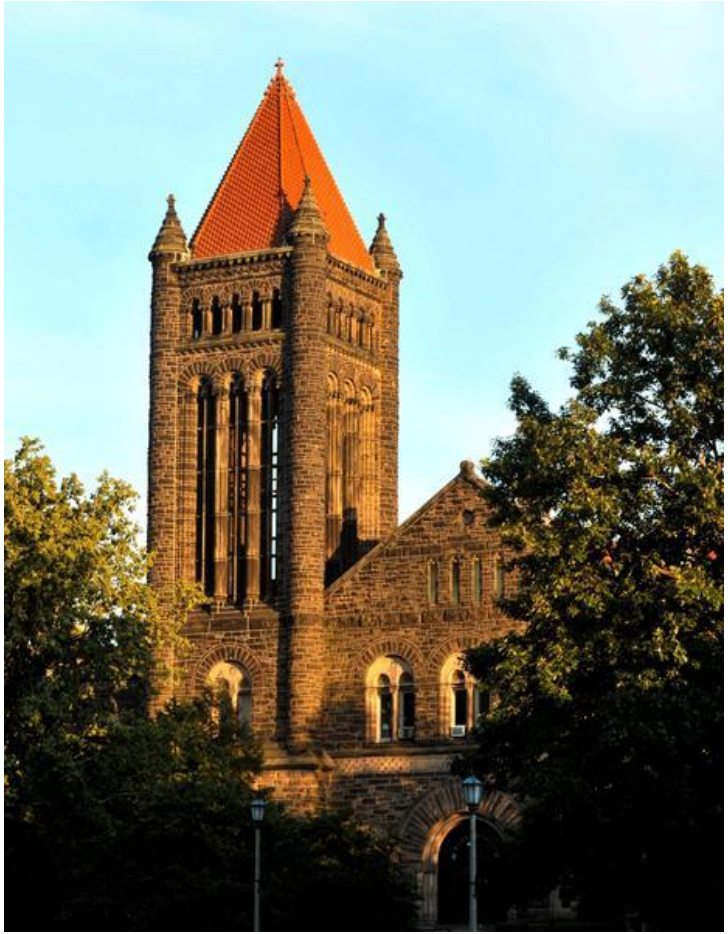
Introduction

My research:

- Sophomore in Math & CS
- IGL Scholar since January ‘17
- Current team leader under Richard Sowers
    - Professor in Math and ISE

Illinois Geometry Lab:

- Founded in 2012
- Ten Labs throughout the country
- 130 Members
    - 81 Student Scholars, 23 Team Leaders, 18 Professors
- 19 current projects, 10 here at the URS



Outline

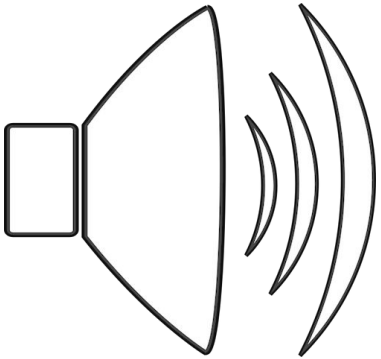
Video As a Sensor (Concept)

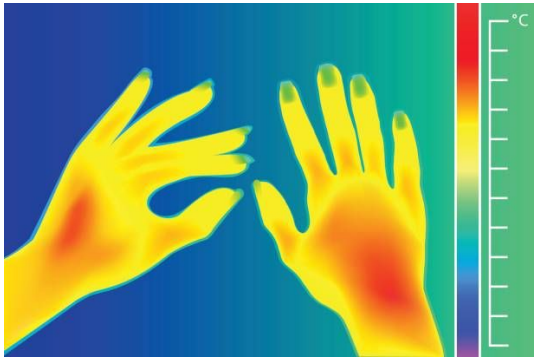
- Sensor Technology is evolving
- Data collection is moving faster than data processing
- This stuff is cool!

Video As a Sensor (Project)

- Geometry of Autonomous Vehicles
- REU Program Summer ‘17
- Hardware and Data

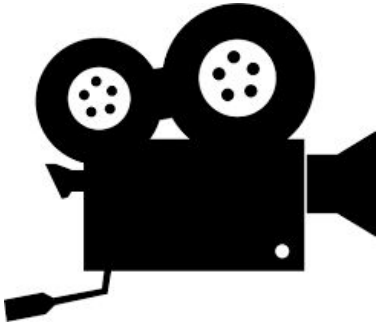
Sensors





Available Technology:

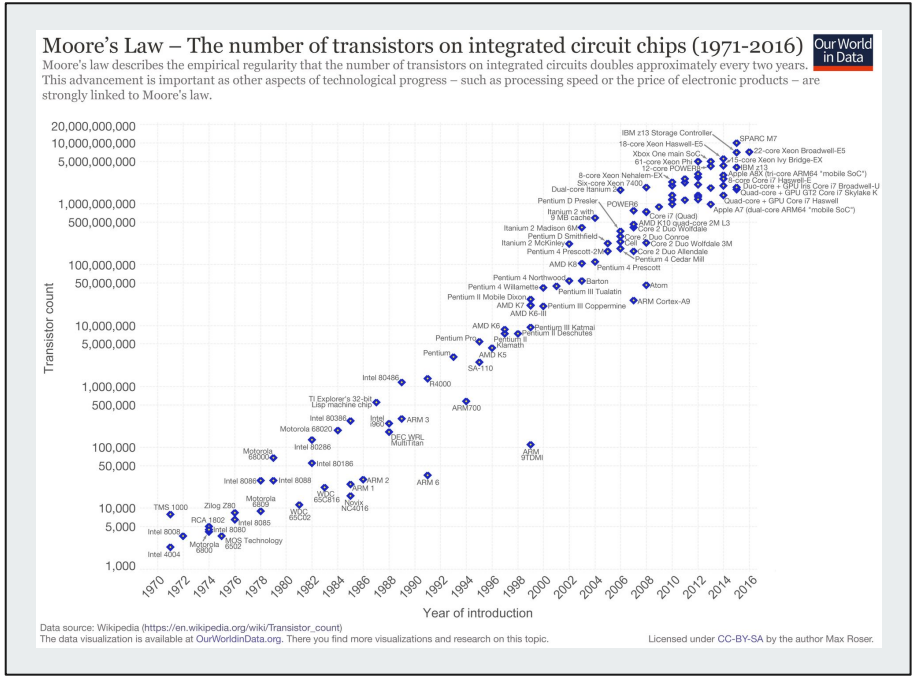
- “DARs”
  - Detection And Ranging systems
  - Radar
  - Sonar
  - LiDAR
- Infrared (IR) detectors
  - Active
  - Passive
- Visual sensors
  - Streaming
  - Embedded



