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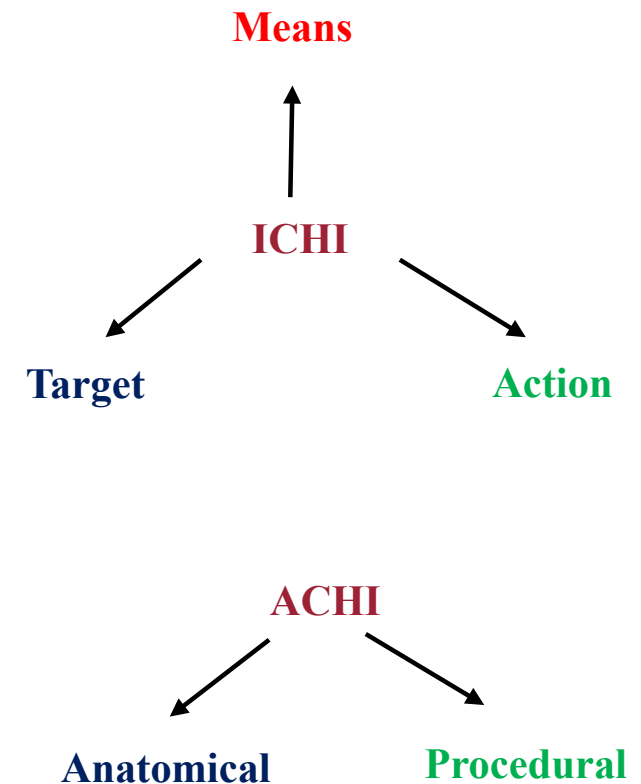
Hybrid (Algorithmic + Manual) Mapping from ACHI to ICHI

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Introduction

- Mapping between ACHI and ICHI is challenging due to sentence structure disparity.
- Lack of hierarchical relationship between classifications
- ICHI has *Means* axis which may or may not occur in ACHI
- A new method is explored (for one chapter) to discover if better mapping results can be achieved.
- Apply Natural Language Processing (NLP) to identify which words are anatomy or procedure.
- Applying supervised Machine Learning (ML) algorithm to predict mapping.



Material

- 6,474 ACHI codes include:
 - ❖ Code
 - ❖ Description
 - ❖ Parent hierarchy
- 6,141 ICHI codes obtained from 2018 Beta version includes:
 - ❖ Code
 - ❖ Descriptions
 - ❖ Inclusion and Exclusion terms

What the Maps are?

- Linkage from a national classification source (ACHI) to target international classification (ICHI)
 - ❖ Source: Australian Classification of Health Interventions (ACHI)
 - ❖ Target: International Classification of Health Interventions (ICHI)

INPUTS

- ACHI codes
 - ❖ Full description along with its parent hierarchical for one chapter
- Complete set of ACHI codes and a subset of ICHI codes
- Each ICHI axis has its own:
 - ❖ Stem code
 - ❖ Title
 - ❖ Inclusions and exclusions

OUTPUTS

- ACHI codes with description with corresponding ICHI codes with descriptions as well as comments

