
INSTITUT TEKNOLOGI BANDUNG
1920

Modul 5: Classification

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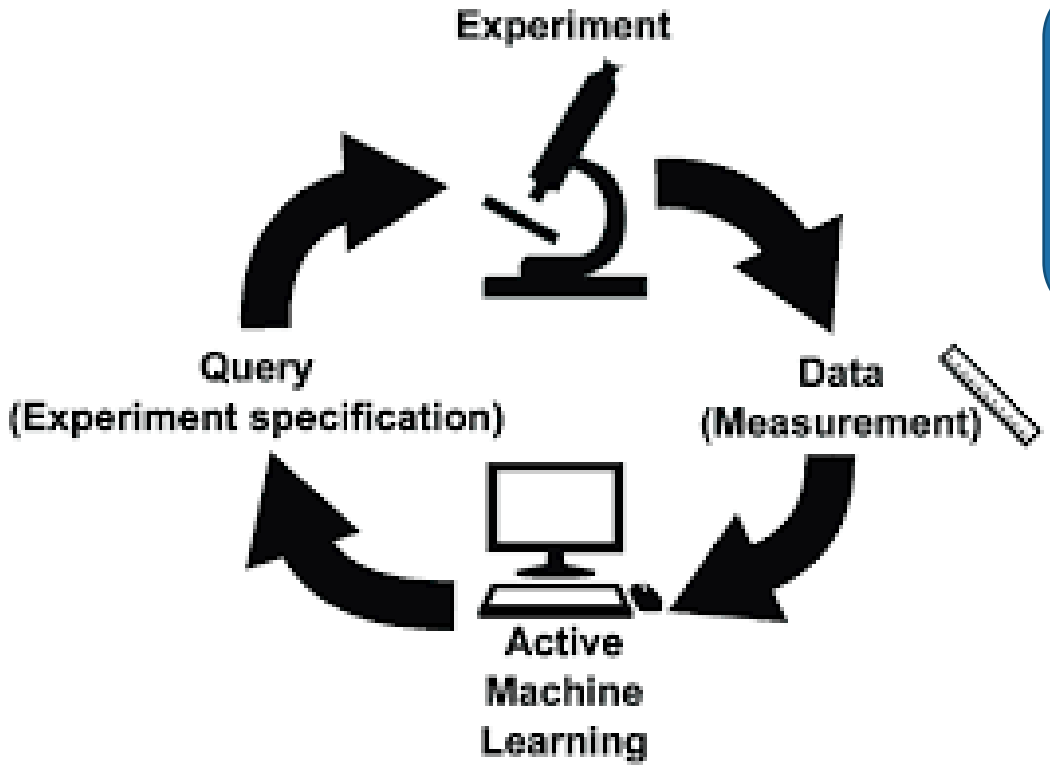
02 Design of Experiments

Pengenalan Pola
(*Pattern Recognition*)

Design of Experiment: What



An experiment is a test or a series of tests where we play with the factors that affect the output.

- Factors may be the algorithm, training set, input features, etc.
- Observe the changes in the response (performance measure) to be able to extract information.

Design and analysis of machine learning experiments:
https://www.cs.purdue.edu/homes/neville/courses/573/readings/08_design-and-analysis-expts.pdf

Design of Experiment: Why

No free lunch theorem (Wolpert, 1995)

Need systematic experiment

manage the experiments you have done, that are running, and that you want to run

Average applied machine learning project may require tens to thousands of discrete experiments

Machine learning experiments can take a long time.

