

9th quarter Machine Learning Factor Analysis

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01

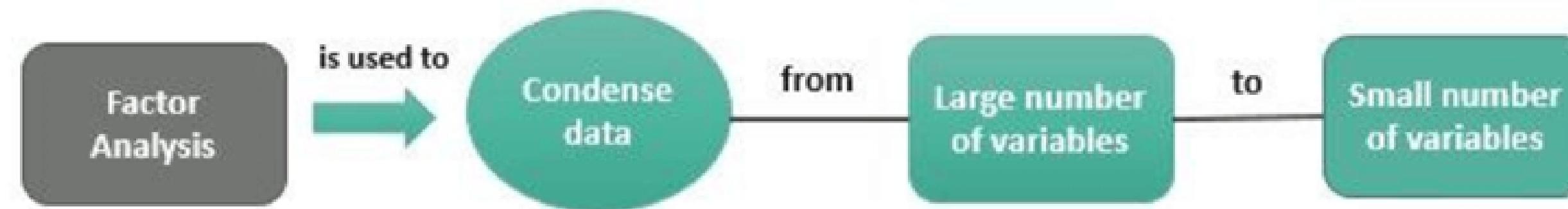
Introduction to Factor Analysis

- Method for modeling observed variables based on underlying "factors".
- Used to condense data from many variables into fewer.
- An unsupervised machine learning algorithm for dimensionality reduction.

02

Concept of Factor Analysis

- Categorizing the labels beforehand to simplify the process.
- It can be achieved by identifying common factors between variables and placing these correlated variables to be in that group.



03

Purpose of Factor Analysis

- Reduce set of data variables without losing significant information.
- Extract hidden factors from observed variables.

04 Example

Simplifying with Factor Analysis

Measuring English proficiency with skills like:

- Listening
- Speaking
- Writing
- Reading



04 Example

Initial Data

- 100 international students
- Scores in 4 distinct areas: Listening, Speaking, Writing, Reading

Emerging Patterns

- High Listening scores correlate with high Reading scores.
- High Speaking scores correlate with high Writing scores.