Types of Maps

SIMPLE MAP

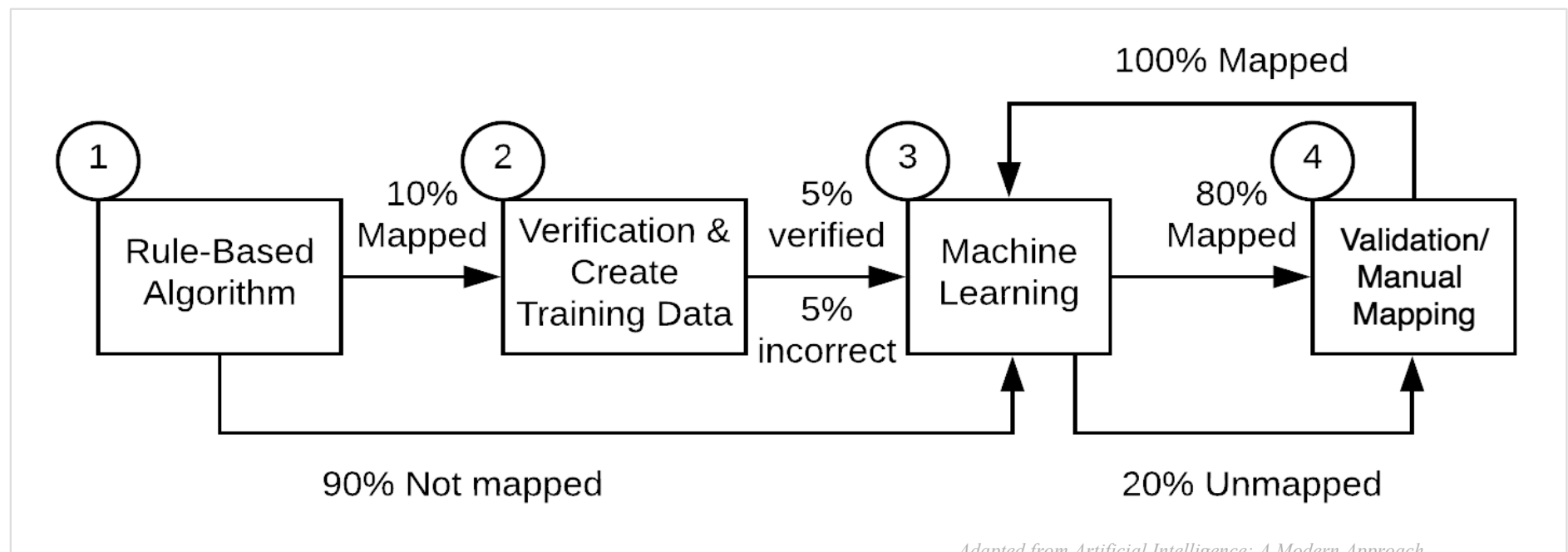
- Links a single ACHI code to a single ICHI code
- Cardinality of simple map is one-to-one

COMPLEX MAP

- Links a single ACHI code to multiple ICHI stem codes or stem codes plus extension code
 - Aggregated of two or more ICHI codes, along with extension codes represent the same semantics that exists in ACHI
- Still the cardinality is considered to be one-to-one

Mapping Methodology

Four steps involved in the process



*Adapted from Artificial Intelligence: A Modern Approach,
Third Edition, by S. J. Russell, P. Norvig (2010)*

Step 1

Rule-based Algorithm

- Rule-based approach is used to map ACHI and ICHI axes
- Deploys Natural Language Processing (NLP) library
- Divide ACHI full descriptions into:
 - ❖ Noun
 - ❖ Verb chunks
- Medical Subject Headings (MeSH) provide hierarchical context to nouns and verbs
- Preliminary tests identify about 10% codes will be accurately mapped

Step 2

Verification and Create Training Data

- Mapped codes in Step 1 are presented to a classification specialist for verification
- Allows creating initial set of training data
- Feed into machine learning step

Step 3

Machine Learning

- Vectorisation of ACHI descriptions using :
 - ❖ continuous bag of words (CBOW)
 - ❖ Skip-Gram algorithm in combination with Apache cTAKES™ noun & verb identification in ACHI description to map 90% that was not mapped in step 1.
- Results of pilot testing, around 80% ACHI codes mapped & 20% unmapped

Step 4

Validation and Manual Mapping

- Validation of all the automatically mapped files and 20% manual mapping of unmapped
- Mapping carried out chapter by chapter basis
- Mapping results of *step-2* and *step-4* are fed back into machine learning (*step-3*) as training data
- Enhances the accuracy of mappings of other chapters and future mappings.

ACHI ↑↓	ACHI - Desc ↑↓	Possible ICHI ↑↓
18233-00	Spinal blood patch Parents: PROCEDURES ON NERVOUS SYSTEM (Blocks 1-86) ↳ SPINAL CANAL AND SPINAL CORD STRUCTURES ↳ APPLICATION, INSERTION, REMOVAL	Possible mapping(s) ↓ <div> IZZ.SN.AF Management of vascular device ⓘ <div> <input checked="" type="checkbox"/> <input type="checkbox"/> </div> </div> <div> ABG.DB.AE Injection of agent into spinal canal ⓘ <div> <input checked="" type="checkbox"/> <input type="checkbox"/> </div> </div>