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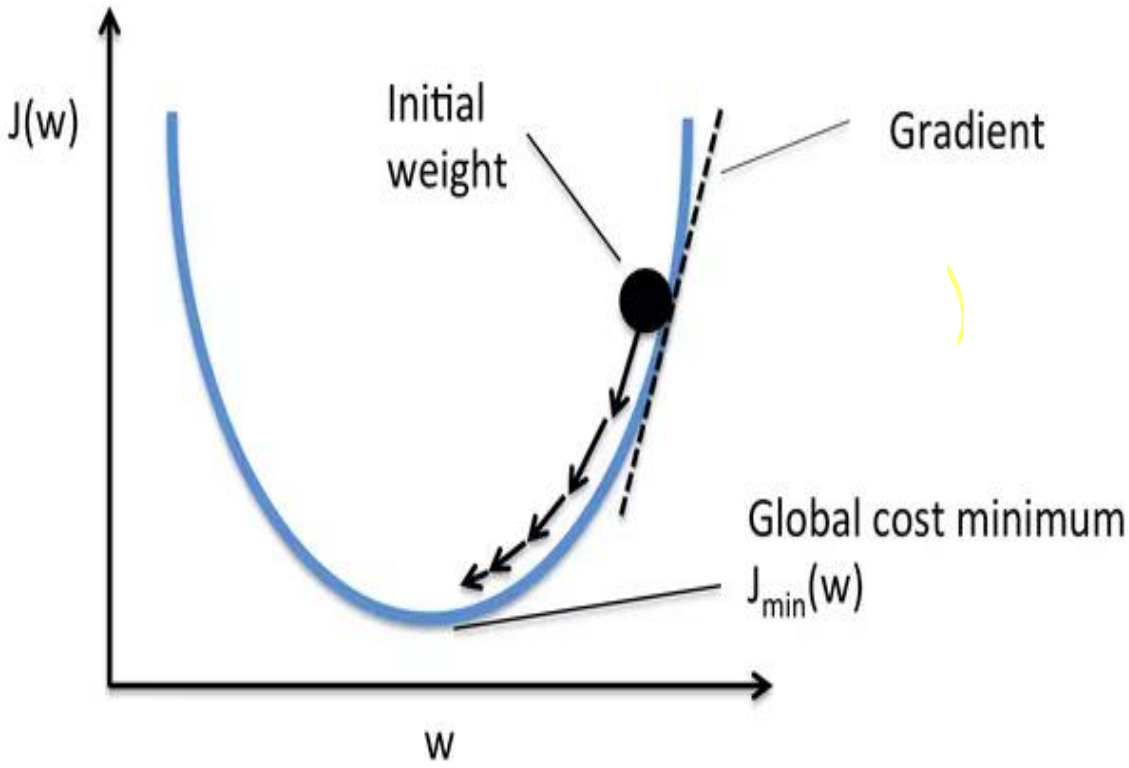
Design of Experiment: Aim