Processing Power

Using Computers:

- Translating video into computer-friendly input
- Algorithmically define the actions taking place?
- Guess and check
  - (don't tell my professor)
- Moore's Law



We need more!

CPU vs GPU

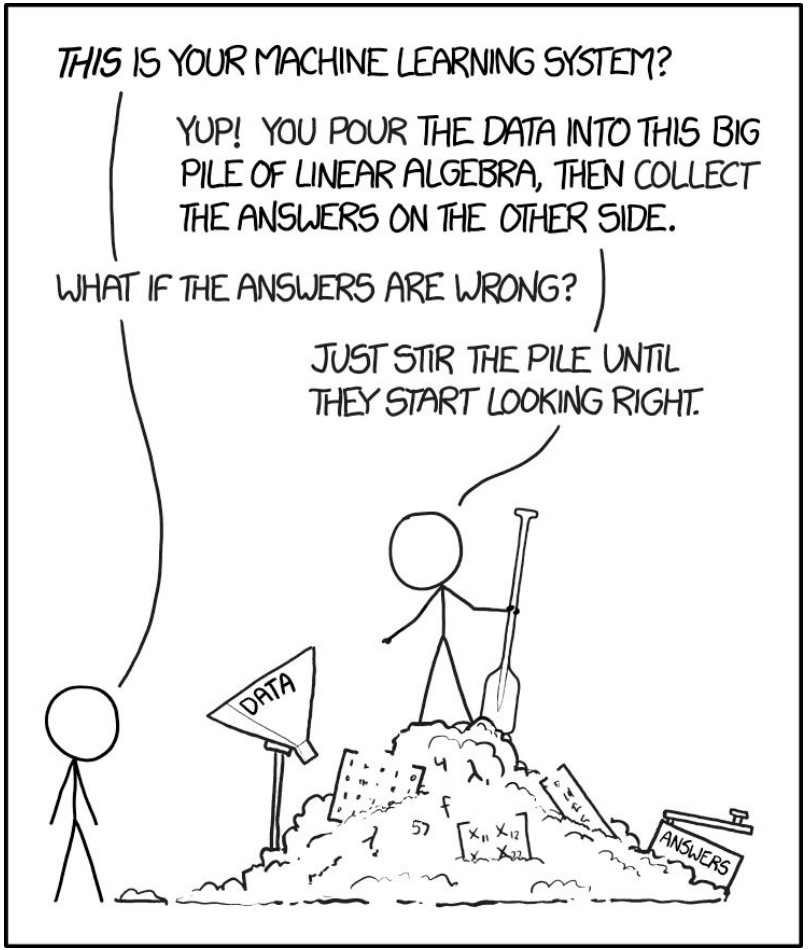
- Parallelizability
- Scalability
- Community / software support
- Very specific purpose
  - 110 Teraflops
  - $2,000

What do we do with all of this?

YOLO

You Only Look Once (YOLO)

- Convolutional neural network
  - (ask later if curious, technical and scary)
- C and CUDA code
  - Low level, high performance
- Open Source Software Project
  - Redmon, Farhadi; U Washington
  - (Links to their work and papers with sources)



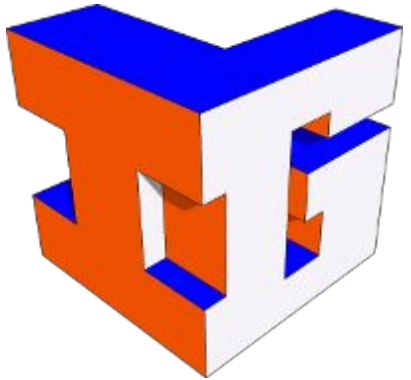
IGL Project

Multidisciplinary project approach

- Students from Math, CS, ISE, Stats, and ECE departments
- Requires (additional) input/consideration for psychology, civil engineering, automotive engineering
- Maintain unique perspectives

Methodologies

- Off the shelf or direct collaboration?
- Low level or high level programming?



Future Work; Current Progress

Planning on…

- Publishing work and getting outside feedback
- Maintaining OSS nature of the project
- Lowering the barrier to entry

We have currently…

- Retrained the Conv-Net for bicycle helmets
- Added privacy-protecting features
- Multi-threaded YOLO's core code
- Live process context-aware detections
- Basic live risk analysis

Team; Thank You's

Professors Rich Sowers, Dan Work, and assoc. university staff

Eric Shen, Felipe Arias, Pengyu Cheng, Wei Liu, Dongjun Seung, Russell Ang, George Aleksandrovich

Daniel Carmody, Myself

Illinois Geometry Lab Staff

Our various class professors and advisors

Sources + Resources

Slides and links will be uploaded to **github.com/kylebegovich/URS**, along with additional resources for finding out more about what we do, how we do it, and