Computer Vision based Behavior Analysis

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20 October 2003

Goal of Seminar

Explore various aspects of behavior analysis and the use of computer vision for that

Example Problem

Geneticist studies mice with defects, e.g., overgrooming (related to human disease).

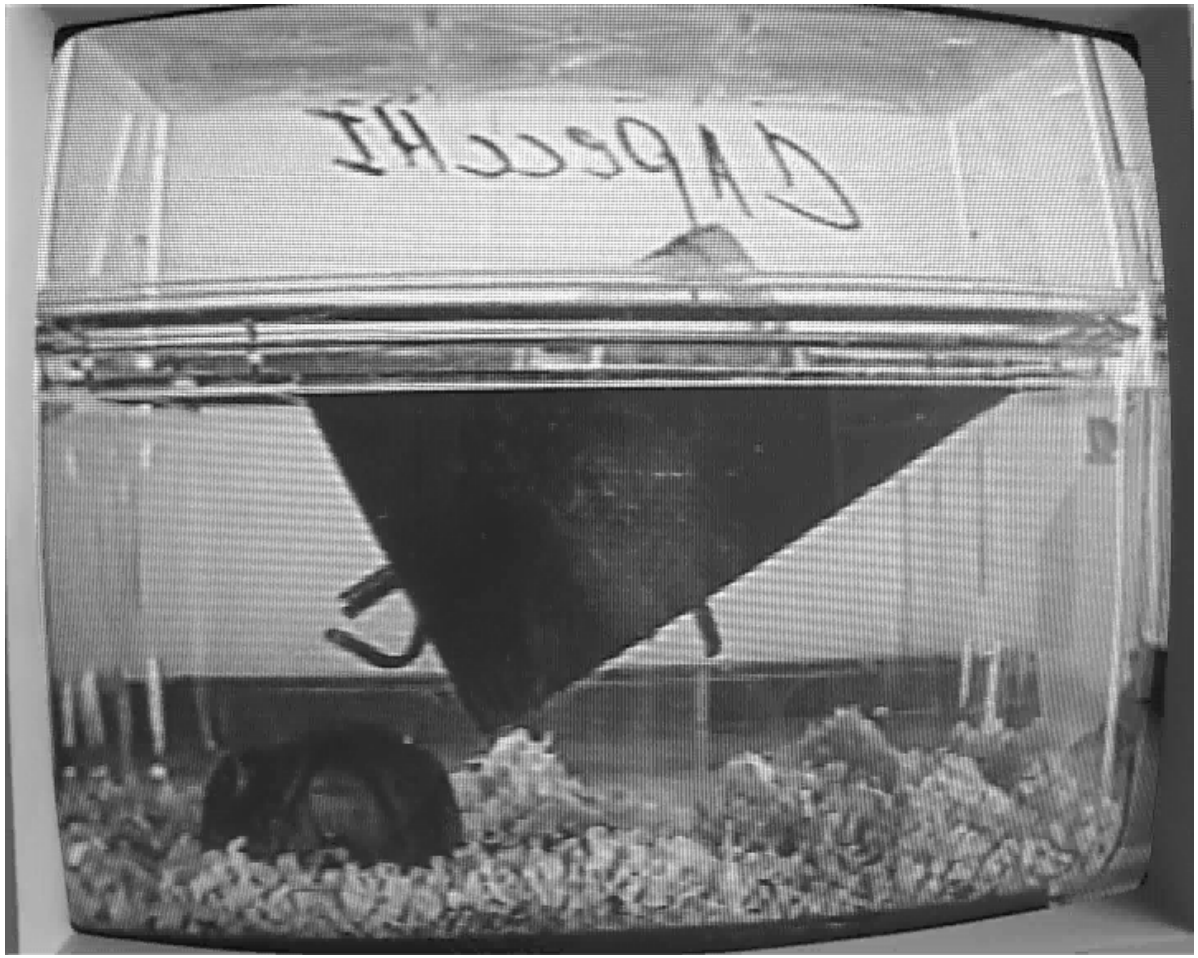
Needs to document time spent grooming, sleeping, eating, drinking, exploring, etc.

Takes video.

Person annotates.

➔ Can this be done automatically?

Mouse Behavior



General Issues

- Very broad subject
- How is it like others?
  - Industrial Computer Vision
  - Medical Image Analysis
  - Computer Graphics (behavior synthesis)
  - …
- Need to understand:
  - Behavior
  - Behavior analysis
  - Role of computer vision

What is Behavior?