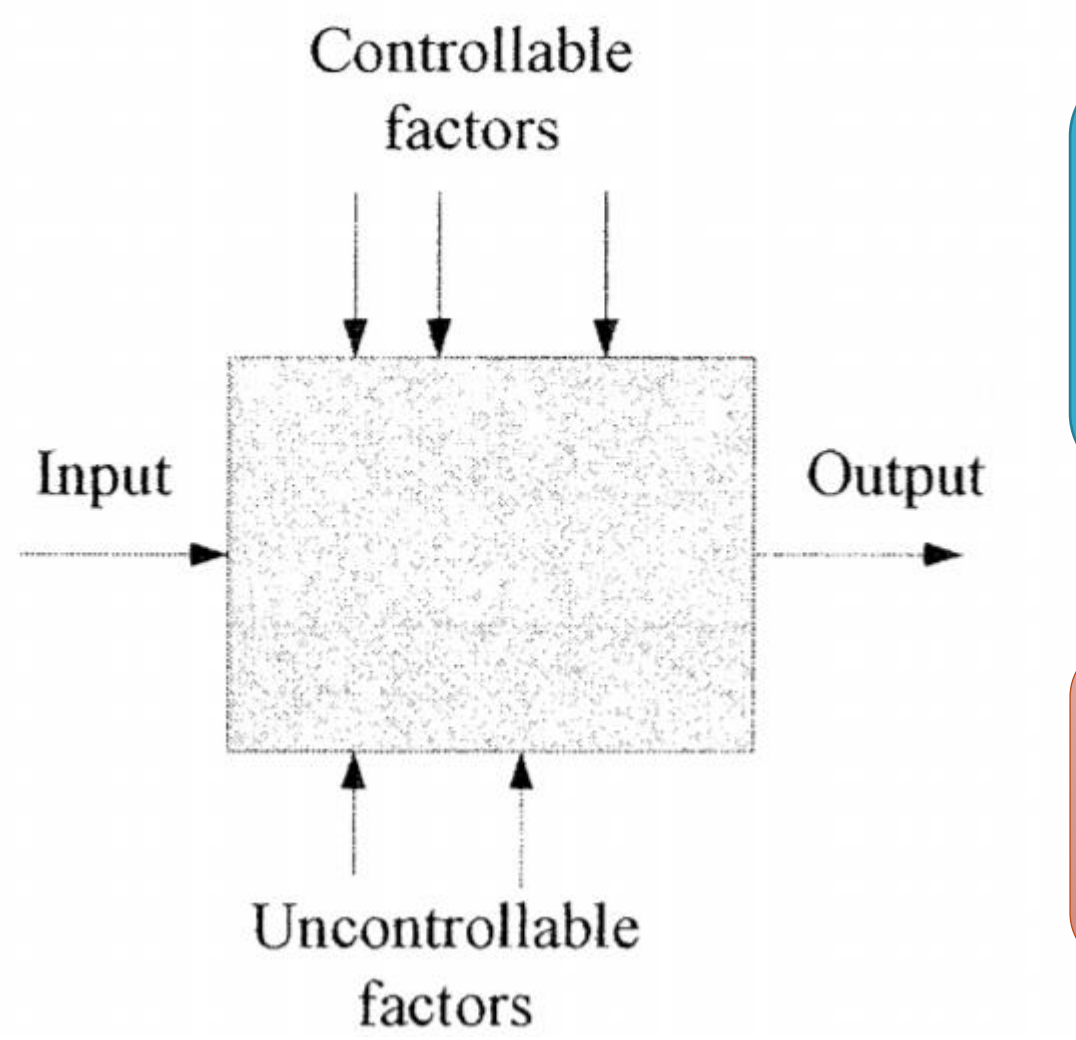
https://medium.com/data-science-group-iitr/loss-functions-and-optimization-algorithms-demystified-bb92daff331c

