AI-Assisted Coding for Transcript Data

FedCASIC
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RTI INTERNATIONAL

PILOT | METHODS | QUESTIONS

What is the study?

National, Longitudinal Study

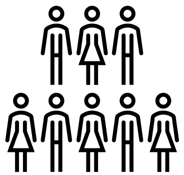
Surveys students during and following postsecondary careers and collects transcripts

Transcripts provide:

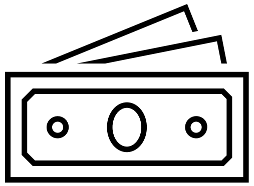
- Enrollment and transfer credit
- Degrees and field of study
- Coursework attempted and completed

What’s the challenge?

>40K transcripts,
500K courses



JAN	FEB	MAR
APR	MAY	JUN
JUL	AUG	SEP
OCT	NOV	DEC



Staff **Duration** **Cost**

What's the goal?

CURRENT STATE: Manual

- Manual coding
- Double coding of 10%

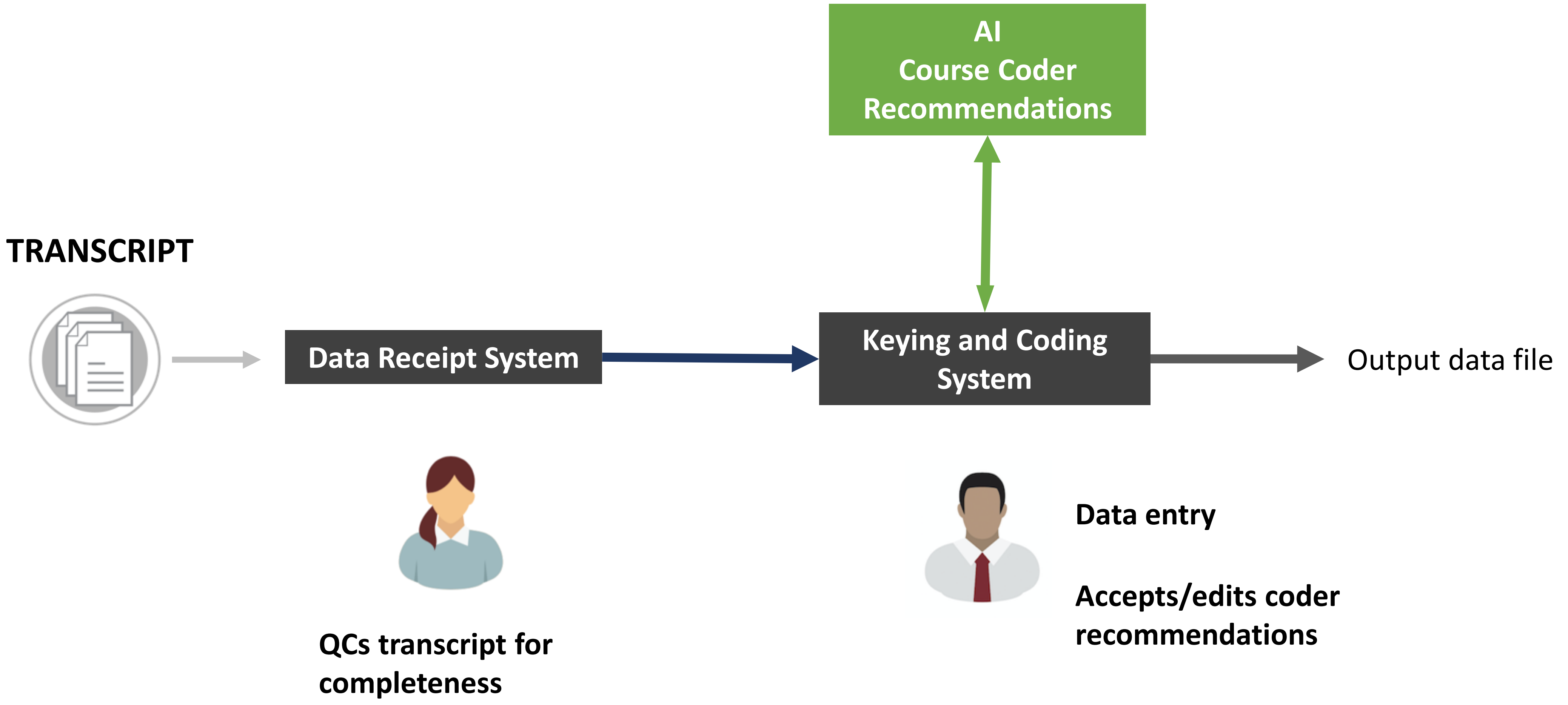
PILOT: AI Assisted

- AI-assisted recommendations
- Double coding of 10%

FUTURE: Human Assisted

- Auto coding of majority
- Double coding only difficult cases

How does it work?



What is course coding?

