HARMLESS

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Combining models using Bayesian Networks

Combining mechanistic models with data to optimise predictive power

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Bayesian network analyses for exposure estimation

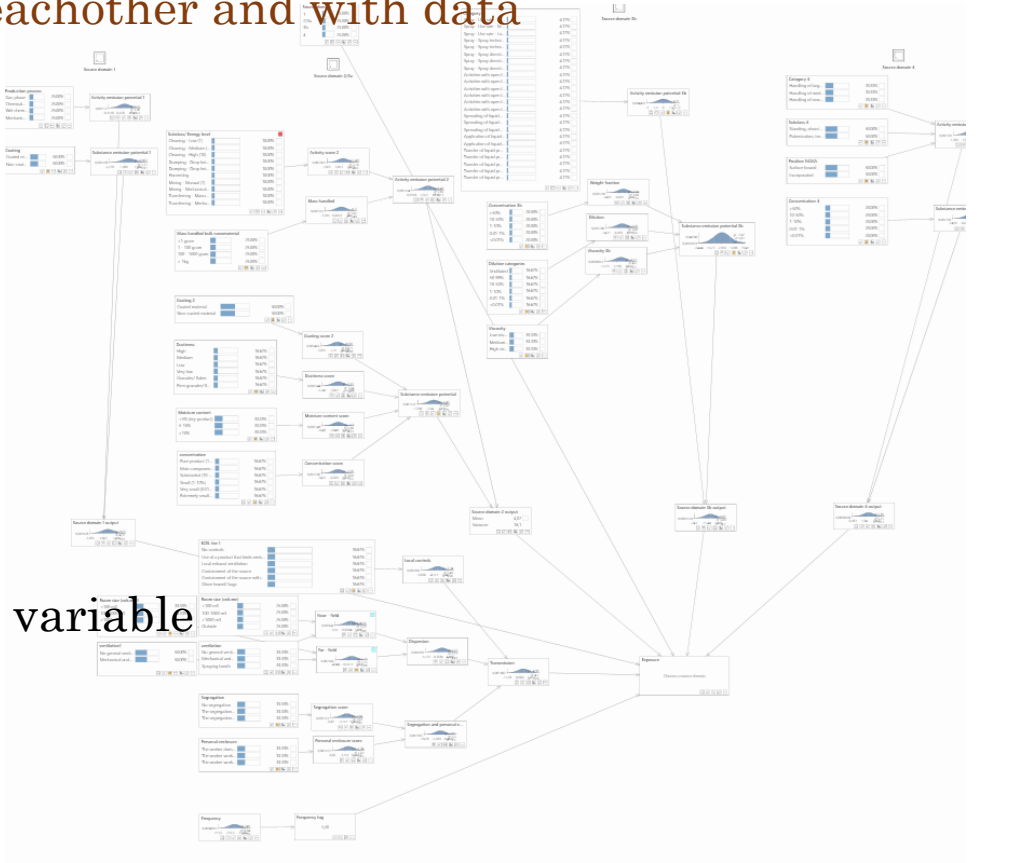
Combine existing Exposure models with eachother and with data

DAG: Directed Acyclic Graph
Nodes → variables
Edges → relations

How to:

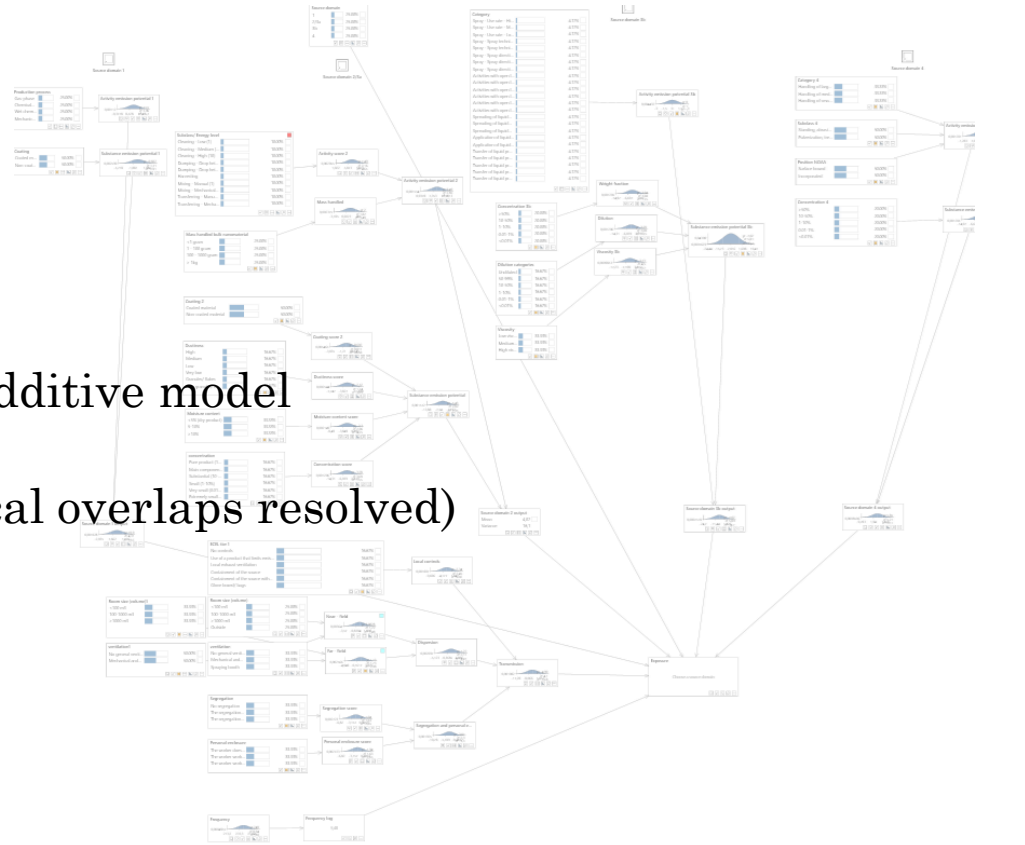
Combining networks:

