Challenges and Potential Benefits of Leveraging Task Data from the Occupational Requirements Survey

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Outline

- Occupational Requirements Survey (ORS)
- Task Data in ORS
- Leveraging task data
- Task Classifier
- Possible Next Steps for ORS Task Data

Occupational Requirements Survey (ORS)

- Establishment survey
- Collected on behalf of the Social Security Administration (SSA) to support adjudication of its disability programs
- Captures the requirements for a job:
  - Education, Training, and Experience
  - Mental and Cognitive Requirements
  - Physical Demands
  - Environmental Conditions

Task Data in ORS

- Reflects the detailed activities workers perform to accomplish critical function
- Collected to aid in collection and review of ORS elements
- Stored as free-form text with minimal structure
  - Start with a verb
  - State the object of the action (if any) and, when relevant, the frequency
  - State the purpose of the action (if relevant)
  - Keep brief and uniformly formatted

Task Data in ORS
Example

Job Title: Hairdresser

Critical Function: Provides beauty services relating to clients' requests

Tasks:

- Shampoos, cuts, colors, blow dries hair
- Recommends styling products
- Perms hair
- Waxes eyebrows and facial hair
- Creates up-dos for special occasions like weddings

Leveraging Task Data
Growing Interest in the Tasks Performed

- There is a growing interest in the types of work being done in the U.S. economy especially with recent advances in technologies
- Studies that explore this topic often rely on job posting data
  - Newspaper job ads: Atalay et al. 2020
  - Burning Glass Technologies: Das et al. 2020
  - Burning Glass Technologies: Deming and Kahn 2018
- Tasks described in job postings and descriptions may not be reflective of the normal expectations and requirements of the job

Leveraging Task Data
A Potential Alternative?

- ORS as a potential data source
  - Representative sample of the occupations in the U.S. economy
  - ORS task data criteria:
    - If workers could not do this, could the main purpose of the job still be accomplished?
    - If no one in this job could perform this task, would the job still be useful to the organization?
    - Are workers rated or evaluated on how well they perform this task?
    - Is this something that anyone in the organization could do?

Leveraging Task Data Challenges

- Challenge #1: Unstructured text data recorded for internal use
  - Abbreviations
  - Shorthand writings
  - Typos
  - Respondent identifying information
- Solution #1: Task Classifier

