ASCLU – Alternative Subspace Clustering

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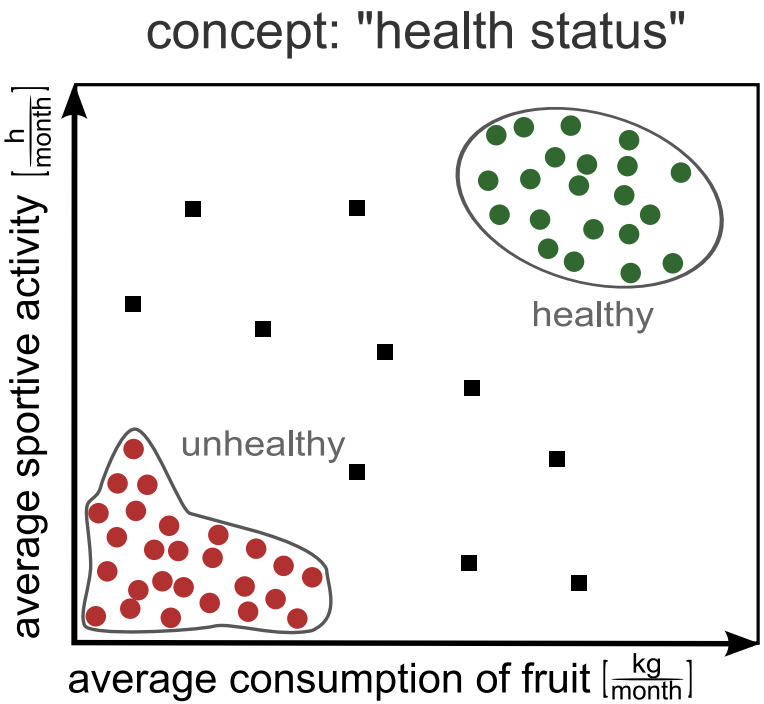
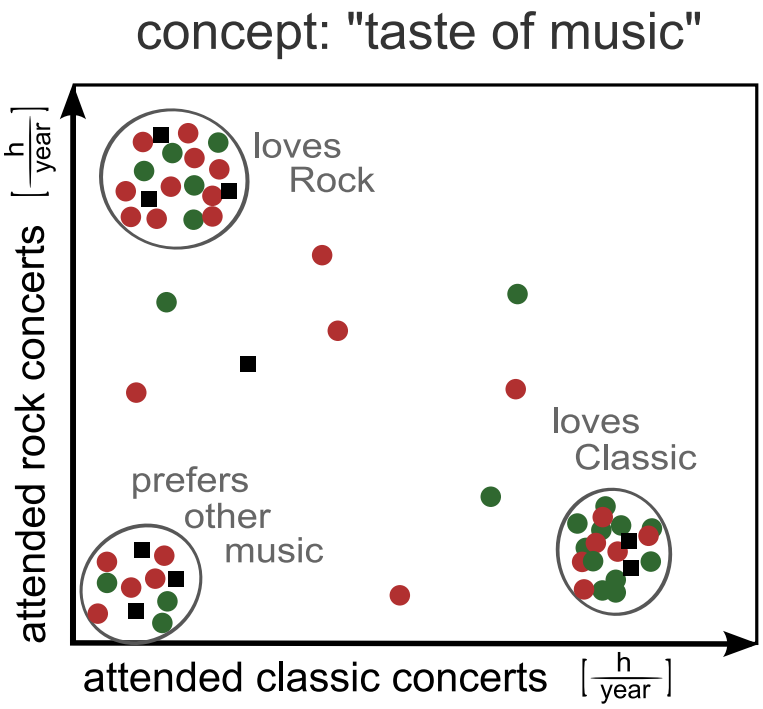
Why Subspace Clustering?