One-to-One Mapping

1. Direct description match

ACHI	ICHI
39000-00	ABG.AH.AE
Lumbar puncture	Lumbar puncture

2. Slight change in description

ACHI	ICHI
39003-00	AAG.AH.AE
Cisternal puncture	Cranial puncture

3. Usage of synonyms

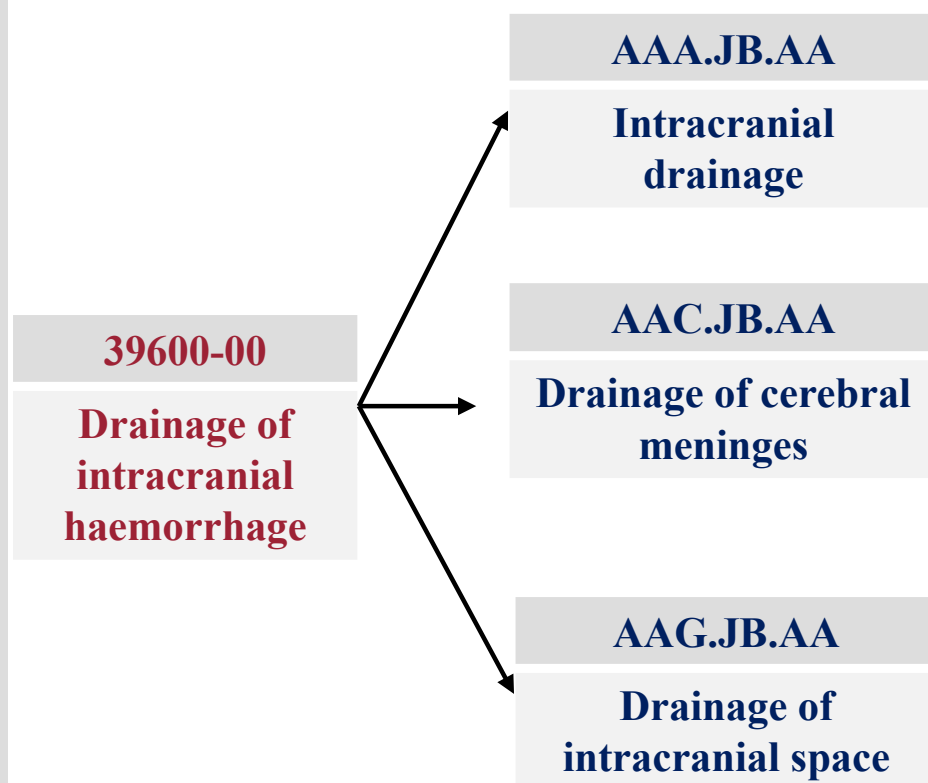
ACHI	ICHI
40330-00	ABN.FC.AA
Decompression of spinal nerve roots	Release of spinal nerve root

4. Terms matching with complex sentence

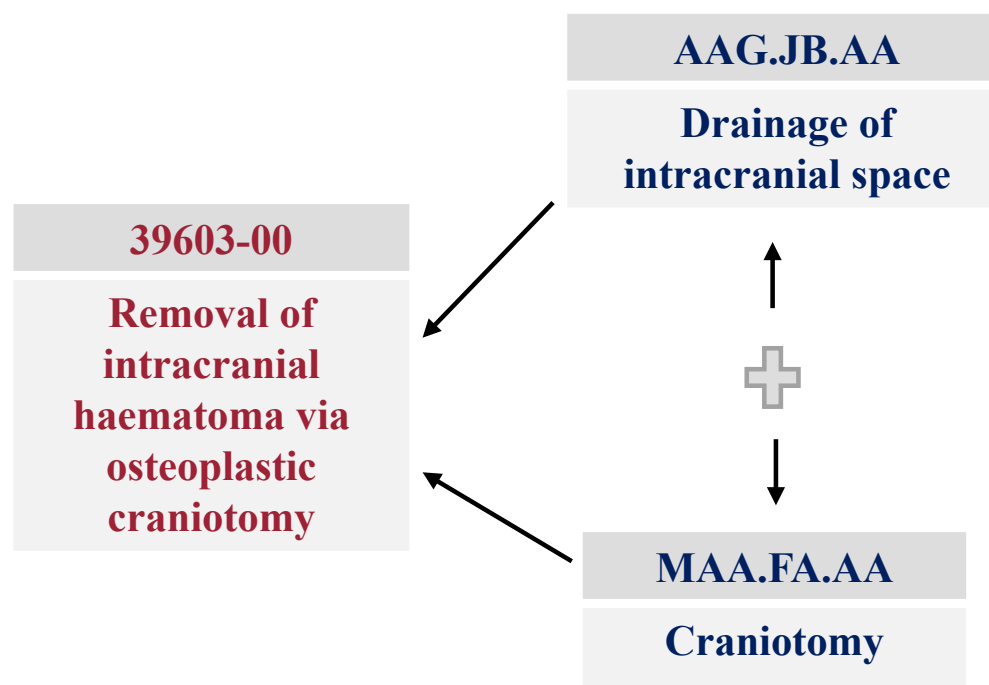
ACHI	ICHI
39139-00	ABG.DL.AE
Insertion of epidural electrodes by laminectomy	Percutaneous insertion of device into spinal canal