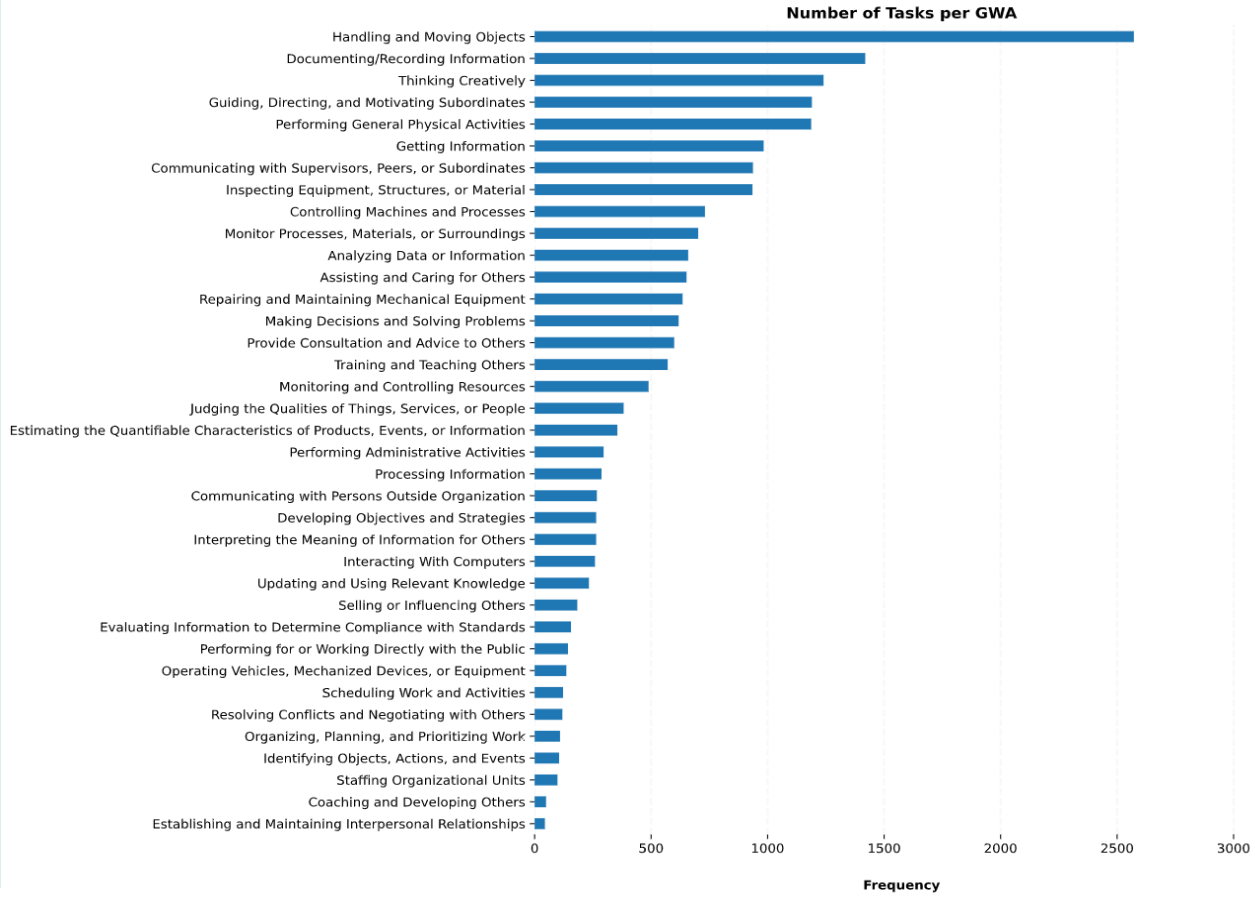
Leveraging Task Data Challenges

- Challenge #2: ORS task data is unlabeled and standardized task taxonomy currently does not exist
- Solution #2a: Topic modeling
- Solution #2b: Use the Occupational Information Network (O*NET) data to train a model then apply it to ORS task data
  - 17,119 unique task statements and 37 unique general work activities (GWAs)
  - Preliminary work done by 2019 Coding it Forward Civic Digital Fellow

Task Classifier

Multi-class, Multi-label Problem

- Multi-class
  - Information input: 5
  - Mental processes: 10
  - Work output: 7
  - Interacting with others: 15
- Class imbalance



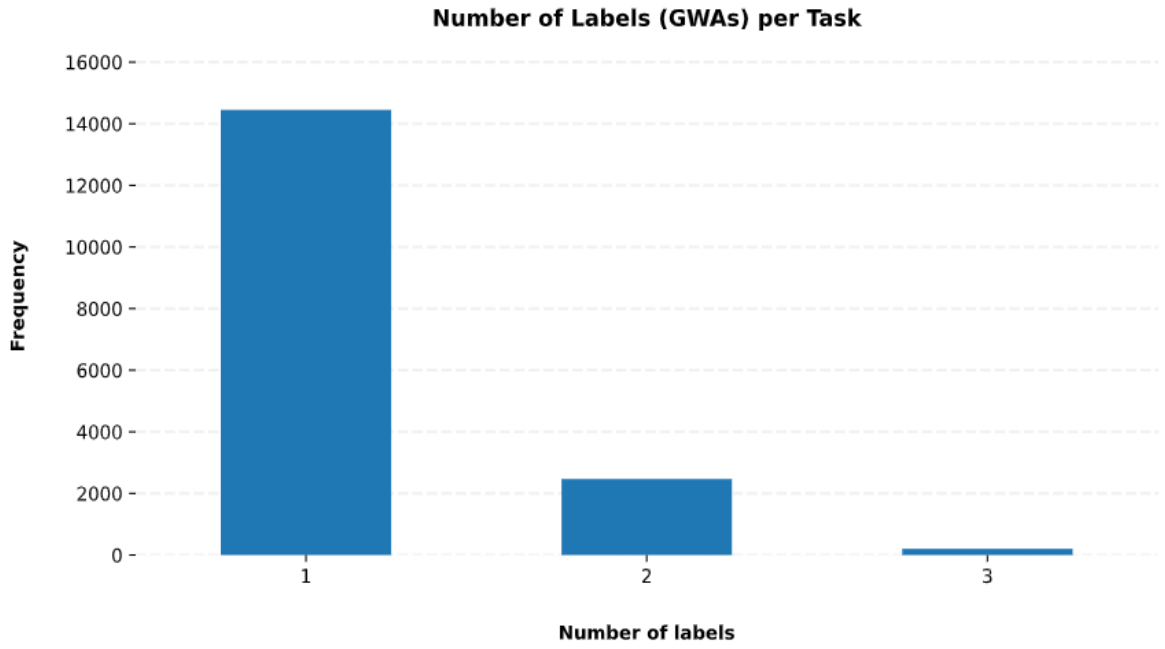
Task Classifier

Multi-class, Multi-label Problem

- Multi-label

Task Statement
Hire, train, evaluate, or discharge staff or resolve personnel grievances.