COURSE CODES

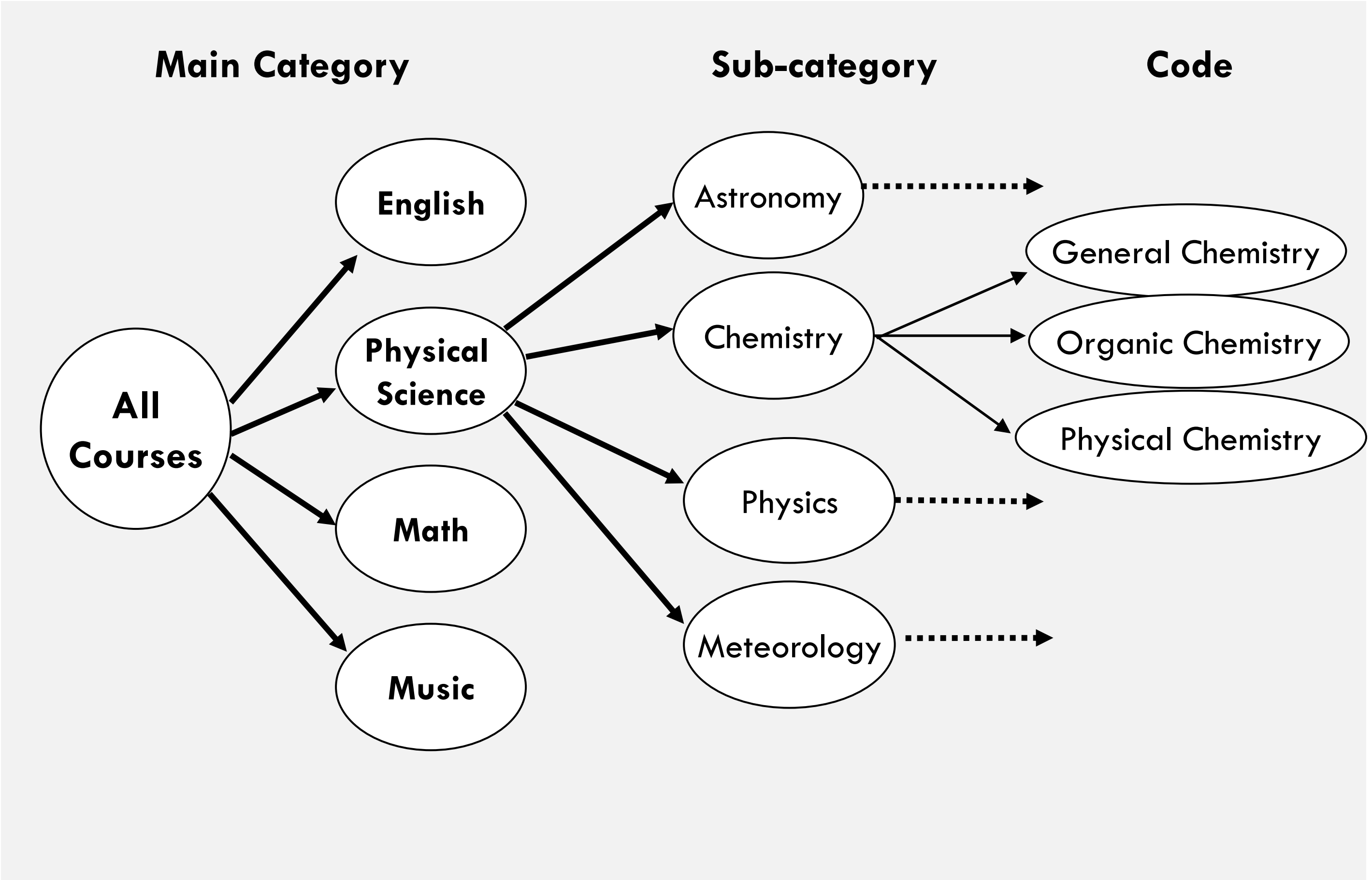
College Course Map (CCM)

23 . 13 01

2-digit
General category

4-digit
Sub-category

6-digit
Specific subject



Coding: Assigning the best code based on the course title and description

MANUAL

Code suggestions are based on key word search and staff look up descriptions in an online or PDF catalog

VS.

AI ASSISTED

Suggests probable matches to a course name using historical data

Is it possible to improve course coding efficiency and accuracy?

EFFICIENCY

Coding courses was faster with enhancements

TIME SAVINGS PER COURSE

7 seconds

Course Coder

for 200K courses, ~400 total hours saved

ACCURACY

(Agreement between human coders)

Agreement rates increased

Agreement rates on 10% of courses (21K of 200K coded)

	Before recommendations	After recommendations
General category (2-digit)	.84	.85
Subcategory (4-digit)	.74	.76
Specific (6-digit)	.62	.65

KAPPA SCORE measures inter-rater reliability

- 0.81–1.00 = “almost perfect agreement”
- 0.61–0.81 = “substantial agreement”

ACCURACY

(Agreement with recommendations)

Coders chose one of the recommended codes 90% of the time

Agreement with Recommendation

Measure	Courses
Top 1 Agreement	69%
Top 5 Agreement	90%

Selection Frequency

Recommended Code (ranked)	Courses
1	69%
2	12%
3	5%
4	2%
5	1%

Agreement rates on >200K courses

We can auto code 70% of courses with the same level of accuracy as human coding.

