

# Sensing And Decision Making With Social Learning

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from a statistical signal processing/stochastic  
control viewpoint



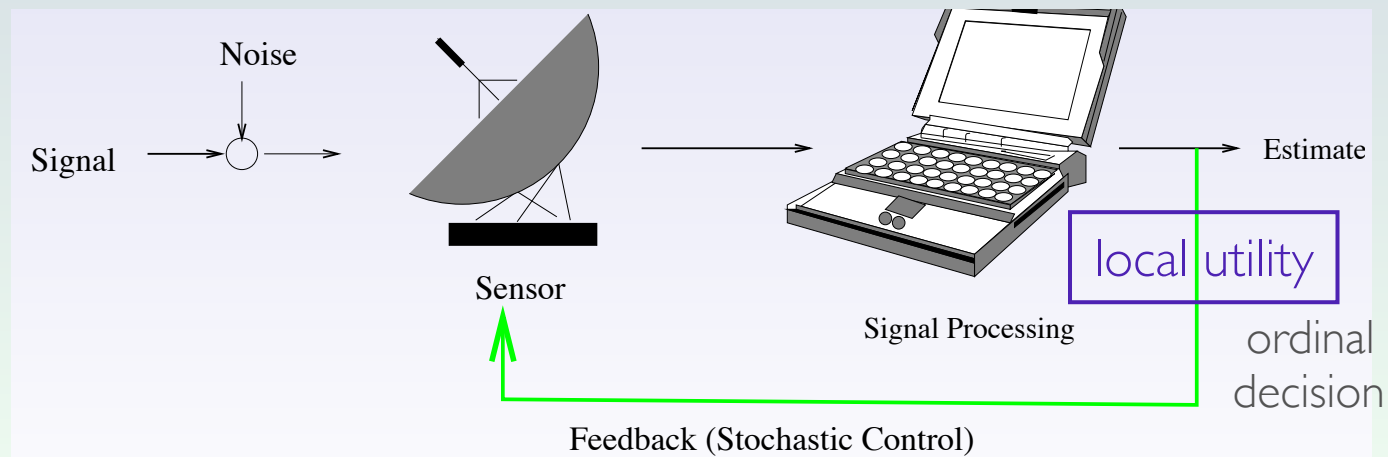
# SOCIAL SENSORS

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- Social sensor: Provides information about environment to a social network after interaction with other agents.
  1. Social Sensors influence each other over a network
  2. Social Sensors have dynamics: learn from past decisions and decisions of others
  3. Social Sensors are rationally inattentive.

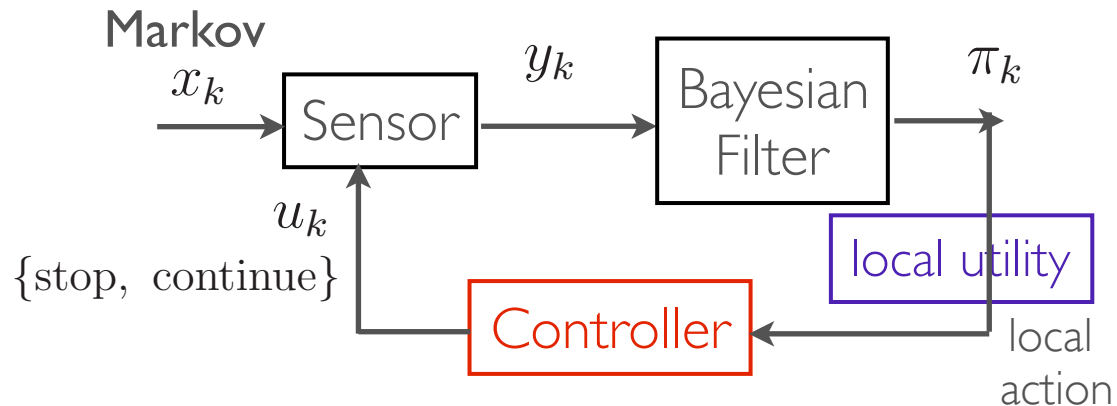


Social learning results in herding - suppose we close the loop.

Q1. How do Local and Global Agents Interact in decision making?

Q2. How to optimize Social Learning to delay herding?

Q3. How to price a product?



# Q1. HOW DO LOCAL & GLOBAL DECISION MAKERS INTERACT?

**Example: Multiagent Quickest Change Detection**



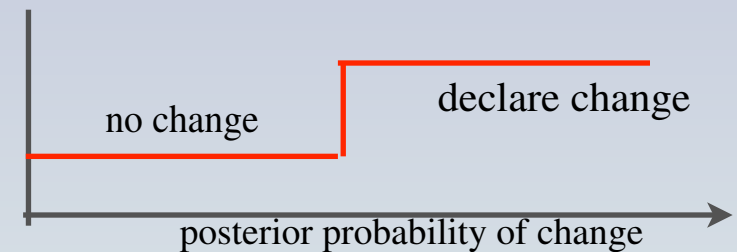
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Observations  $y_k \sim \begin{cases} B_1(\cdot) & k \leq \tau^0 \\ B_2(\cdot) & k > \tau^0 \end{cases}$ , where  $\tau^0 = \text{change time (usually geometric)}$