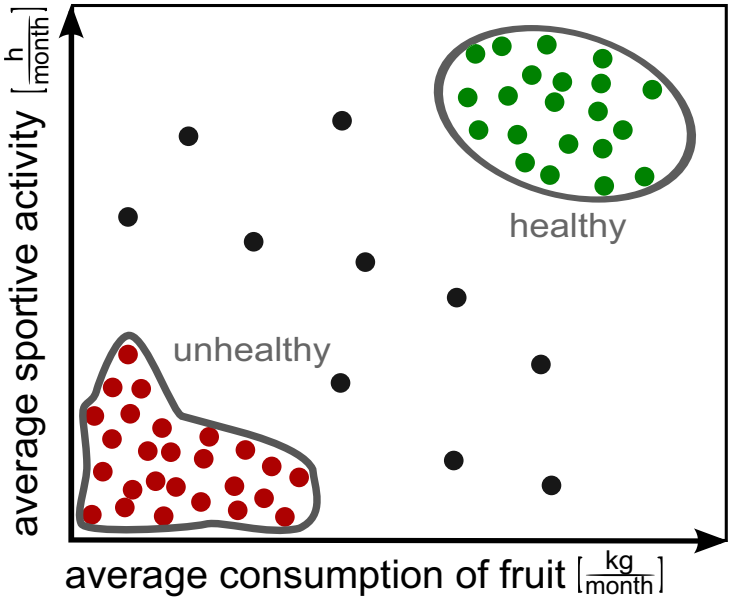


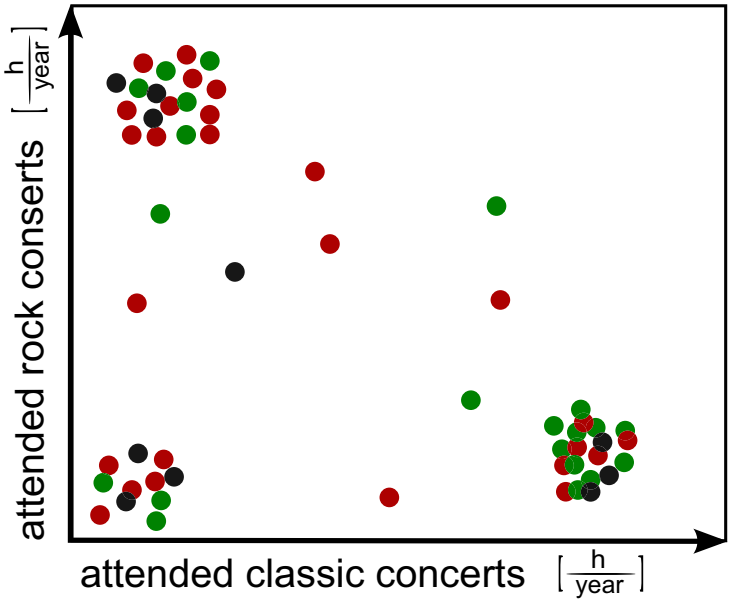
- data allows to be clustered through different perspectives
- each object in various groupings based on different attributes

⇒ multiple views due to locally relevant dimensions of clusters

⇒ subspace clustering

Why Alternative Clustering?





- often trivial groupings or already detected clusters given
- user not satisfied with previous results