Human accuracy threshold = 80%

Example 1: High Predicted Probability

Input

Course Number	SPC1026
Course Name	Public Speaking

Output

Rank	CCM Code	Probability	Title
1	09.0196	0.99	Public Speaking, Debate and/or Forensics.
2	09.0101	0.01	Speech Communication and Rhetoric.
3	23.9987	0.00	Remedial Speech, Basic Speech, Basic Oral Communication, Basic Oral Skills and/or Listening Skills.
4	52.0808	0.00	Public Finance.
5	09.0900	0.00	Public Relations, Advertising, and Applied Communication.

Example 2: Lower Predicted Probability

Input

Course Number	MATH 151
Course Name	Precalculus Math

Output

Rank	CCM Code	Probability	Title
1	27.0198	0.42	Pre-Collegiate Math General, Basic Concepts of Math, Elementary Math, Introductory Math, Developmental Math and/or Preparatory Math.
2	27.0101	0.40	Mathematics, General.
3	27.9996	0.16	Analytic Geometry, Elementary Functions and/or pre-calculus.
4	27.9989	0.00	Collegiate Business Math, Math for Business, Math for Economics, Math Accounting and/or Business Algebra.
5	27.9999	0.00	Mathematics and Statistics, Other.

Double coding

TO DATE

Random selection of 10% of courses

NEXT ROUND

Selection within the 30% of difficult courses only

Could double code all 30% to gather data to refine Course Coder over time and increase accuracy of auto-coding the "30%"

FUTURE

Decrease number of courses needing to be double coded over time

What are the implications of the findings?

Auto coding saves time without sacrificing accuracy

For a study with 200K courses,
Auto code: 140K
Manual code: 60K

Savings
2,300+ hours in coding

Reduction of QC for auto coded courses

More efficient and faster leads to fewer temporary staff

PILOT | METHODS | QUESTIONS

Developing AI model for course coding

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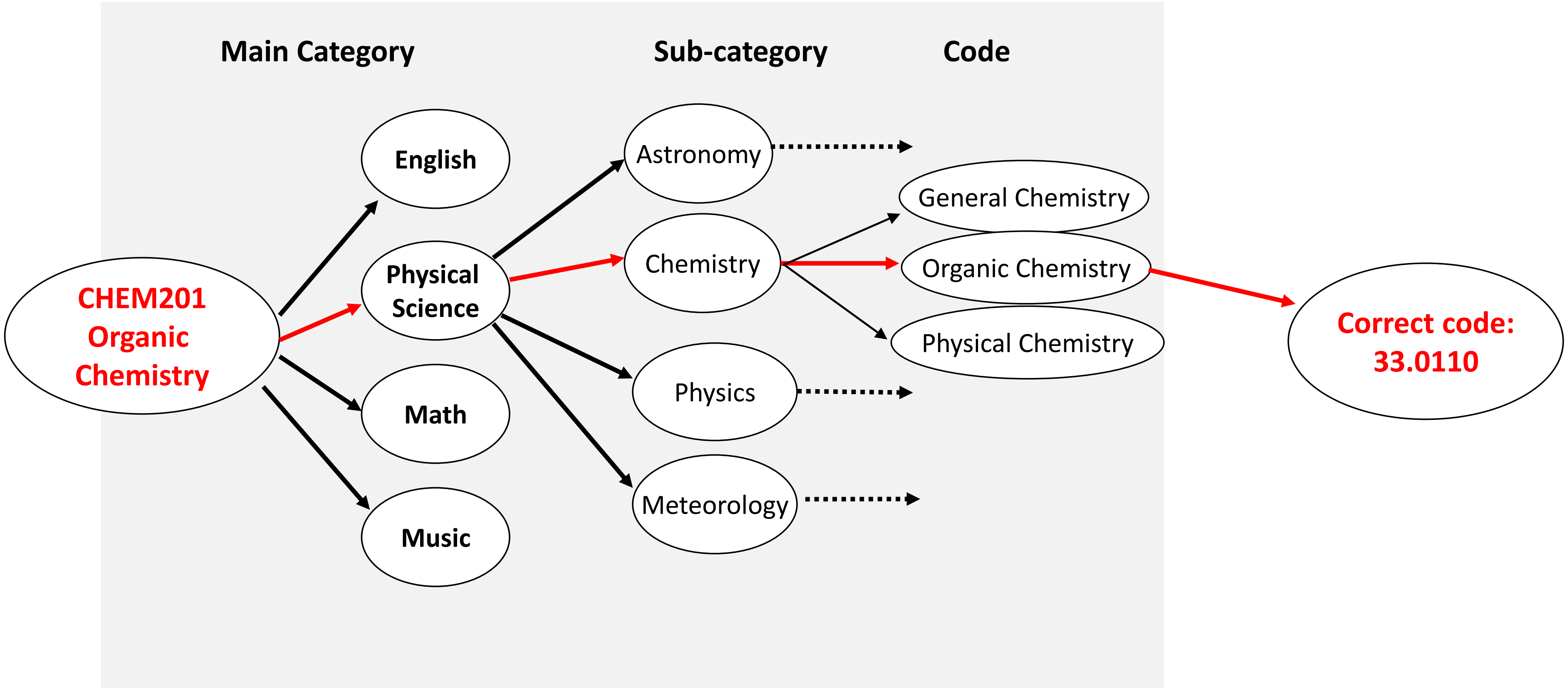
METHODS