**Aim:** Compute time  $\tau$  to announce change: **Minimize**  $\mathbb{E}_{\pi_0}^{\mu} \left\{ \underbrace{d|\tau - \tau^0|^+}_{\text{delay}} + \underbrace{f I(\tau < \tau^0)}_{\text{false-alarm}} \right\}$

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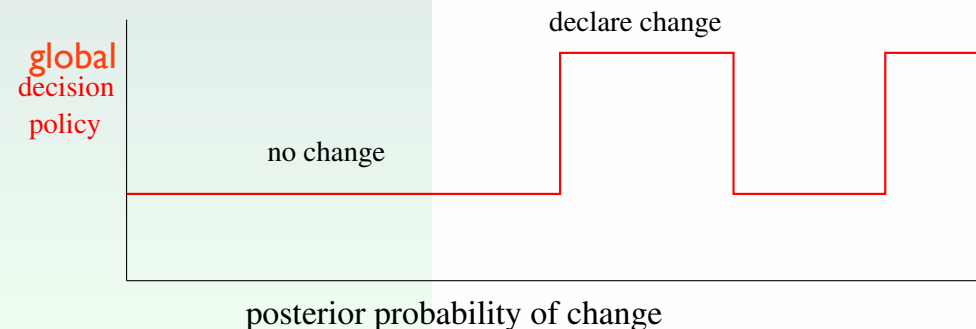
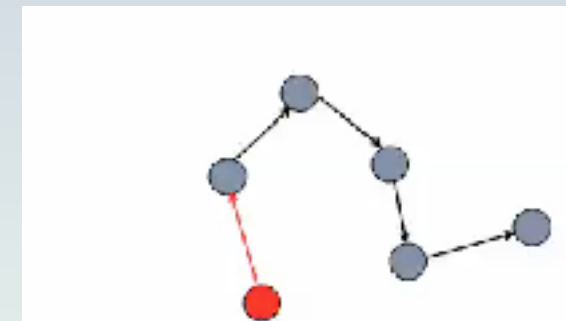
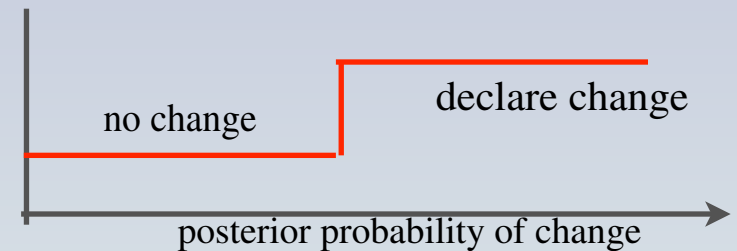
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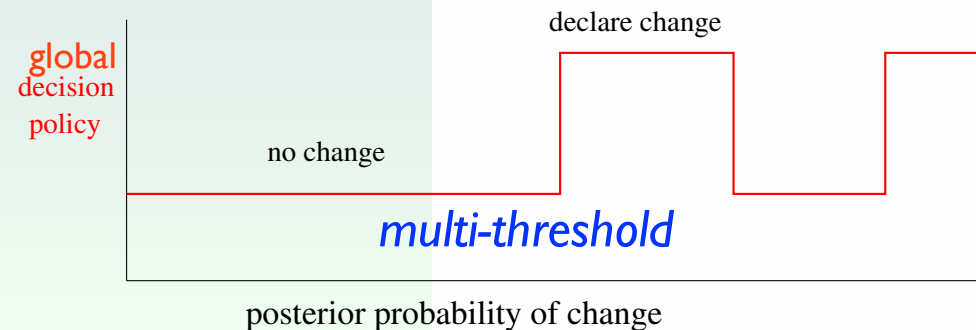
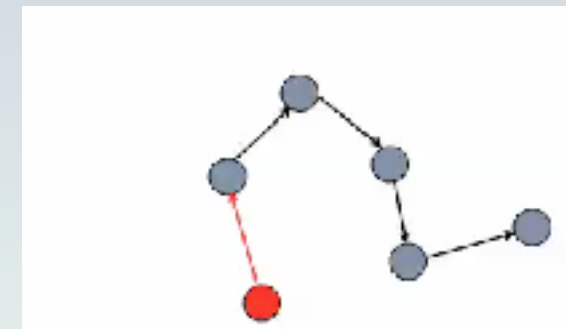
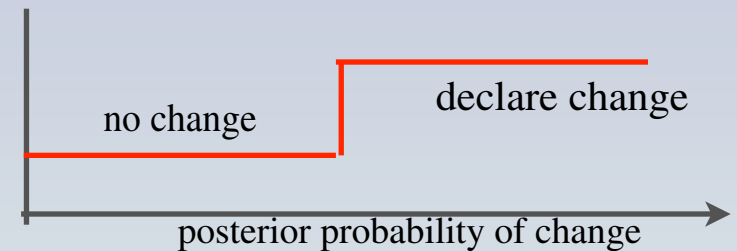
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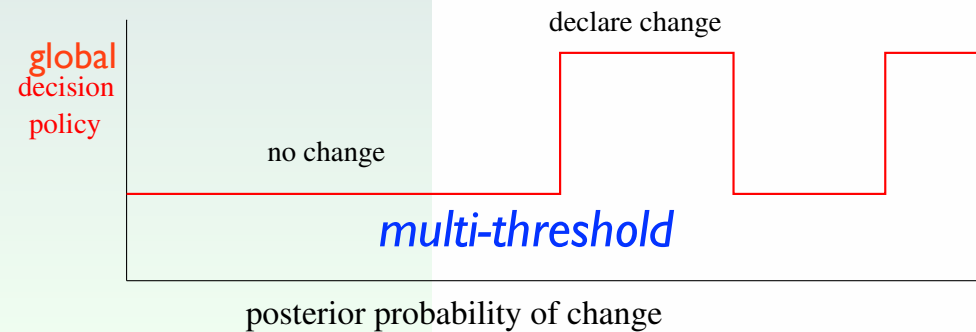
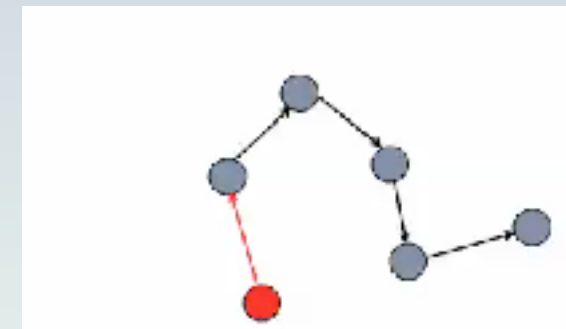
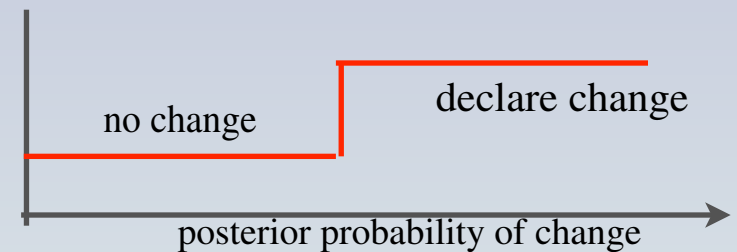
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.Stopping set is non-convex