⇒ aiming for alternative, yet comparable good groupings

⇒ avoid re-detection of already known clusters

→ combination of subspace clustering and alternative clustering

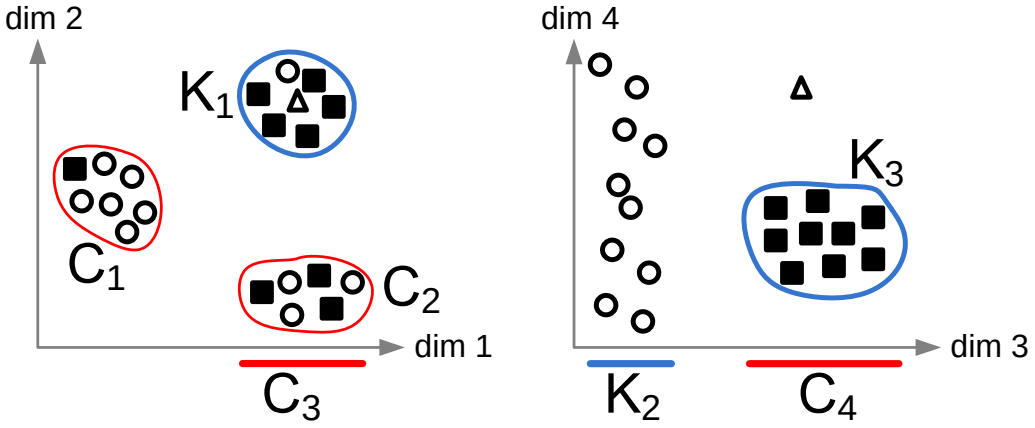
What To Do? – The General Picture

input: subspace clustering $Known = \{K_1, \ldots, K_m\}$

Cluster selection approach

set of possible subspace clusters *All*
$\rightarrow$ select optimal subset $Res \subseteq All$ fulfilling specific properties

- avoid redundancy
  $\rightarrow$ w.r.t. known clusters
  $\rightarrow$ among novel clusters
- select alternative clusters



Alternative Subspace Clustering Model – I

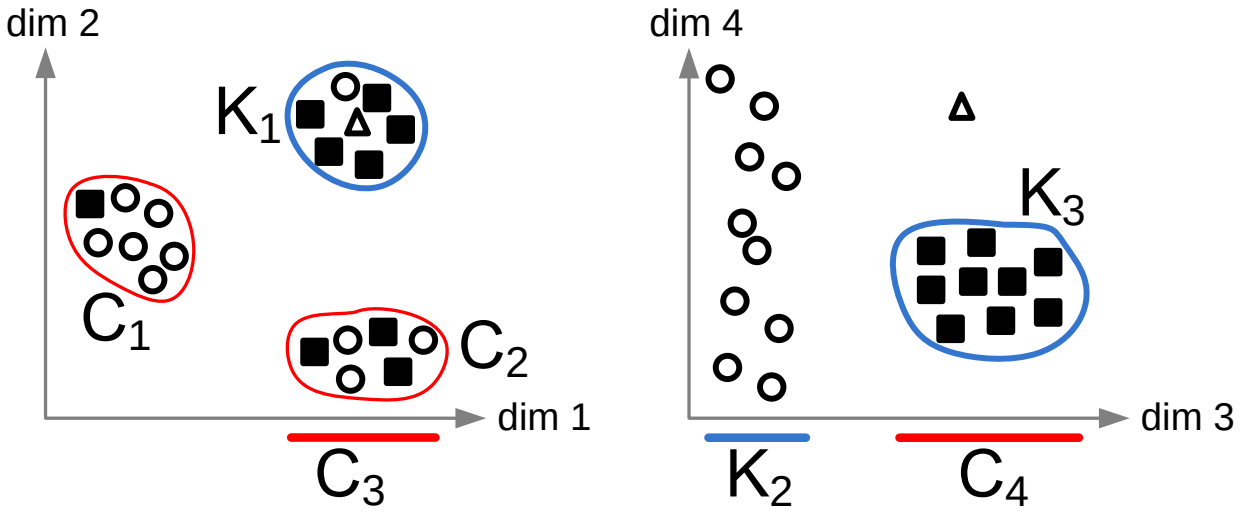
Each cluster $C \in Res \subseteq All$ should deviate from *Known*

1. deviating w.r.t. subspaces
   - known clusters in **alternative** subspaces are already different enough

$$InAlterSubspace(Known, C) = \{(O_i, S_i) \in Known \mid |S \cap S_i| < \beta \cdot |S|\}$$

2. deviating w.r.t. objects
   - known clusters in **similar** subspaces should cover different objects

$$\frac{|O \setminus CoveredInSimilar(Known, C)|}{|O|} \geq \alpha$$



Is C_1 an alternative to *Known*?

