INF367 25H: Selected Topics in Artificial Intelligence

Diamonds and Rust in the AI Treasure Chest

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Plan for today

- Recap from last lecture
- Dimensionality
- Support Vector Machine

Dimensionality

Dimensionality

Curse

- **Curse of dimensionality**
  - Intuitions on relative proportionality and similarity break down beyond 3D
    - Examples of relative density of data points in unit d-cubes for larger d
    - Examples with d-dimensional sphere with respect to the unit d-dim. cube

Dimensionality

Reduction

- **Dimensionality reduction** helps in scenarios where less dimensions are better
  - Attribute or feature selection (manual, or informed by some method)
  - Transformation into lower-dimensionality space, e.g. via PCA
- Having less dimensions may help, for example,
  - to have less computations involved e.g. for k-nn
  - to visualize after reducing to a d-dimensional space, d <= 3

Support Vector Machine

Support Vector Machine (SVM)

Summary of the general approach

- If data is linearly separable:
  - Use Vapnik algorithm of support vectors to find the (weight vector characterizing the) optimal hyperplane, e.g. with Lagrange multipliers
- If data is not linearly separable:
  - Project data into a higher-dimensional space with linear separability
  - Apply Vapnik algorithm on those projected vectors
    - Avoid its costly dot products going from original space to the result products via kernel trick