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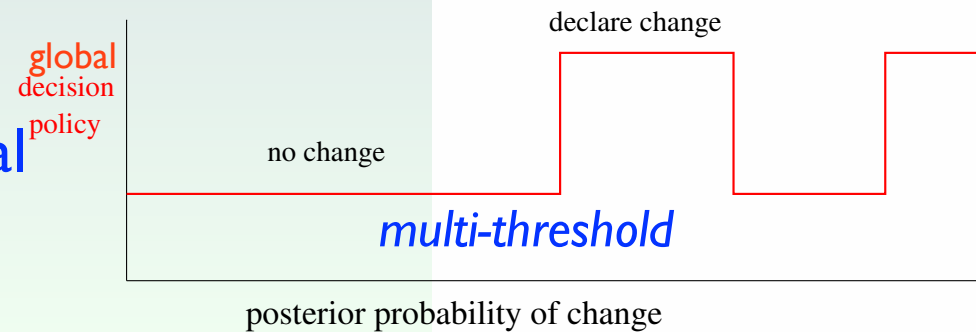
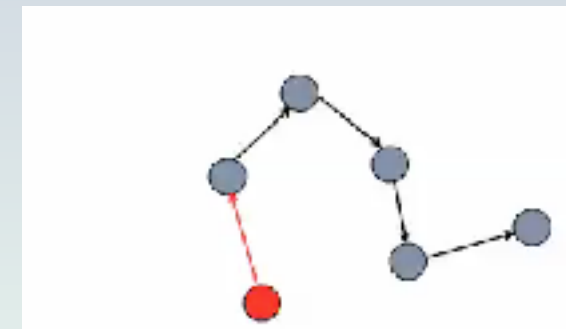
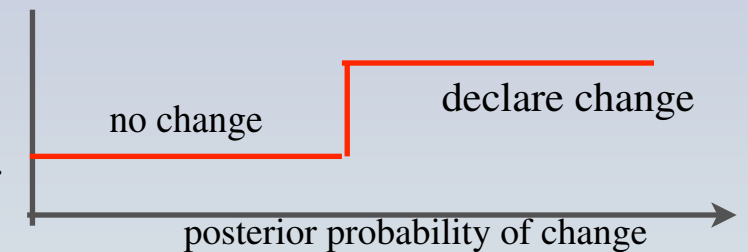
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**Summary: Global Decision making using local decisions is non-monotone!**



# REFERENCES

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