1. Create two separate networks based on models
   - ➢ Create structural model with a node for each variable & edge for each relation
   - ➢ Create priors based on model coefficients
2. Identify overlaps and differences
3. Merge
4. Update with data
5. Evaluate results



Why Bayesian networks?

1. Allow for uncertainty
2. Allow for missing data
3. Can ‘grow’ with new models & data

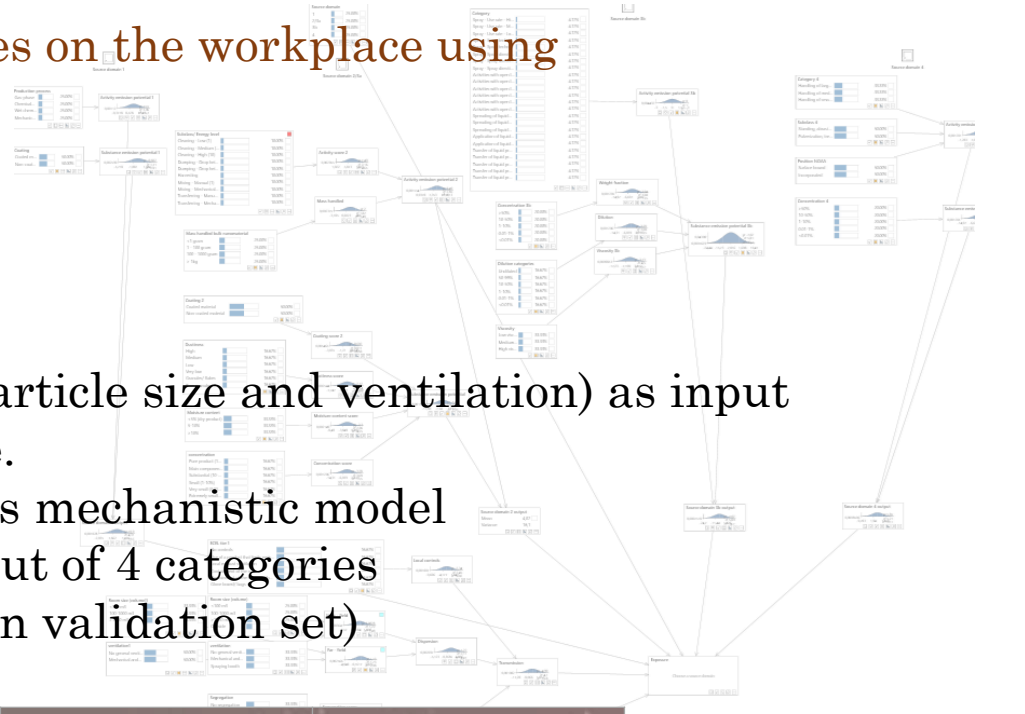


Challenges:

1. Model was multiplicative → Log transform for additive model
2. Similar but not equal variables
    1. Reparametrize where needed (e.g., categorical overlaps resolved)
    2. Transform input where needed

Results

Goal: Estimation of exposure to nanoparticles on the workplace using workplace properties.



80% was used for training
20% for validation
204 records available
→ Dataset of exposure descriptors (e.g. room size, particle size and ventilation) as input and measured exposure to nanoparticles as outcome.
→ General estimation same for non-trained model as mechanistic model
→ Trained model shows improved estimation for 3 out of 4 categories
→ 4th categorie had very few cases (total 10, 2 in validation set)

	Rows with valid predictions	Mean Absolute Error	Mean Squared Error	Variance
Updated network	**50 in 50 records**	**2.27**	**7.76**	**5.76**
Original network	**50 in 50 records**	**3.01**	**15.41**	**25.77**

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