1. What is the technical problem?
2. Machine learning (ML) background
3. How we applied ML to automate course coding

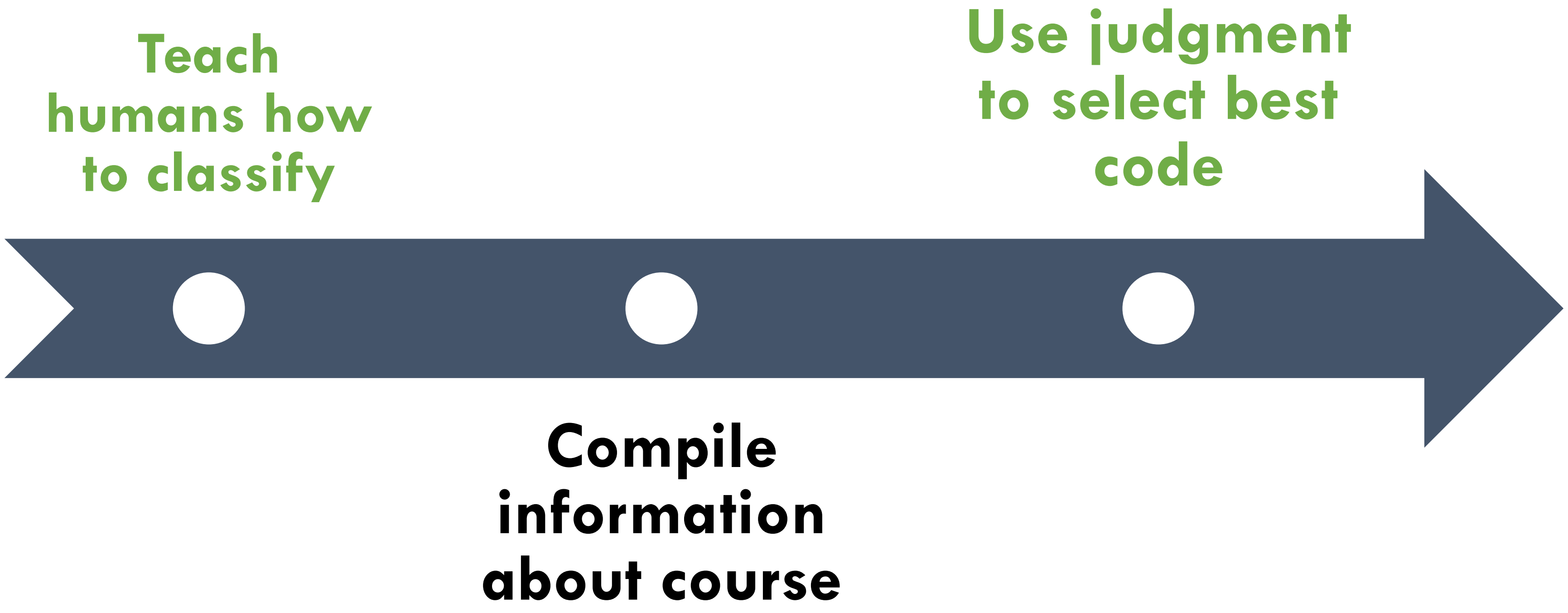
METHODS

1. **What is the technical problem?**
2. Machine learning (ML) background
3. How we applied ML to automate course coding

