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NodeBots Demo Night

Machine Learning & Bad Robots

Martin Andrews

About Me

- ## UK
  - Early 90s : PhD in Machine Learning

- ## New York
  - Started finance-related Internet business in 1999
  - Fixed Income Trading business 2002 - ...

- ## Singapore
  - Arrived in Sept 2013
  - Getting back to Machine Learning roots

Industrial Robots

- Pros
  - Precision
  - Power
  - 24 / 7 operation

- Cons
  - Dumb precision & Power => safety hazard
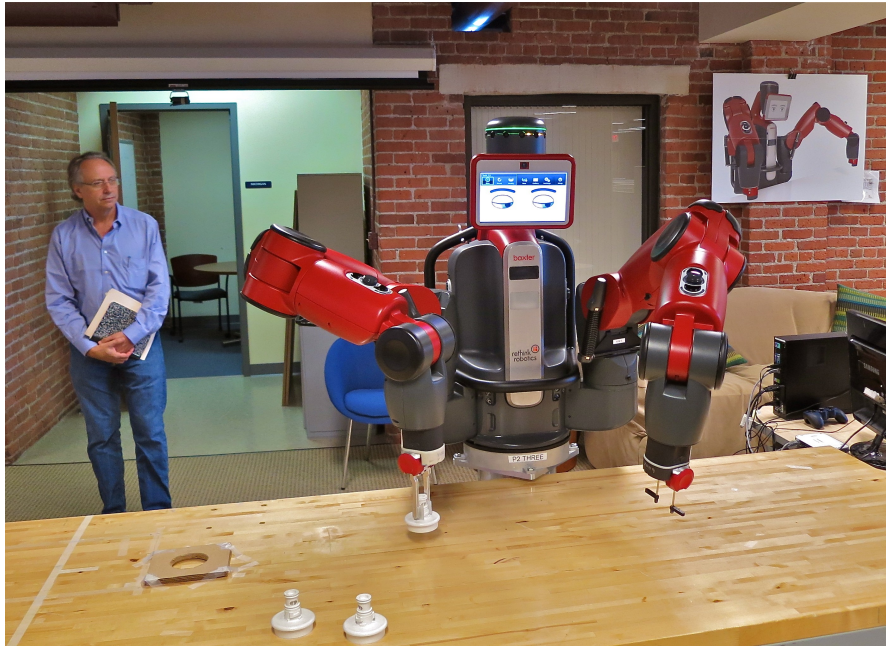 - Cost
  - Difficult to re-purpose

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CoWorking Robots

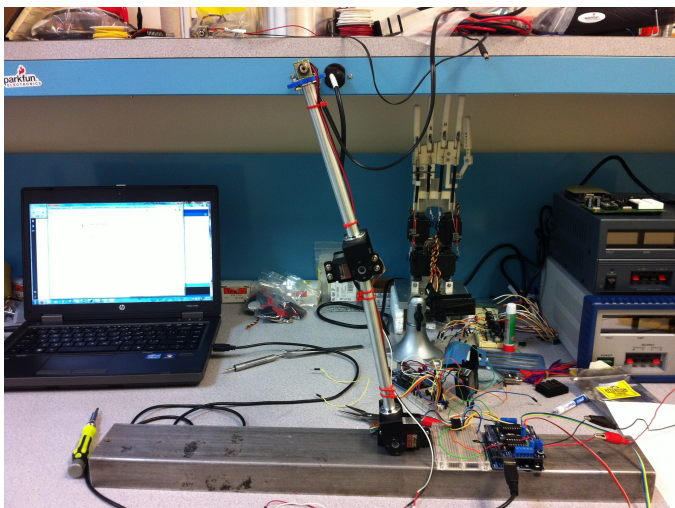- Pros
  - Compliant : Safe
  - Teachable
  - Disruptive Price-Point

- Cons
  - Lack of Power : Slow
  - New Market

"Bad Robots"

- Qualities
  - Low w.r.t. Mechanical stuff
  - High w.r.t Sensor stuff
  - High w.r.t Software stuff
  - Even more disruptive price

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Machine Learning

- ## Optimal Control = IMPRACTICAL
  - ### Perfect is enemy of Good

- ## Adaptive Systems = REQUIRED
  - ### Need to learn regions that can be controlled
  - ### Need to learn to adjust control within regions