identify the most important factors, and remove the unimportant ones

find configuration of the factors that optimizes the response

ML: highest generalization accuracy, minimal complexity, and robust

Experimental Factors



Controllable factors: learning algorithm, algorithm parameters, dataset, input representation, feature set.

Uncontrollable factors: noise in the data, resampling data, randomness in initial state

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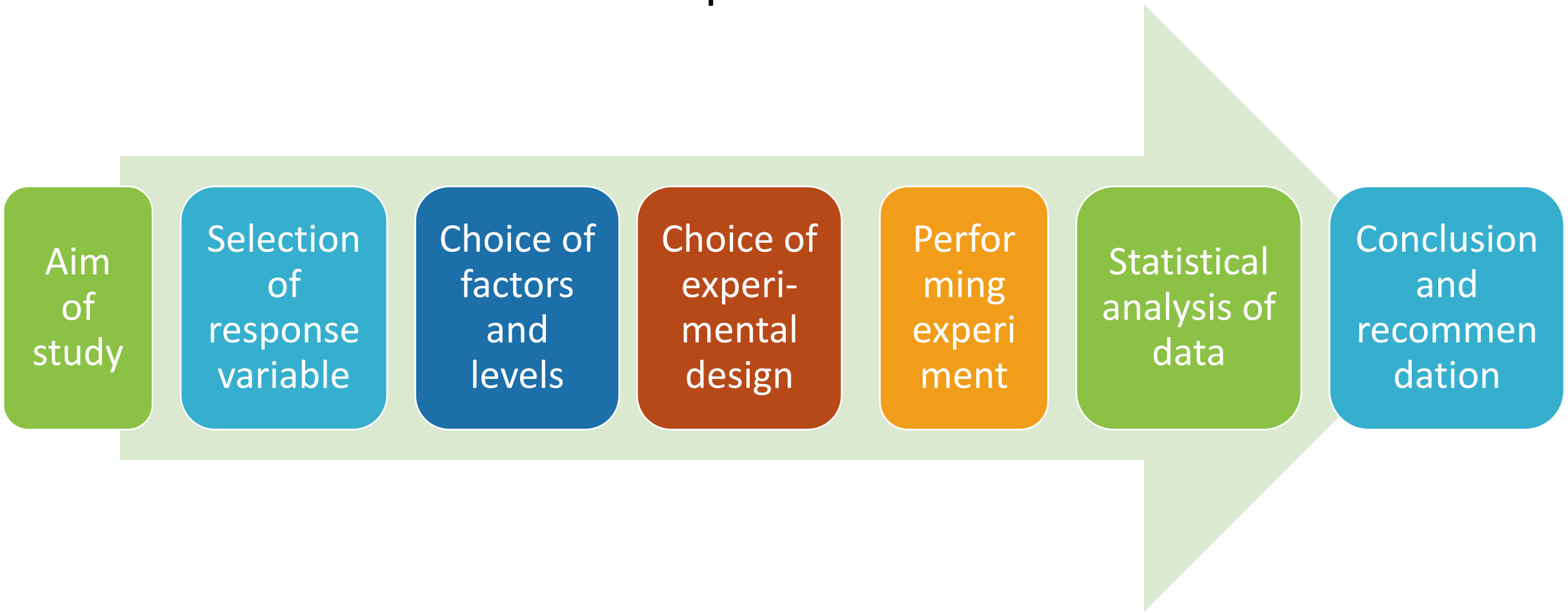
Guidelines for ML Experiments