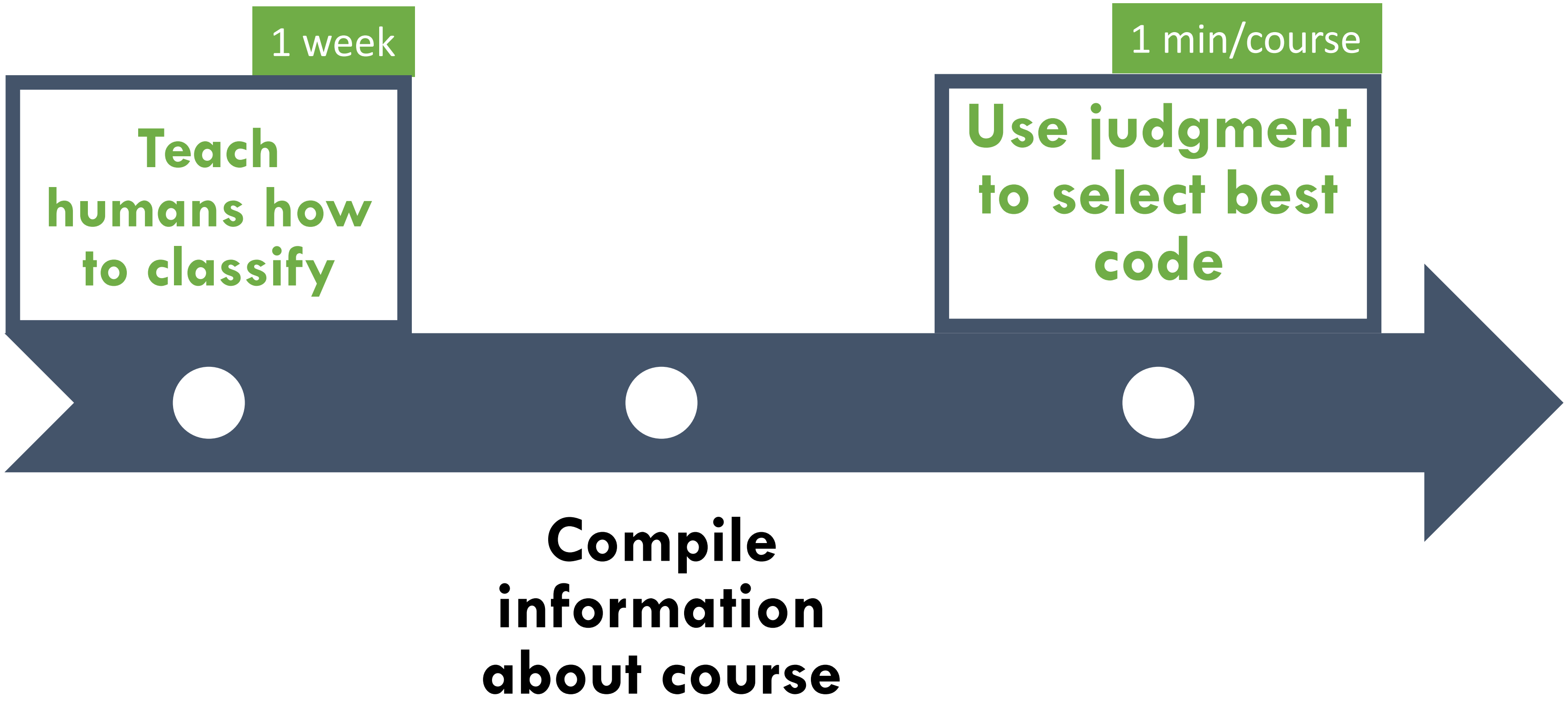
Course coding makes intuitive sense to humans



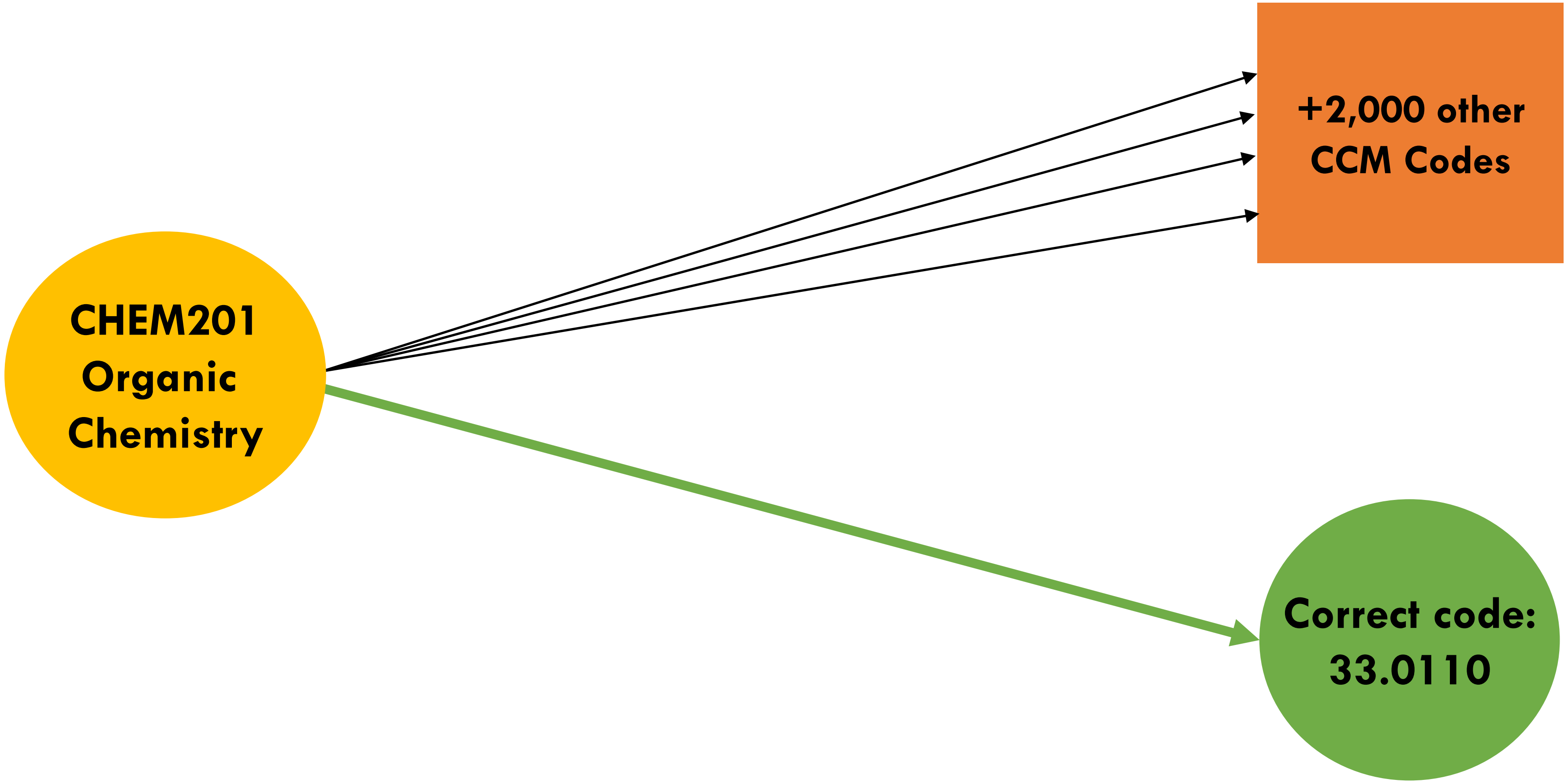
Coding courses is relatively easy for humans…