- ## Machine Learning Paradigms
  - ### Neural Networks / Tree methods
  - ### Reinforcement Learning (e.g.: Q-Learning)
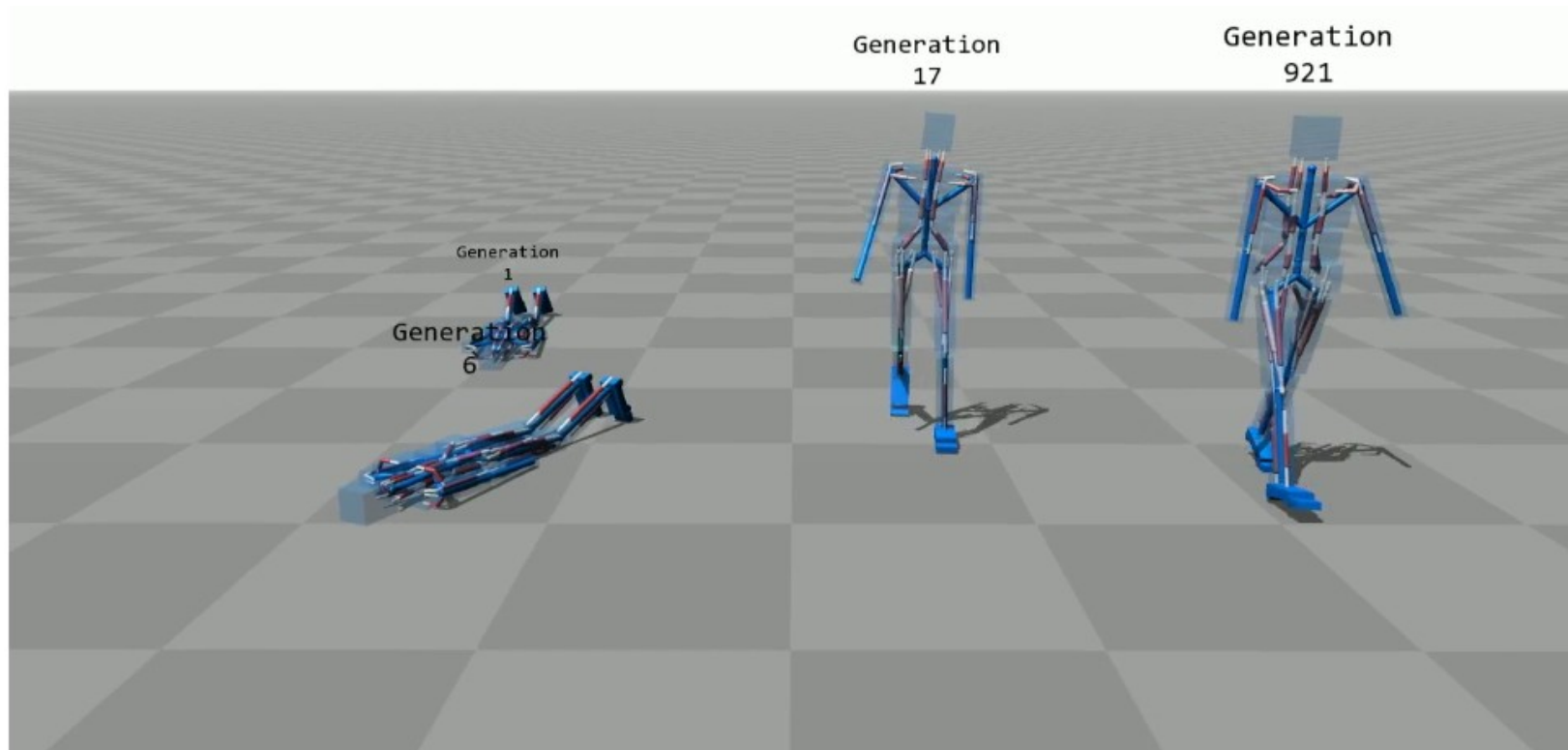 - ### Ensemble methods
  - ### Evolutionary methods

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Quick Video : Evolution

- http://vimeo.com/79098420

Conclusion

- This is a very exciting time!

