

Predictability and Forecasting of Acquisition Careers in the Army

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What is talk about?

Quantitative characterization of career sequence patterns in time, and how to use this information for forecasting

What do we find?

Several quantifications are informative, including careers through organizational units and occupational codes. Memory effects play critical role

Why should we care?

Better career management for individuals and organization increase job match quality

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A brief history of career modeling?

Careers have been thought about in many ways:

- as crafts (apprenticeships)
- as occupations
- inside organizations (internal labor markets)
- crossing organizations (boundaryless careers)
- protean careers (self-directed, driven by values and goals)

Some conceptualizations are amenable of tracking/modeling, e.g.

- as occupations → occupation (OC) codes
- inside organizations → OC and/or ranks
- crossing organizations → labor flow networks

All conceptualizations are incomplete

- as occupations → misses org + detailed tasks
- inside organizations → misses detailed tasks
- crossing organizations → misses OC + tasks

Ultimate goal: find description of career steps ideal for prediction, i.e. describe well tasks + motivating factors affecting moves

Career modeling: what we can do now

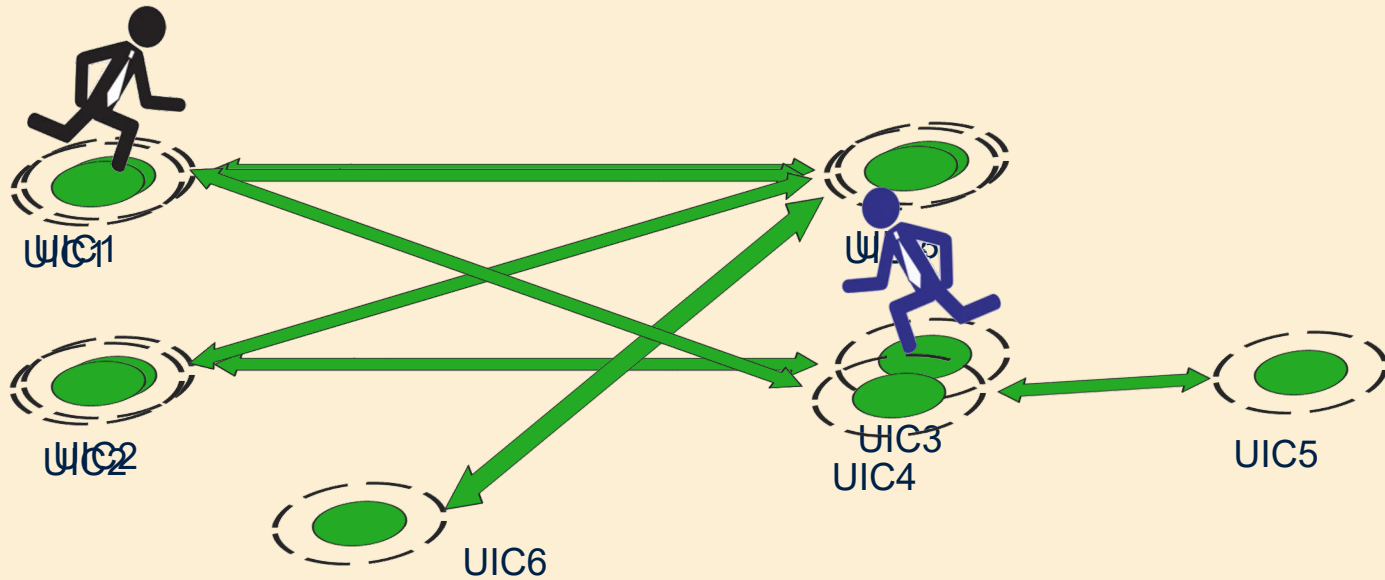
HR data tracks info such as:

- UIC (Unit ID Code)
- location
- occupation series (OC)
- pay grade

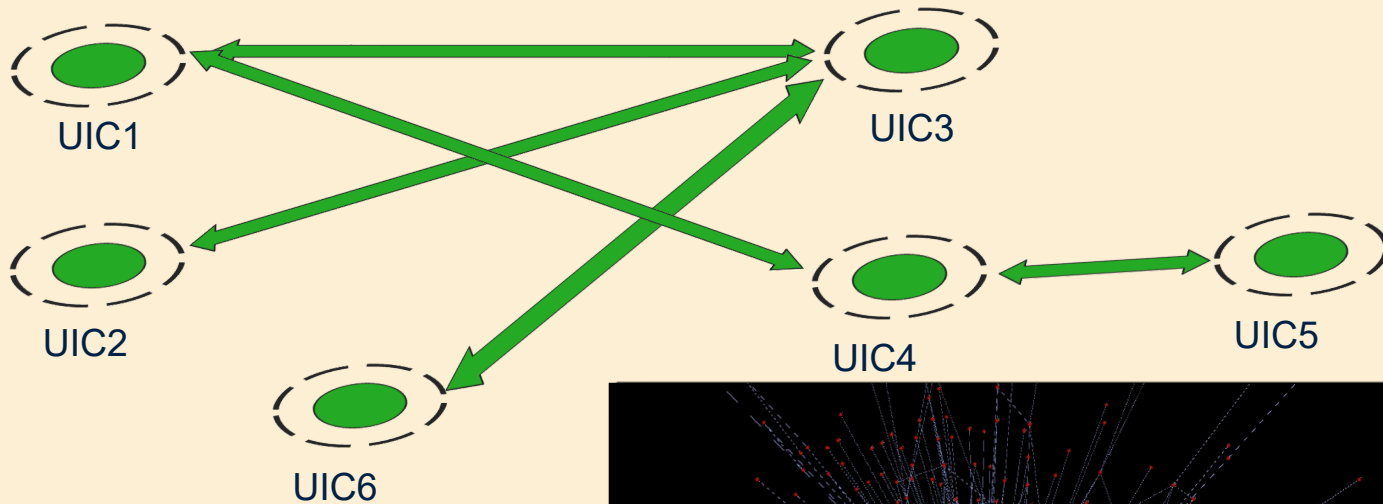
Each such feature (or combinations) can be seen as career step

We analyze and compare UIC or OC as steps

To do this, we take advantage of network representation: e.g. with UICs



Do transitions really signal a hidden network?