But it's also slow...



Course coding is a highly-dimensional text classification problem



How can we automate these steps computationally?

- "Intuitive" problems for humans rely on subjective knowledge about the world
- Impossible to develop "rule-based" system to classify all courses

Course Number	SPC1026
Course Name	Public Speaking

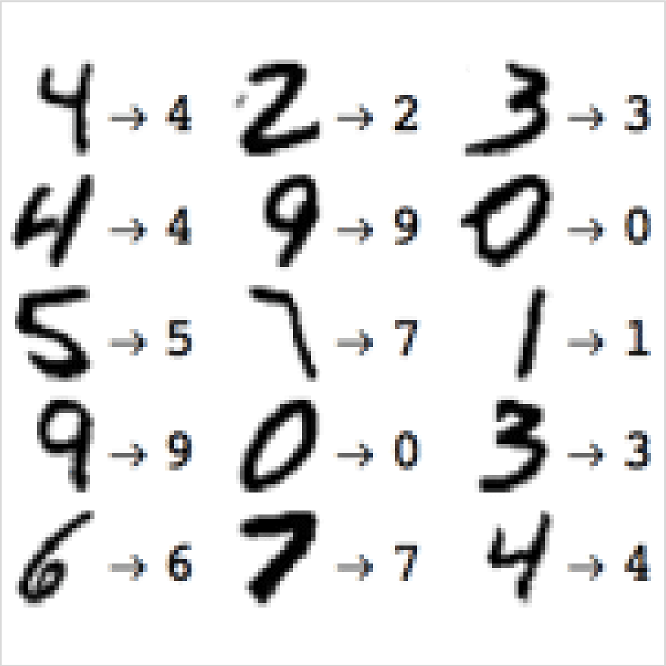
Course Number	BIO151
Course Name	Ecology and Evolution

Course Number	HIST573
Course Name	Gulf War

METHODS

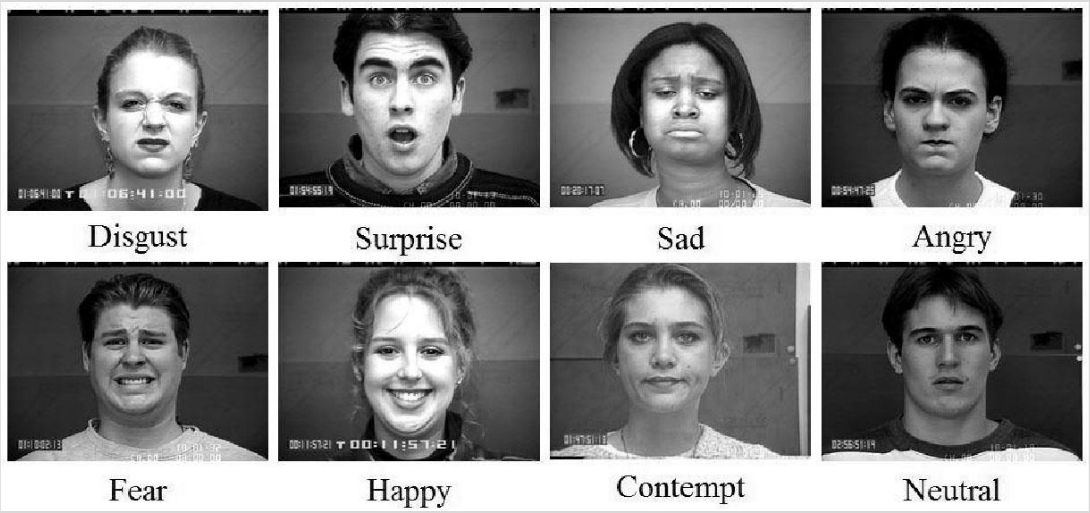
1. What is the technical problem?
2. **Machine learning (ML) background**
3. How we applied ML to automate course coding