GWA
Judging the Qualities of Things, Services, or People
Training and Teaching Others
Staffing Organizational Units



Task Classifier
Preprocessing

- All lowercased
- Keep only alphanumeric
- Remove stop words
- Remove single characters
- Lemmatization
- N-grams
- TF-IDF

Task Statement
Hire, train, evaluate, or discharge staff or resolve personnel grievances.
Train newly hired laboratory personnel.

Preprocessed Task Statements
[0.2719769, 0.2719769, …, 0.19351381, 0.2719769, 0.00000000]
[0.0000000, 0.0000000, …, 0.25948224, 0.0000000, 0.36469323]

Task Classifier Modeling

- One-vs-rest model for each GWA
  - 37 binary classification models
- Set aside 5 percent of the data for testing
- 3-fold cross validation grid search to find the best set of parameters for each GWA model
- Logistic regression, SVM, and others

Task Classifier

Evaluating

- Evaluation for a multi-class, multi-label classifier is slightly different from a typical multi-class classifier
- In a multi-class, single-label problem:

Train newly hired laboratory personnel.	
Predicted Label	Training and Teaching Others
True Label	Training and Teaching Others

Train newly hired laboratory personnel.	
Predicted Label	Analyzing Data or Information
True Label	Training and Teaching Others

Task Classifier
Evaluating

- In a multi-class, multi-label problem:

Hire, train, evaluate, or discharge staff or resolve personnel grievances.	
Predicted Label(s)	Judging the Qualities of Things, Services, or People
	Training and Teaching Others
	Staffing Organizational Units
True Label(s)	Judging the Qualities of Things, Services, or People
	Training and Teaching Others
	Staffing Organizational Units

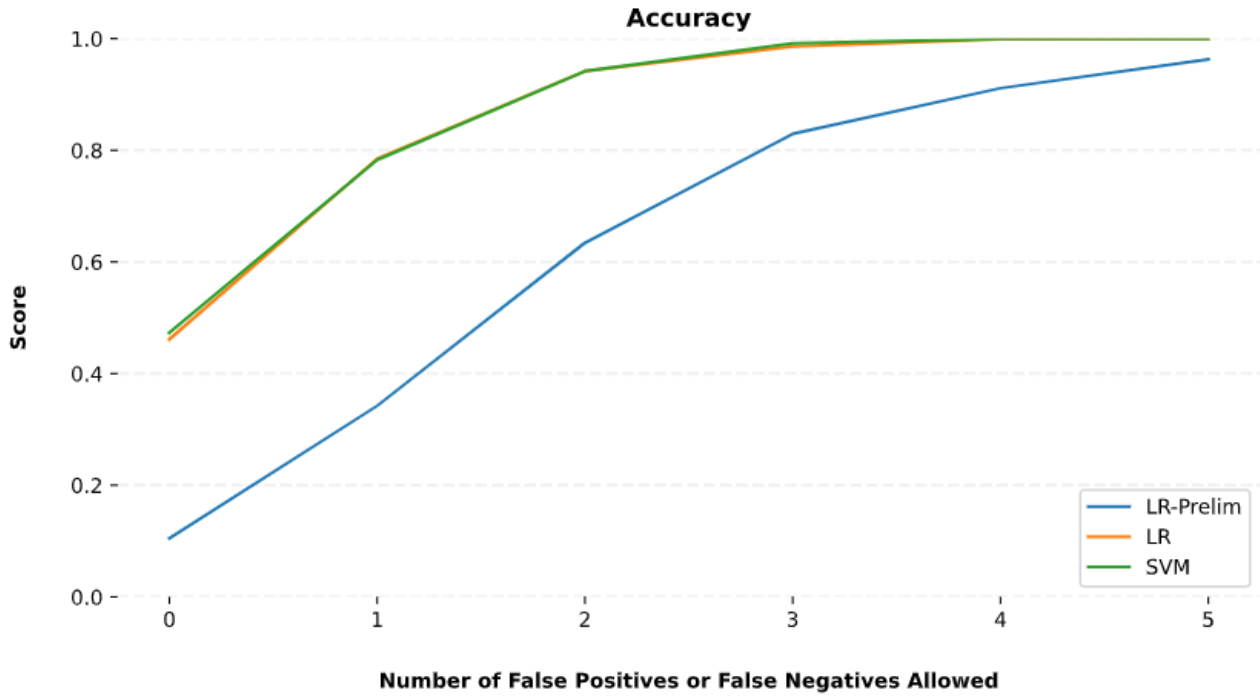
3 True positives

Hire, train, evaluate, or discharge staff or resolve personnel grievances.	
Predicted Label(s)	Judging the Qualities of Things, Services, or People
	Analyzing Data or Information
True Label(s)	Judging the Qualities of Things, Services, or People
	Training and Teaching Others
	Staffing Organizational Units