Listening

Reading

Speaking

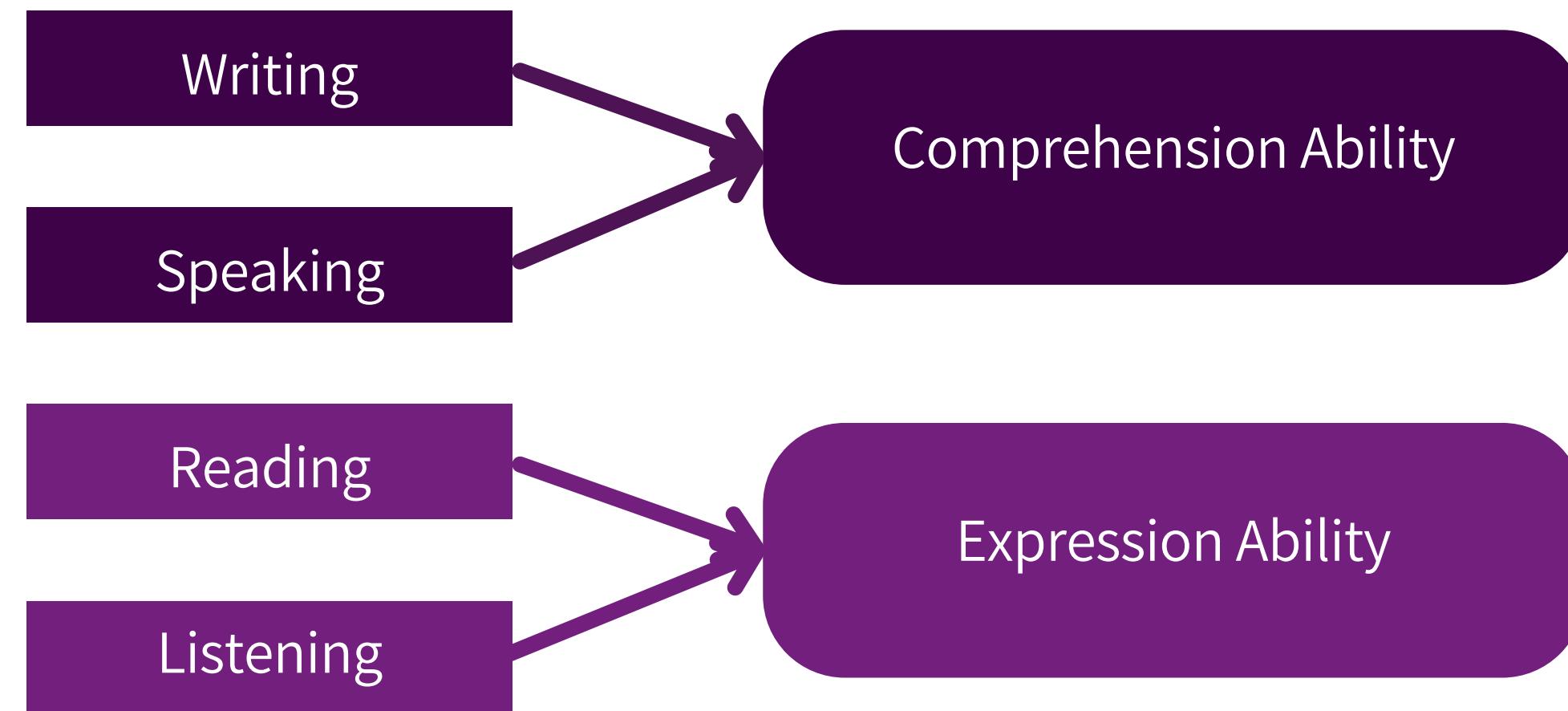
Writing



04 Example

Discovering Underlying Factors

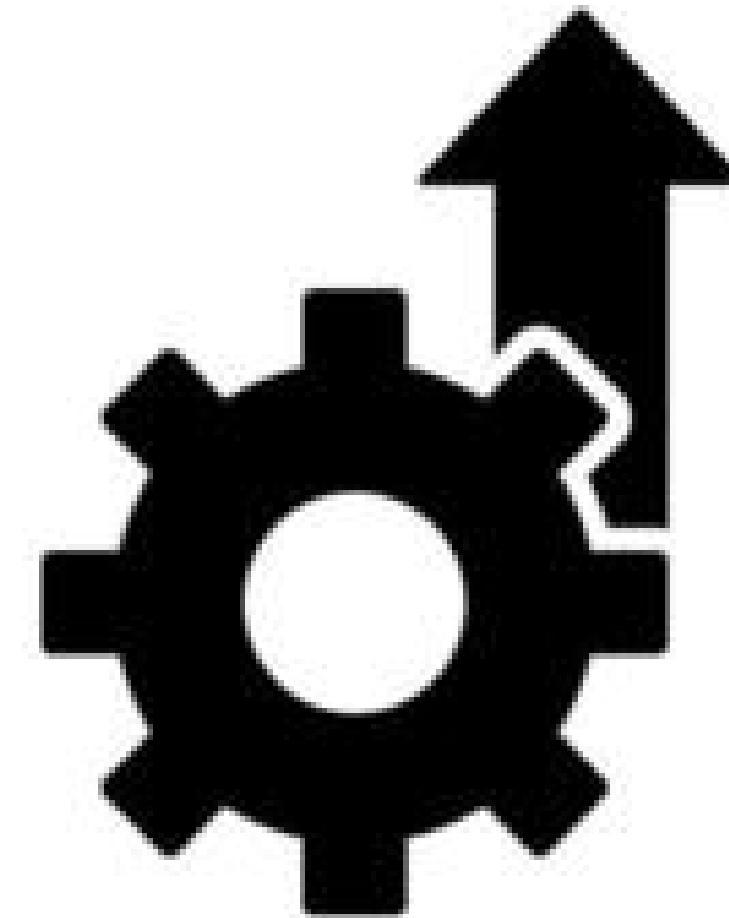
- Comprehension Ability: Combines Listening & Reading
- Expression Ability: Combines Speaking & Writing



04 Example

Simplifying the Model!

- Predicting proficiency based on two main factors.
- More efficient, accurate, and interpretable results.



05

Types of Factor Analysis

- (PCA) Principal Component Analysis
- Common Factor Analysis
- Image Factor Analysis
- Maximum Likelihood Approach

05

Types of Factor Analysis

(PCA) Principal Component Analysis

- Focuses on factors with highest variance.
- Reduces complexity while retaining vital information.

Common Factor Analysis

- Focuses on elements contributing to prevalent variation.
- Reduces data complexity for enhanced understanding.

05

Types of Factor Analysis

Image Factor Analysis

- Based on the correlation matrix.
- Used in computer vision and image processing.