Machine learning is a powerful tool for solving similarly intuitive problems



Classifying hand-written digits

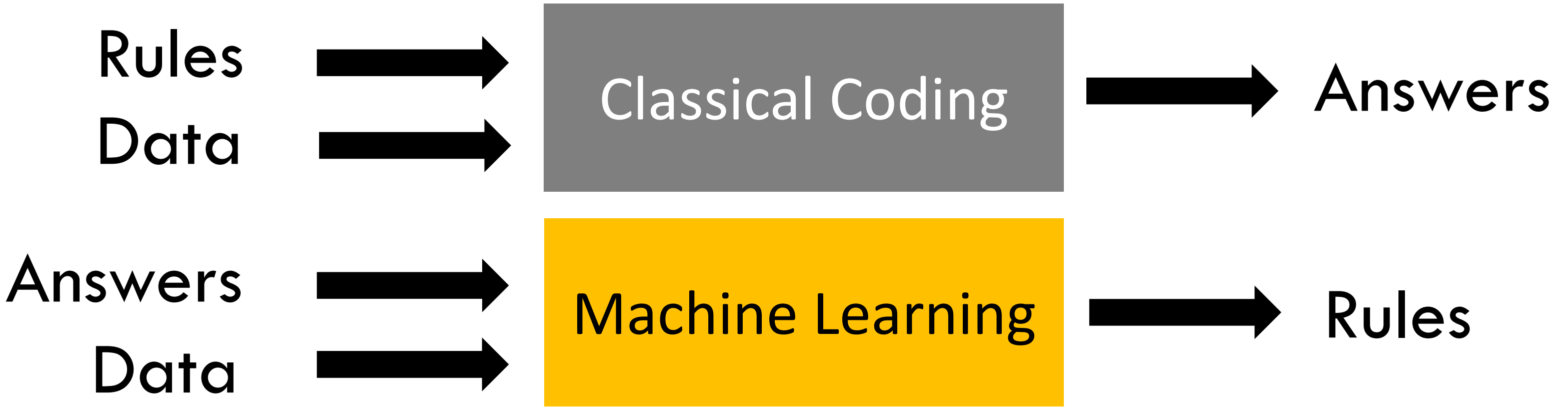
Source: https://www.wolfram.com/language/11/neural-networks/digit-classification.html?product=language



Classifying human facial expressions

Source: Chen et al. (2014) Facial Expression Recognition Based on Facial Components Detection and HOG Features. Scientific Cooperations International Workshops on Electrical and Computer Engineering Subfields 22-23 August 2014, Koc University, ISTANBUL/TURKEY

ML uses past experiences to "learn" the rules we may not be able to easily articulate



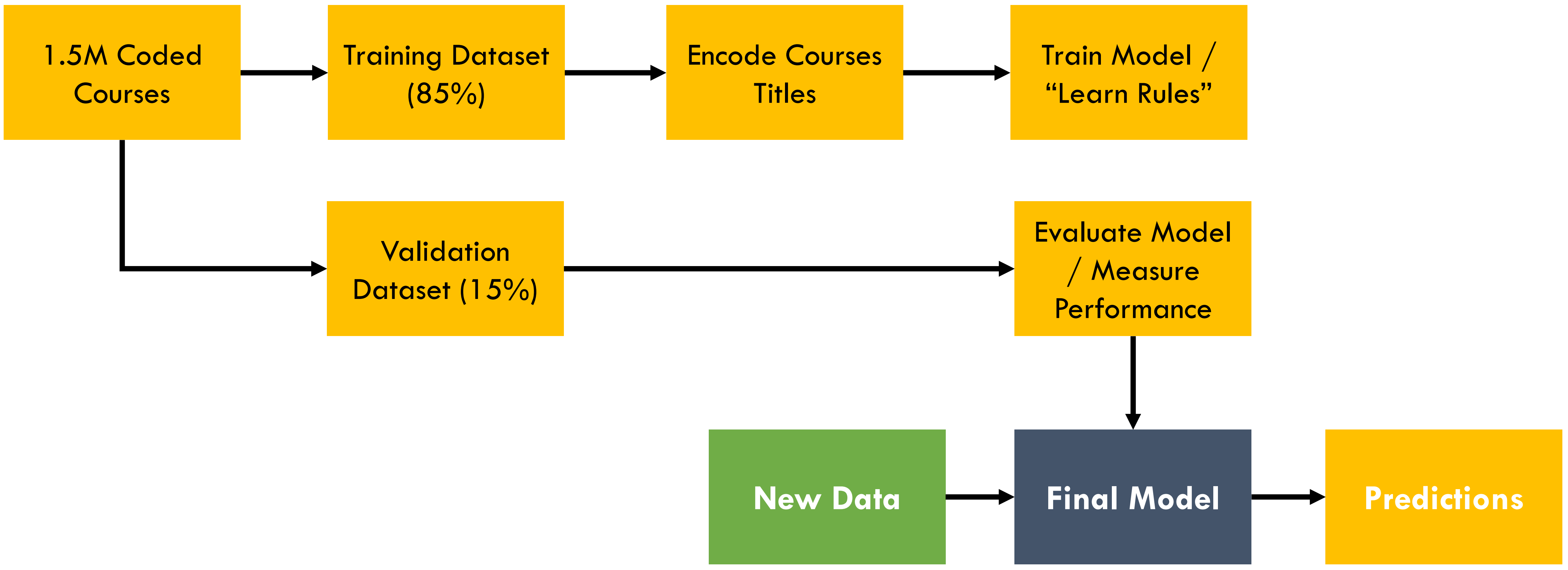
Adapted from: Chollet, Francois. Deep learning with Python. Shelter Island, NY: Manning Publications Co, 2018.

