NRI: INT: COLLAB: Co-Robotic Systems for GeoSciences Field Research

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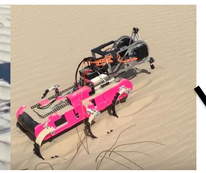
This work anticipates a near future where humans and robots operate in coordination to explore, collect data, and test hypotheses on Earth, and other planets.

THE CHALLENGE

Locomotion in sand

Science exploration HRI

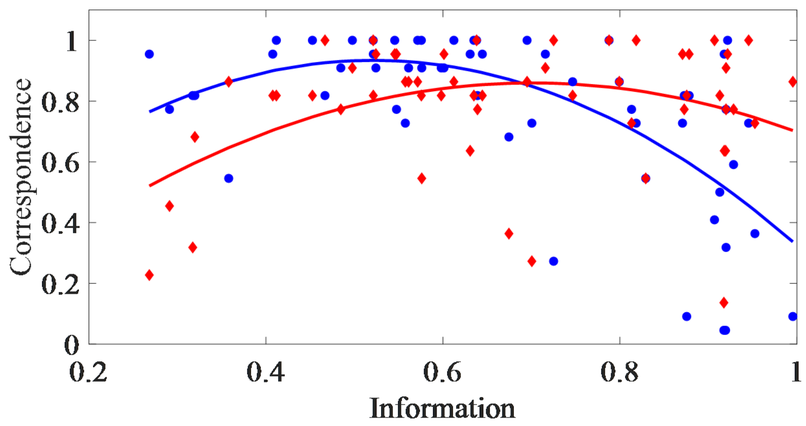


Complex sediment transport processes

SCIENTIFIC & BROADER IMPACTS

- Direct-drive robotic leg to allow precise measure of soil strength and environment-aided locomotion
- Multi robot team to help human scientists isolate and model dependence of soil strength on different environment controls
- Simulated field scenario to explore data collection behavior and objectives amongst disciplinary experts
- *Computational models translating abstract human expert objectives into quantitative actions, rendered as scripts executed by mobile robot field assistants to aid in real-time data collection*

Correspondence of computational models at predicting expert data collection decisions in simulated field scenario



Maximize Spatial Information Reward

$$I_s(l_t) = \sum_{l \in l_s} e^{\frac{-(l-l_t)^2}{2\beta_1^2}} \times e^{\frac{-1}{2\sqrt{n}}}$$

l_t: Targeted Location; l_s: All Sampled Location; $\frac{-(l-l_t)^2}{2\beta_1^2}$: Indirect Information Inference; $e^{\frac{-1}{2\sqrt{n}}}$: Diminished Information Gain

Maximize Discrepancy to Invalidate

$$R_d(l) = \int_{m=m_{min}}^{m_{max}} P_m(l) \int_{s=s_{min}}^{s_{max}} P_s(m) * D(m_c)$$

l: Targeted Location; $P_m(l)$: Moisture Distribution Given Location; $P_s(m)$: Shear Strength Distribution Given Moisture; $D(m_c)$: Measured Discrepancy

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