One-to-One Aggregate Mapping

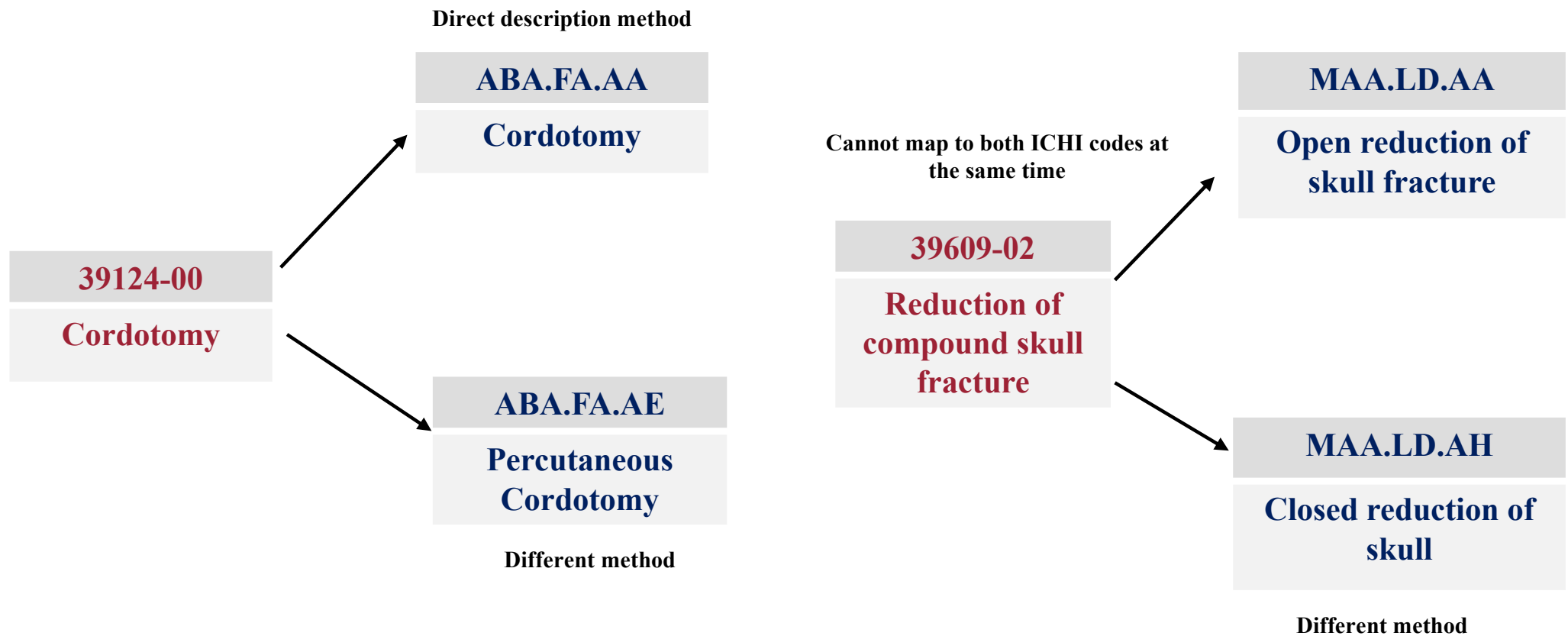
1. ACHI code involves three ICHI targets



2. ICHI codes can combine to make ACHI code



One-to-Many Mapping



Results

- Out of 315 ACHI codes in first chapter, 199 codes found with small list of possible ICHI code mappings using rule-based algorithm
- 141 ACHI codes have correct mappings
- Machine Learning step: Run to be poor due to limited training data

Conclusion

- Has potential to carry out mapping between heterogeneous classification and terminology systems.
 - E.g. SNOMED-CT and ICD-10/11
- As more mapping data is validated and provided, the accuracy of the algorithm increases

Our thanks to

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