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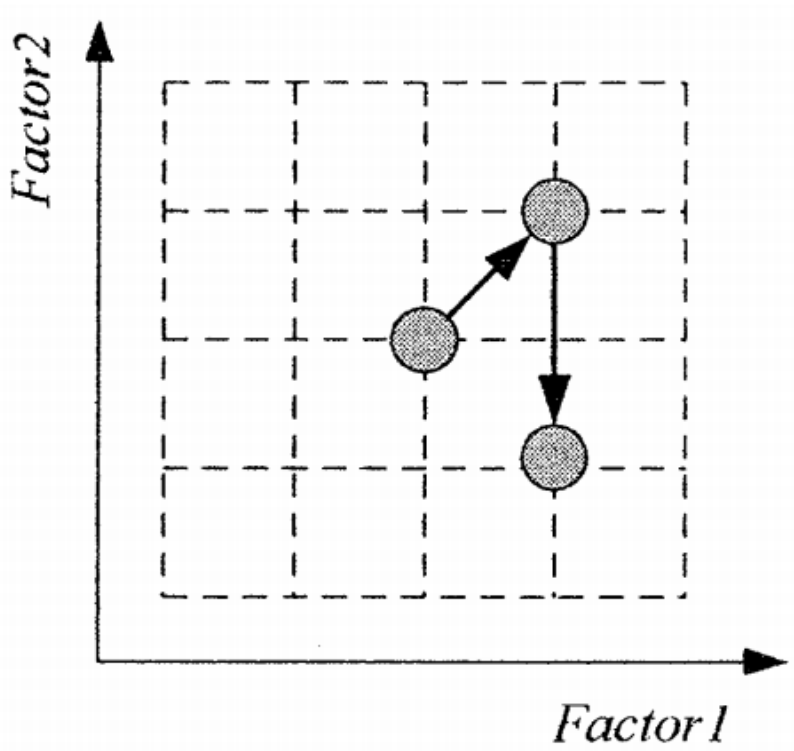
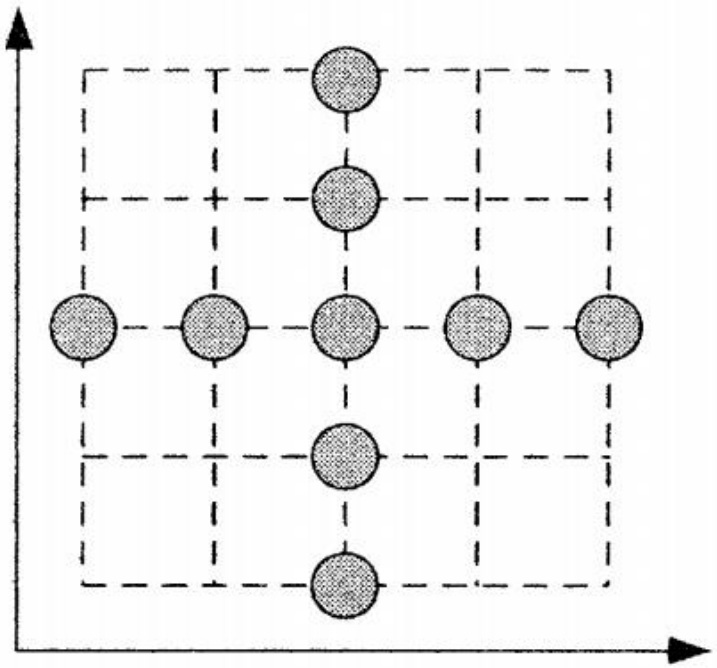
Strategies of Experiments