1 True positive
1 False positive
2 False negatives

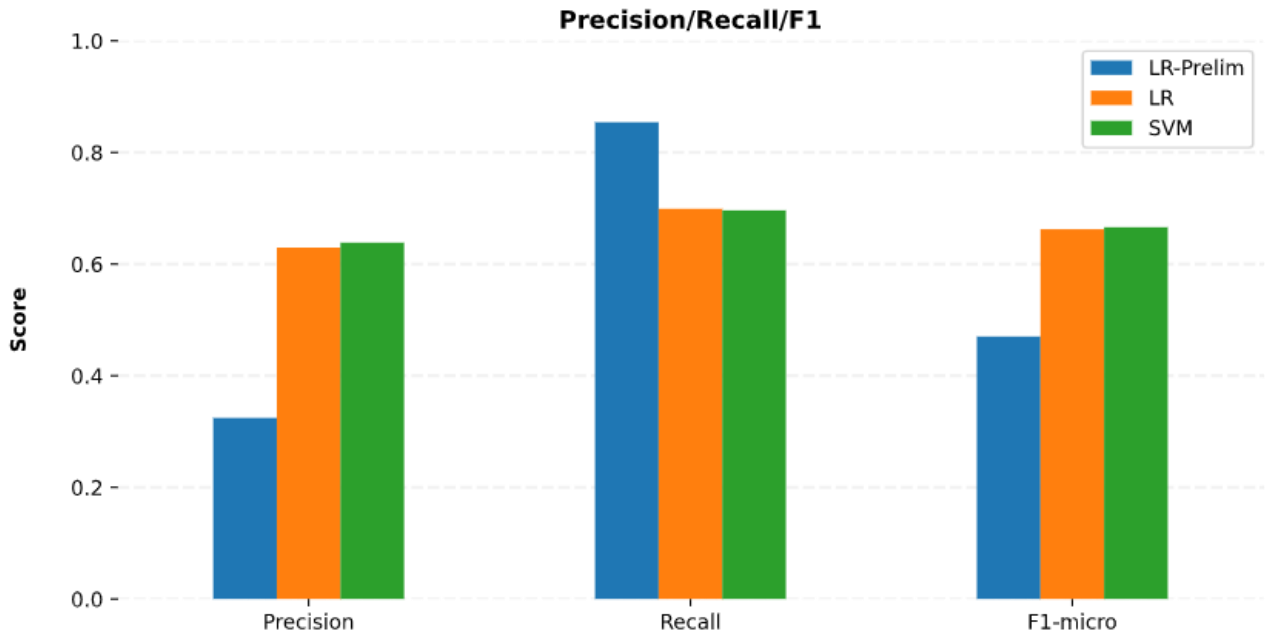
Task Classifier
Evaluating

- Accuracy measures how well our set of models perform, on average, at applying labels to a given task statement
- Performance greatly increases as restriction on how many mistakes are allowed for a given task statement is lifted



Task Classifier
Evaluating

- Precision measures proportion of positive identification that was actually correct
- Recall measures proportion of actual positives that was identified correctly
- F1 is the harmonic mean of precision and recall



Task Classifier Applying to ORS

ORS Task	Predicted GWA
Shampoos, cuts, colors, blow dries hair	Handling and Moving Objects
Recommends styling products	Thinking Creatively
Perms hair	Handling and Moving Objects
Waxes eyebrows and facial hair	Handling and Moving Objects
Creates up-dos for special occasions like weddings	Organizing, Planning, and Prioritizing Work

Similar O*NET Task Statement	GWA
Shampoo hair.	Handling and Moving Objects
Sell makeup to clients.	Selling or Influencing Others
Bleach, dye, or tint hair, using applicator or brush.	Handling and Moving Objects
Shave, trim, and shape beards and moustaches.	Handling and Moving Objects
Apply makeup to enhance or alter the appearance of people appearing in productions such as movies.	Handling and Moving Objects

Possible Next Steps for ORS Task Data

- Continue to improve supervised machine learning models
- Transfer learning with transformers
- Topic modeling
- Invest in developing a comprehensive task taxonomy for ORS
- Applying differential privacy using word embedding

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