- How something acts
- What it does

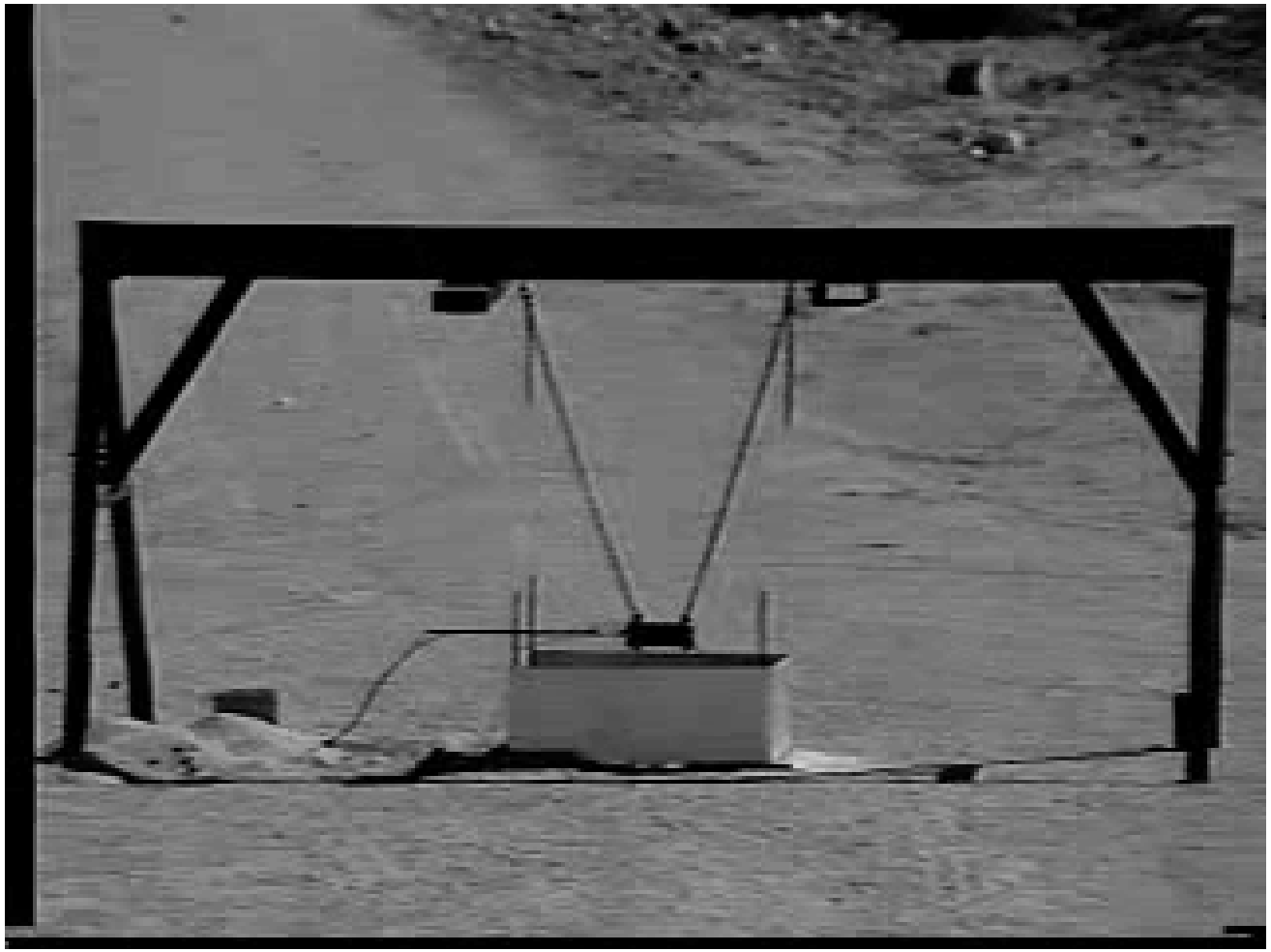
Physics:

- Observe nature
- Model observations [mathematics]
- Predict/exploit

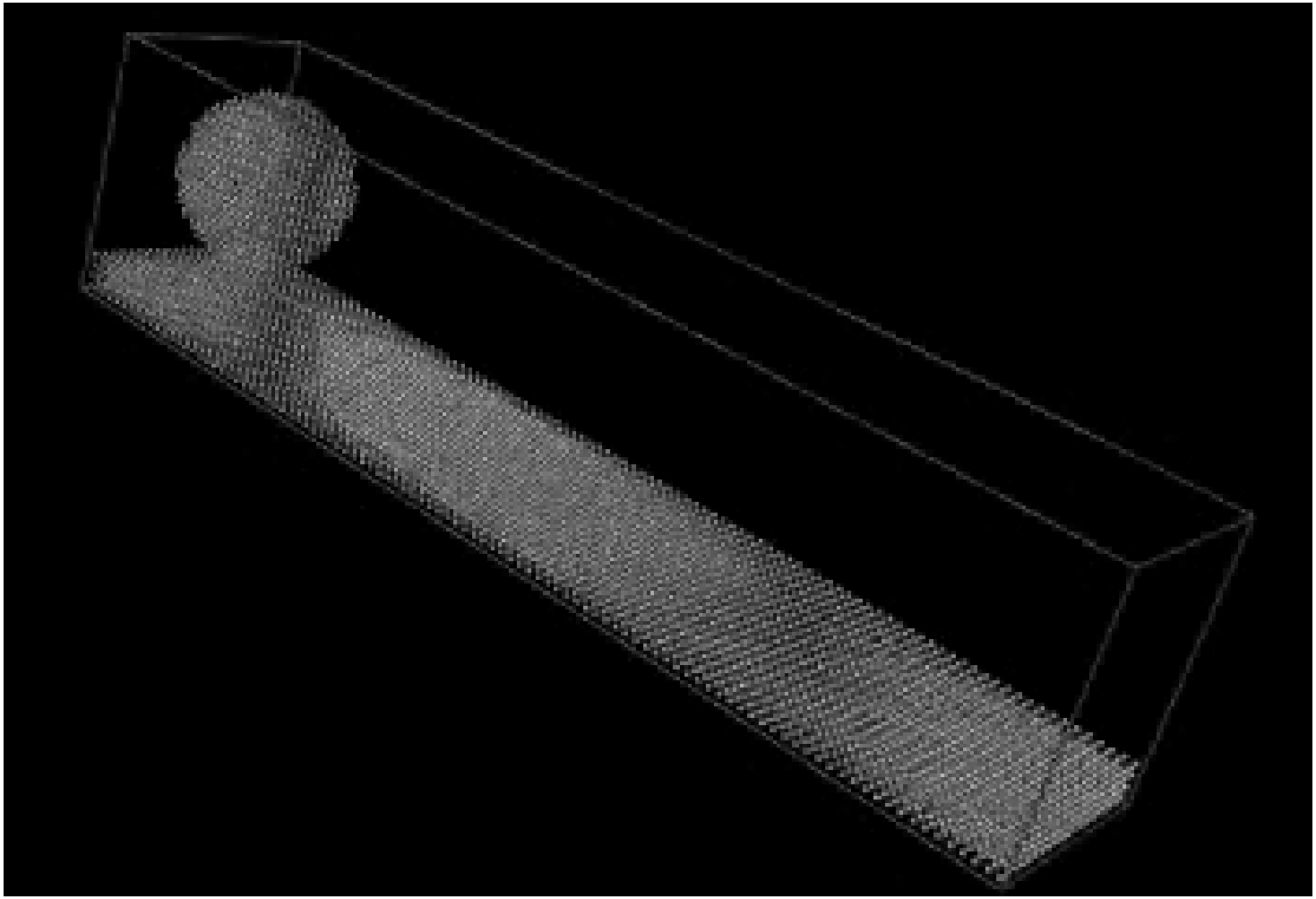
People use naïve/qualitative physics

E.g., how liquids work, how things are stable, how to move things

Physical Behavior



Physical Behavior Simulation



What is Behavior?

Animals:

- Observe nature
- Model observations [ethology]
- Predict/exploit [traps, hawk silhouette on window, commercials

Programs:

- operations are units of behavior
- behavior is actions and reactions of object
- designed to behave certain way [semantics]

Physical/Program

What is Behavior?

Temporal sequence of activity

Includes:

- Physical aspect (position, orientation, …)
    - Context (relation to environment)
- Temporal aspect
    - Context
- Mental/State Aspects (goals, etc.)

Very problem dependent! Is there a good abstraction or generalization?

Computer Vision Issues

- Video Sequences
- Segmentation
- 3D Reconstruction

Need to:

- Extract physical parameter of agents
- Extract physical relations between agents and world
- Extract segments
- Extract temporal sequence

➔ Need to solve the general 3D vision problem!

Applications/Topics

1. Animal Tracking
    1. Ants
    2. Poultry
    3. Rodents
2. Human Gesture
3. Human Facial Expressions
4. Human Physical Tracking
5. Human High-Level
    1. Social
    2. Obs Models
    3. Imitative
    4. Waibe
6. Tools
    1. Nagel
    2. Ethovision
    3. Natural Setting
    4. Vid
7. Other
    1. Roads
    2. Crowds/Graphics
    3. Pedestrians

What to Do?

1. Look over topics (i.e., papers on web)
2. Propose 1 or 2 topics (send email to tch)
3. Get topic settled (receive email from tch!)
4. Read appropriate survey
5. Read papers on topic
6. If necessary, read other papers, references in bibliography
7. Develop report; i.e., describe:
    a. How papers fit in survey framework
    b. What problem is posed
    c. What solution is proposed
    d. What methods are used
    e. What contributions are made
    f. What's missing, incomplete or unconvincing
    g. What is quality of work
    h. What are next questions to be studied
8. Hand in written report
9. Give oral report

Questions?