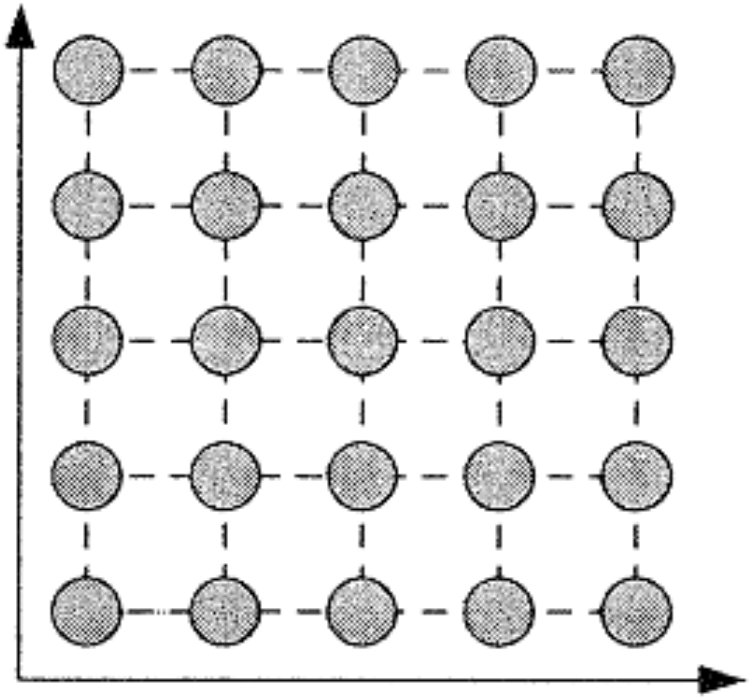
Two factors and five levels each



Best Guess



One Factor at A Time



Factorial Design / Grid Search

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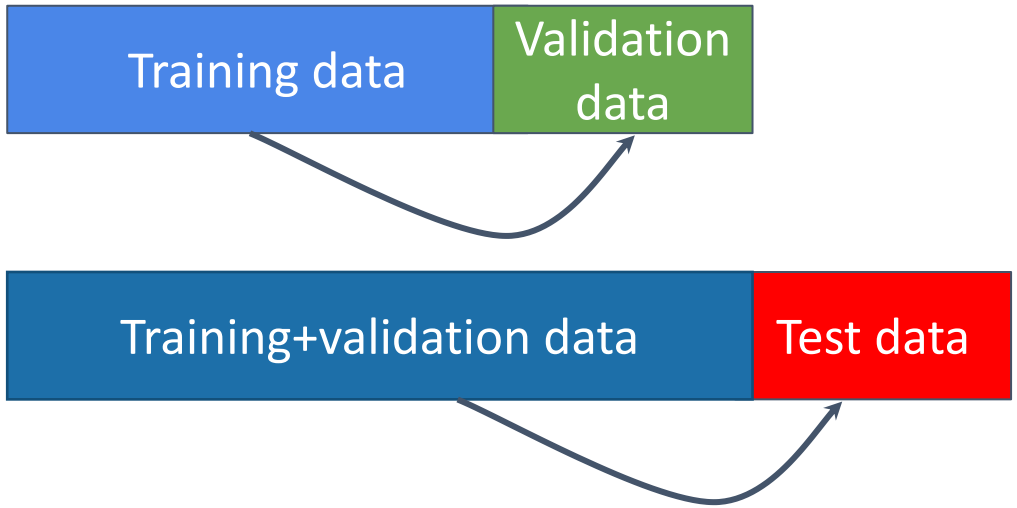
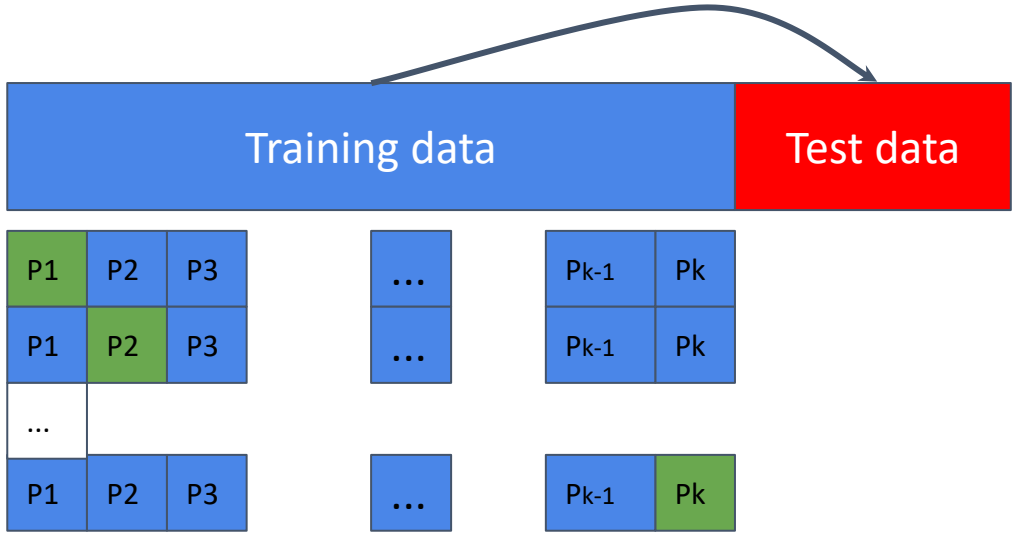
Validation Schematic