- Hardware inflection point
  - Though it's still HARD …

- Software-ize everything

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Enabling Technologies

- ## Rise in Cheap Embedded FLOPs
  - Arduino ...
  - ... ARM boards (STM32Fn, BeagleBone, Raspberry Pi)

- ## Brushless Motors becoming 'easier'

- ## Cheap phone components
  - eg: Accelerometer / Gyroscope / Barometer / Compass

- ## Vision
  - Webcams, Phone cameras
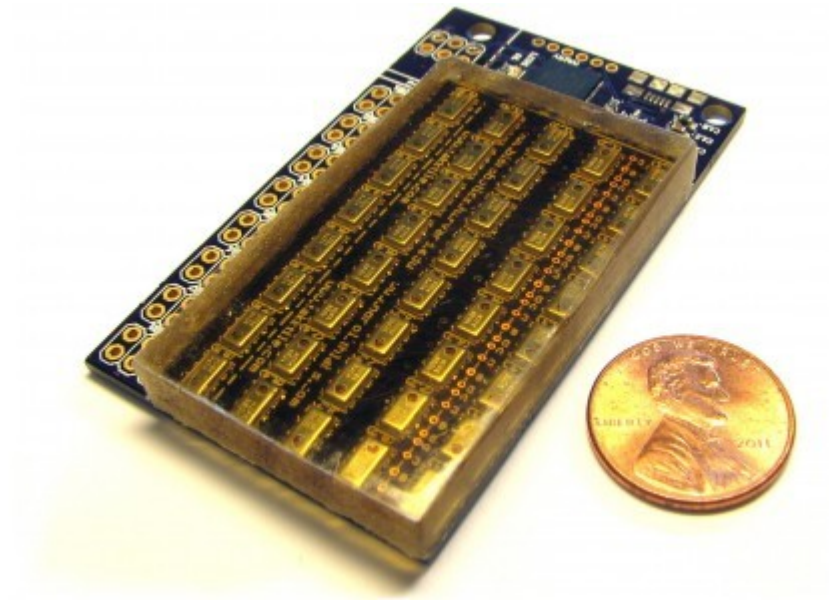 - Mice

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Quadrotors

- ## Enabling Technology :
  - Brushless Motors
  - FLOPs (moving from Arduino -> ARM)
  - Sensors galore
  - [still need better batteries]

- ## Bad Robot?
  - Solve bad environment for cameras with Gimbal
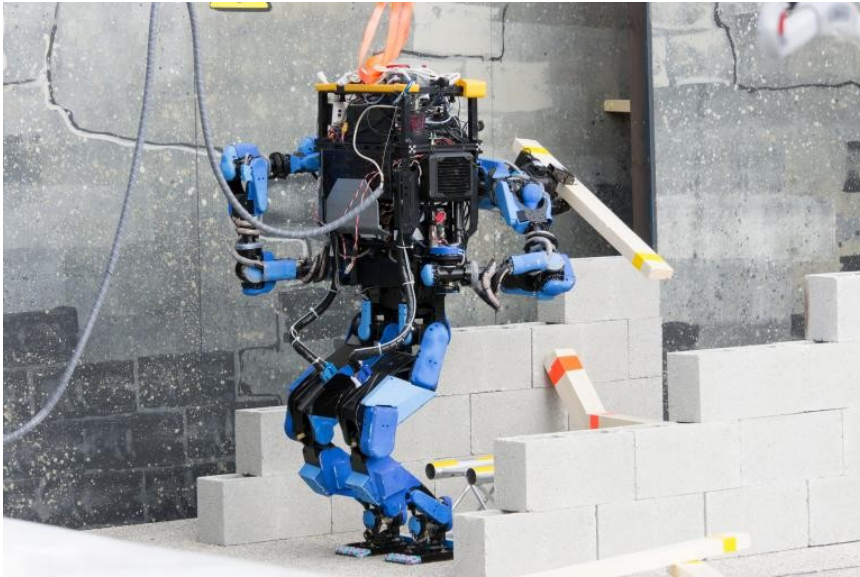
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Sense of Touch

- **"Touch" is a problem**

- **Pick any Two:**
  - Accuracy
  - Robustness
  - Low Price

- **Enabling Technology:**
  - Barometer (from Phone)

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SCHAFT Humanoid - DARPA

- **Brushless Actuators:**
  - Liquid cooled
  - Computer-controlled Overdrive
  - Capacitor for Amps

- **Active Control:**
  - Look-ahead for motion planning

- **Backing :**
  - Now a Google company…

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