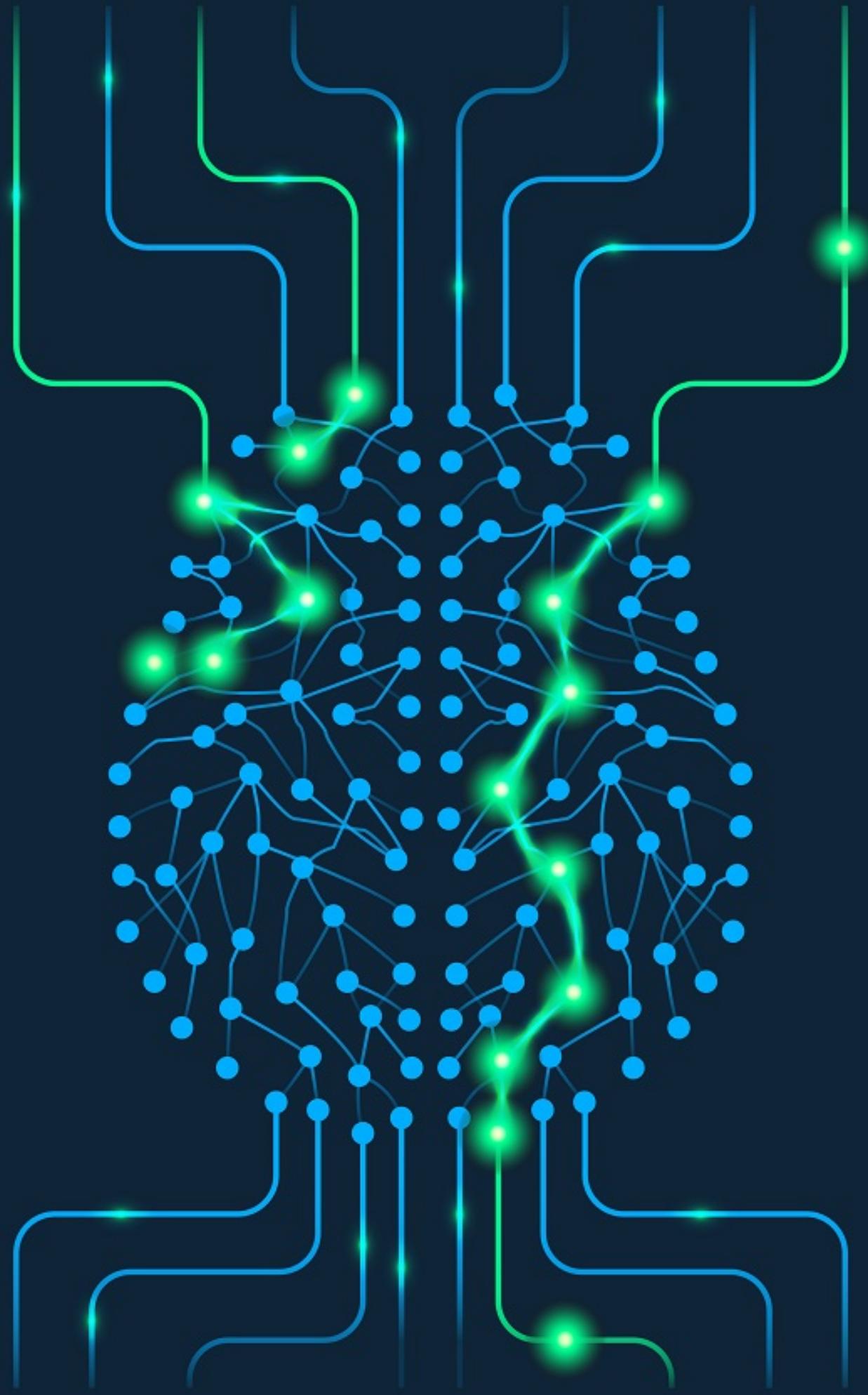
Maximum Likelihood Approach

- Operates on correlation matrix.
- Estimates parameters based on specific observed data.

Advantages and disadvantages

- Can use both objective and subjective qualities.
- Identifies hidden dimensions.
- Simple and economically applicable.
- Interpretation flexibility.

- Depends on comprehensive list of product characteristics.
- Naming components can be challenging.
- Can't provide patterns for unrelated variables.
- Theorizing is needed for understanding factors.



07 Conclusion

- Explores and simplifies complex variable relationships.
- Uncovers essential structures and associations.
- Widely used in various fields for understanding latent constructs.

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References

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