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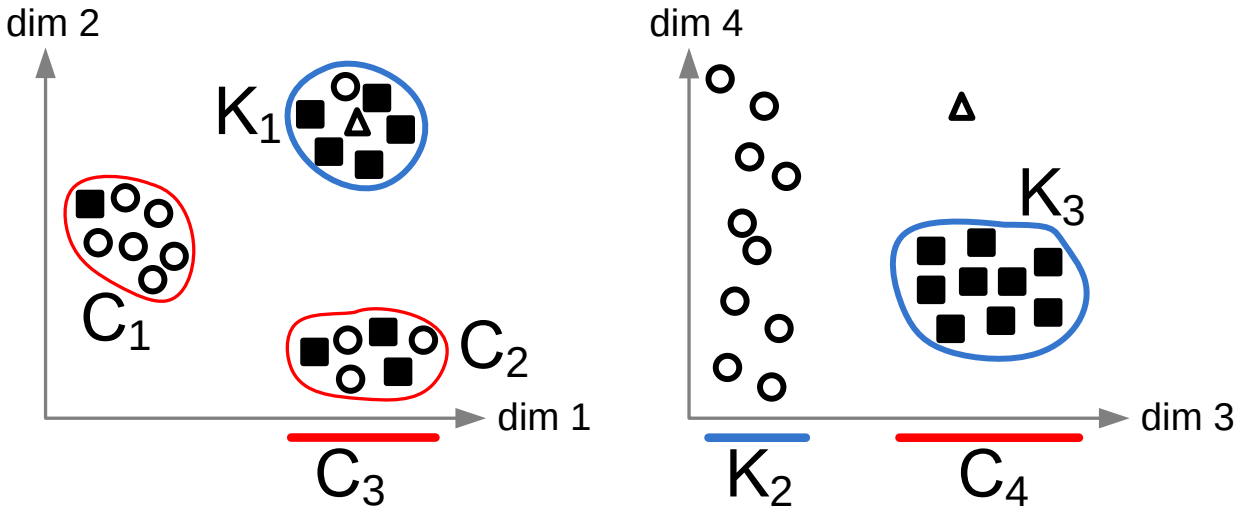
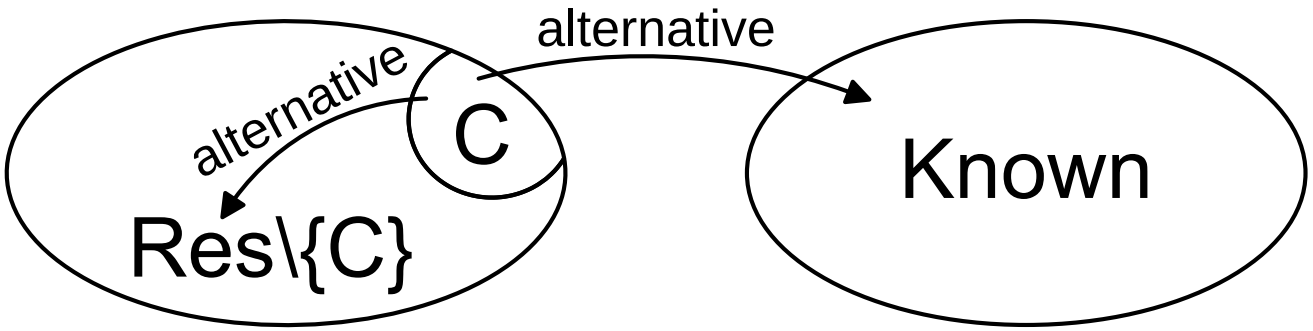


C_1 is a ***valid alternative*** to *Known*!

Alternative Subspace Clustering Model – II

Avoiding redundancy

- so far: $C \in Res$ different to given clusters $\Rightarrow$ non-redundant w.r.t. *Known*
- redundancy between $X, Y \in Res$ still possible
- solution: $C \in Res$ valid alternative to remaining novel clusters $Res \setminus \{C\}$



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Optimal alternative subspace clustering

Given previous clustering *Known* and set of possible subspace clusters *All*, choose $Res \subseteq All$ such that

1. $\forall C \in Res : C$ is a ***valid alternative*** to *Known*
2. $\forall C \in Res : C$ is a ***valid alternative*** to $Res \setminus \{C\}$
3. *Res* is the most interesting clustering fulfilling 1 & 2

Conclusion

ASCLU – Alternative Subspace Clustering

- ASCLU detects alternatives based on
  $\longrightarrow$ deviating subspaces
  $\longrightarrow$ deviating object sets
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Thank you for your attention.

Questions?