Hold-out validation

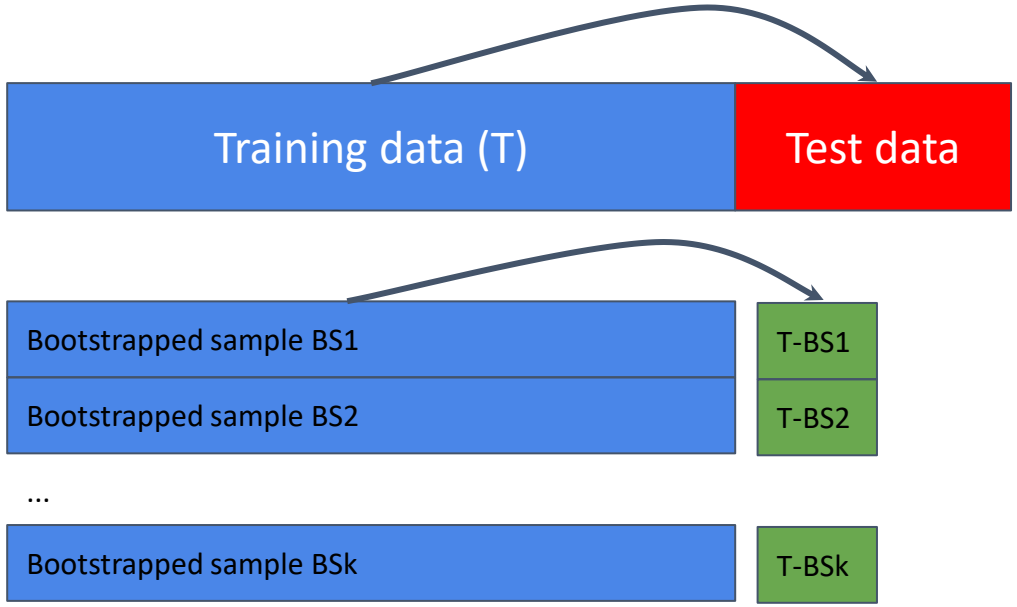


K-fold cross validation

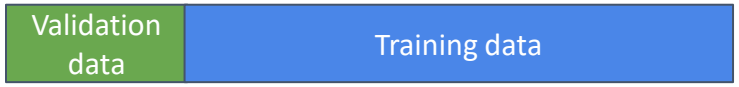


Validation Schematic: Bootstrap validation

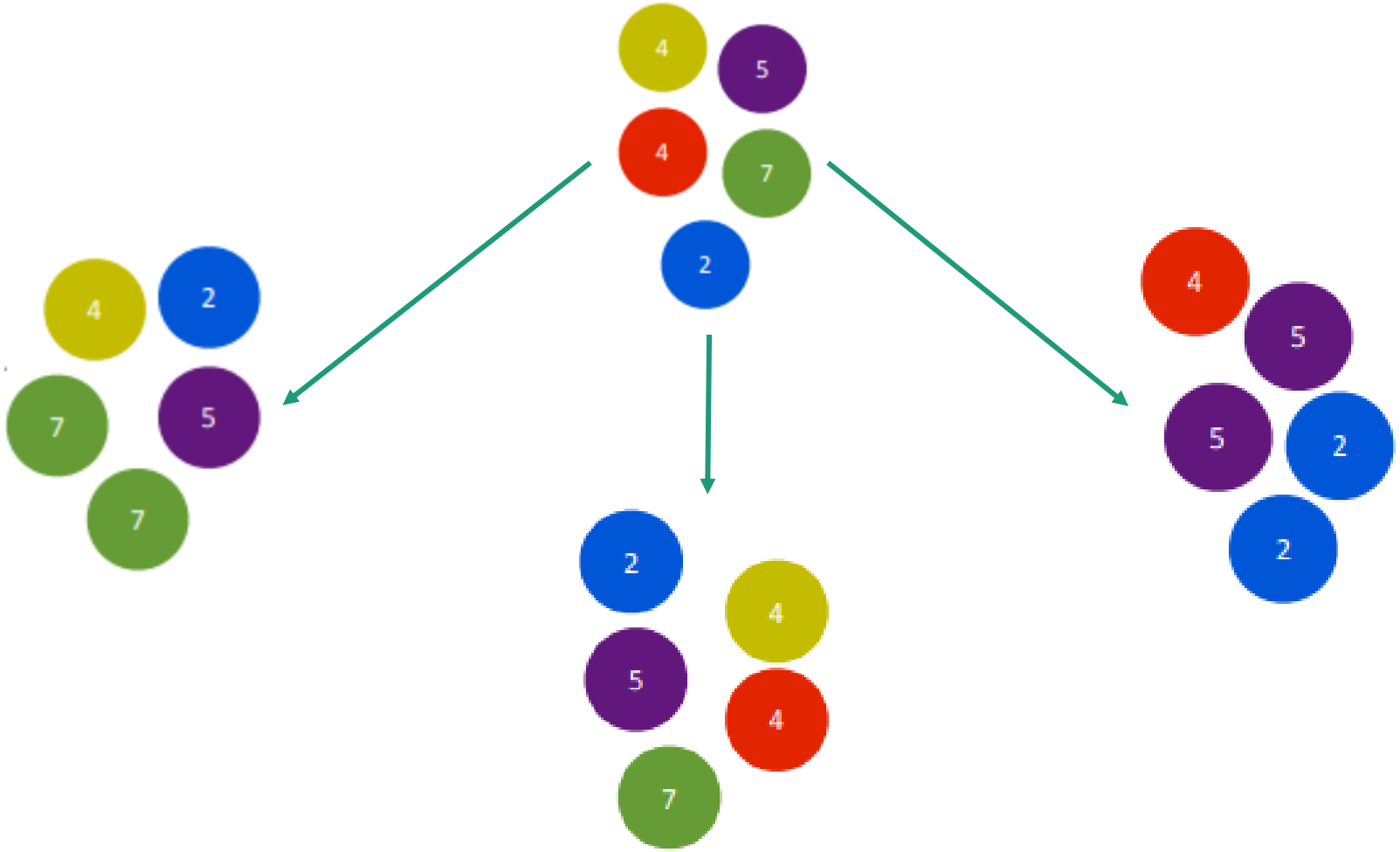
resampling with replacement



Keterangan:

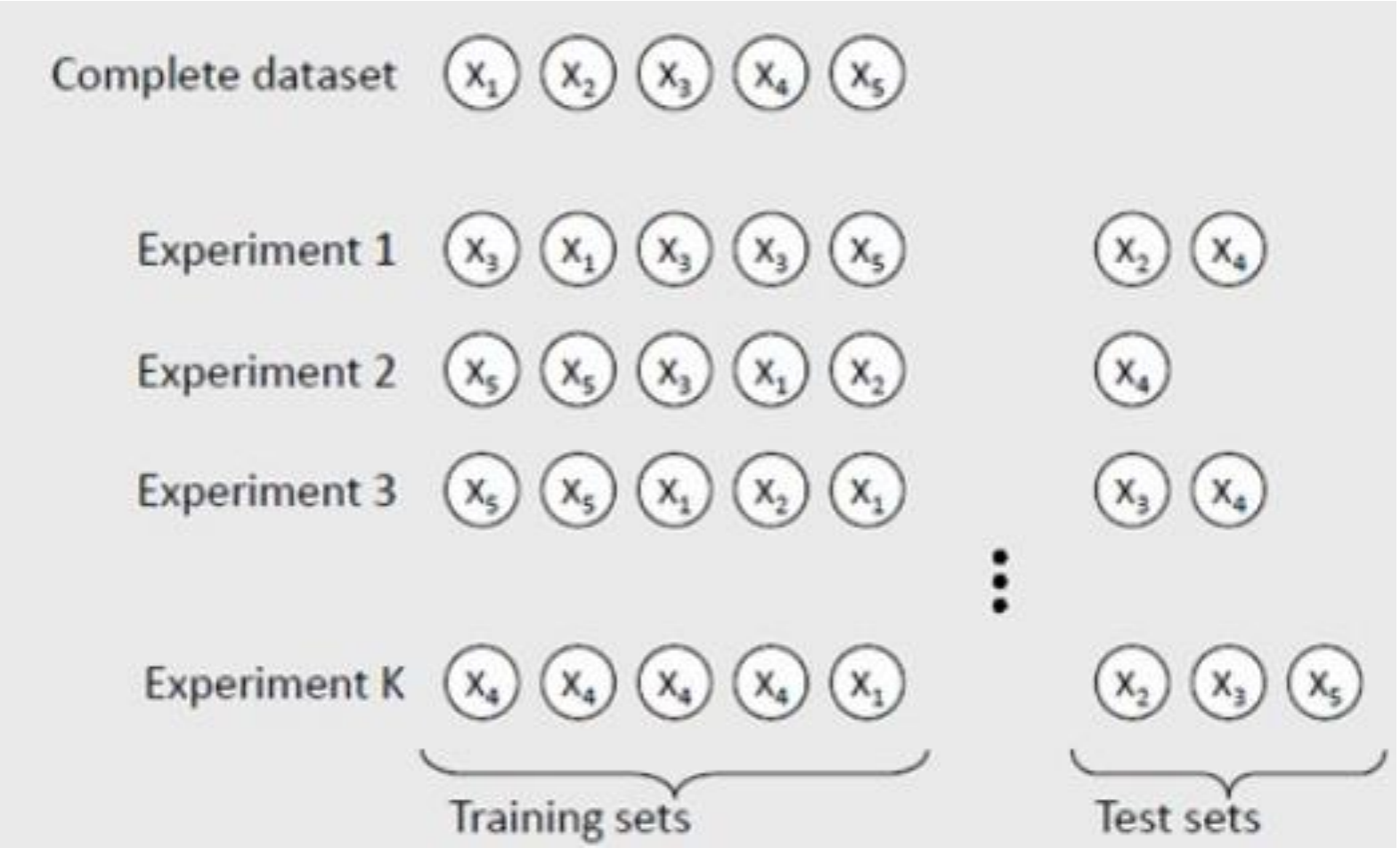


Bootstrapped Sample (n=5)



Bootstrapping Validation

- Bootstrap samples may overlap more than cross-validation samples
- Their estimates are more dependent
- The best way to do resampling for very small datasets



Experiment Strategies: One Factor at A Time

Id	Parameter	Variasi	Jumlah	Total
P1	Pembaruan bobot	*Stochastic gradient descent, mini-batch gradient descent*	2	2
P2	Jenis RNN	GRU, LSTM, BiGRU, BiLSTM	4	4
P3	Jenis *word embedding*	*Double embeddings, domain-specific embeddings, general-purpose embeddings, merge embeddings*	4	4
P4	Pengaruh penggunaan *coupled attentions*	Model dengan *coupled attentions*, model tanpa *coupled attentions*	2	2
P5	*Hidden units*	25, 50, 75	3	81
	Coupled attention layers	1, 2, 3	3	
	Jumlah tensor	10, 15, 20	3	
	Dropout rate	0, 0.2, 0.5	3	
Total				93

Summary

DoE: What & Why

Guidelines

Strategies: best guess, one factor at a time, grid search

Validation: hold-out, k-fold cross validation, bootstrap validation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