TRACS: Center for Theoretical Research and its Applications in Computer Science (An Overview)

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1. Possible Problems: General View

- Intelligent human activity:
  - find the state of the world – *science*
  - make decisions based on this analysis – *business*
  - design new things, new objects, new configurations – *engineering*

- Common problems:
  - uncertainty
  - complexity
2. Our Expertise

- Find the state of the world:
  - data processing: \( y = f(x_1, \ldots, x_n) \);
  - measurement uncertainty: \( \Delta x_i \overset{\text{def}}{=} \tilde{x}_i - x_i \neq 0 \);
  - problem: how \( \Delta x_i \) affects \( \Delta y = \tilde{y} - y \);
  - tools: traditional statistics, interval computations, etc.
  - who: Kreinovich, Ceberio

- Make decisions based on this analysis:
  - traditional approach: \( M_p(a) \overset{\text{def}}{=} \sum p_i \cdot u_i(a) \rightarrow \max \);
  - uncertainty: in \( p_i \), in \( u_i(a) \)
  - example: worst-case analysis \( M_P(a) = \max_{p \in P} M_p(a) \)
  - general case: non-linear (“fuzzy”) measures \( M_P(a) \)
  - who: Modave

- Design new things, new objects, new configurations:
  - general case: find \( x = (x_1, \ldots, x_n) \) that satisfies several constraints \( f_i(x) \geq 0, f_j(x) = 0 \)
  - problem: constraints are “soft"
  - who: Ceberio

- Complexity: Longpré
3. Application Areas

• Current Application Areas – with examples:
  
  – Geoinformatics:
    * eliminating duplicates and outliers in gravity databases
  
  – Structural Integrity of Aerospace Structures:
    * detecting and locating faults
  
  – Security and Privacy:
    * maintaining privacy in a statistical database

• Developing Application Areas:
  
  – Bioinformatics
  
  – Transportation
  
  – ?