- Model updates it's internal rules as it sees more examples
- Generalized rules can be applied to unseen data with similar performance

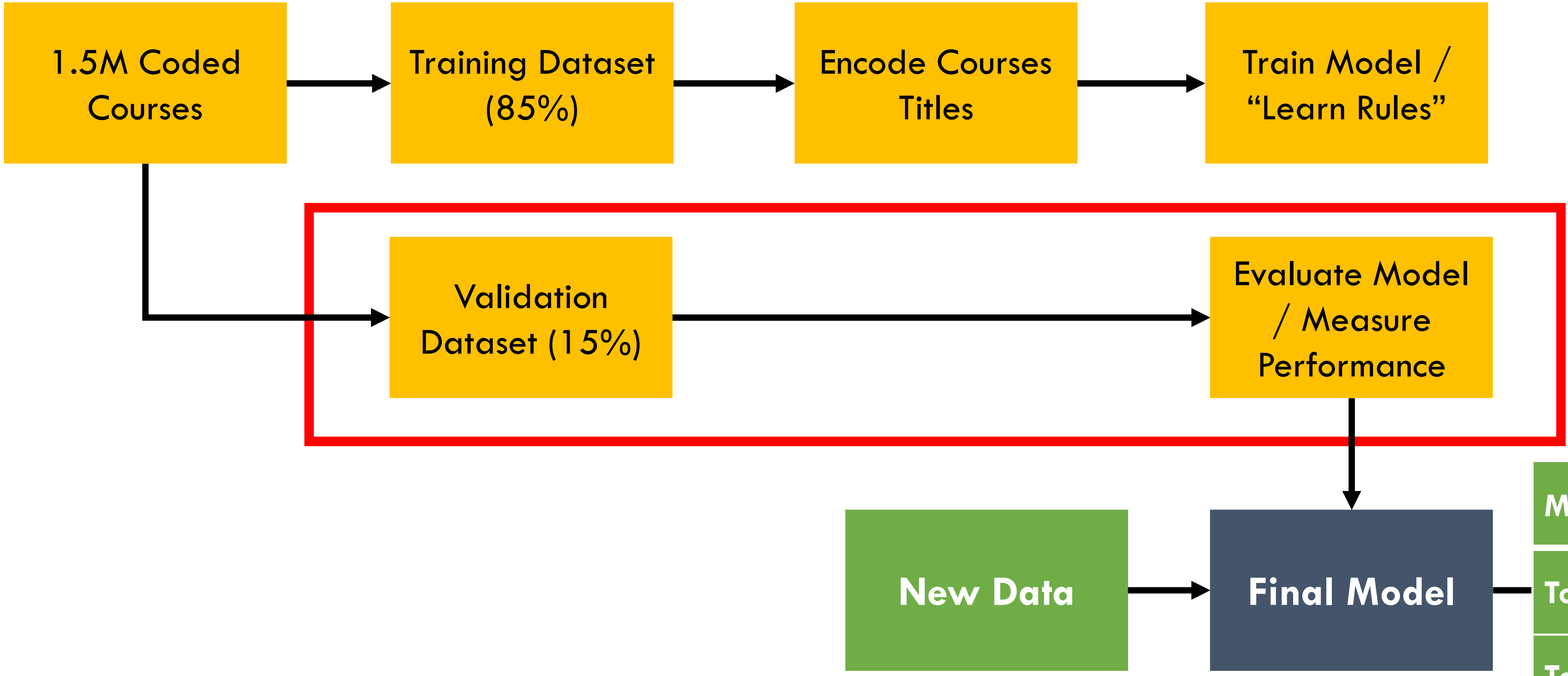
METHODS

1. What is the technical problem?
2. Machine learning (ML) background
3. **How we applied ML to automate course coding**

How we built our deep learning college course coder



Evaluate final model performance on past experiences that weren't included in the training set



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SUMMARY

- AI is not just helpful in theory.
  Demonstrated measurable gains in efficiency without sacrificing quality on RTI projects by using AI solutions.

- AI can expand the scope of the problems we can solve and questions we can answer.

THANK YOU!

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