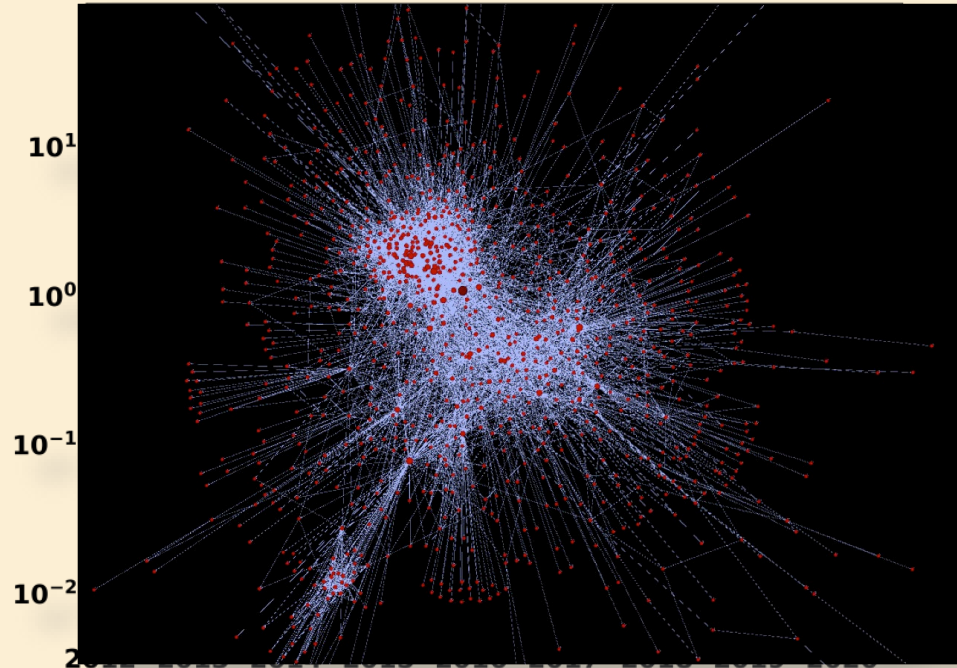


e.g. network of UICs

Nodes have defined connections

Key! Only links with persistent flow accepted

Stats test tuned for persistence

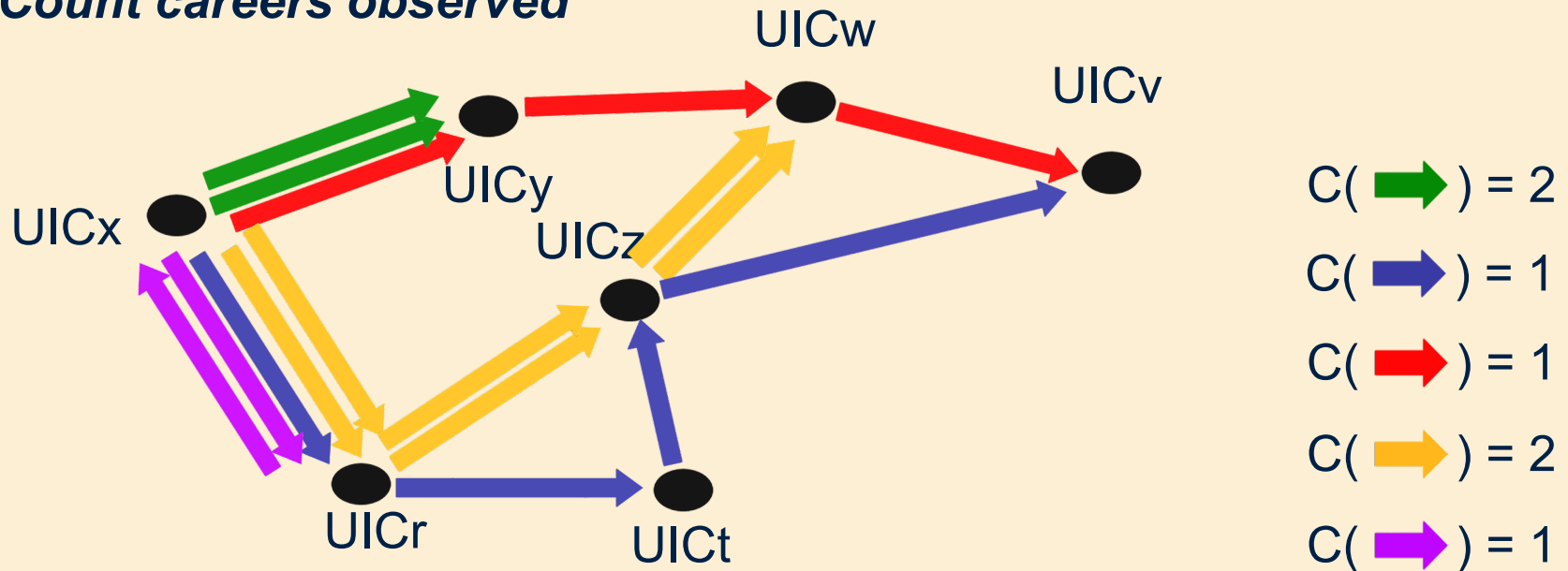


Career Prediction and Forecasting (e.g. UIC)

Anatomy of a career sequence:

- Comprised of a sequence of **steps** e.g.
UICx → UICy → UICw → UICv

Count careers observed



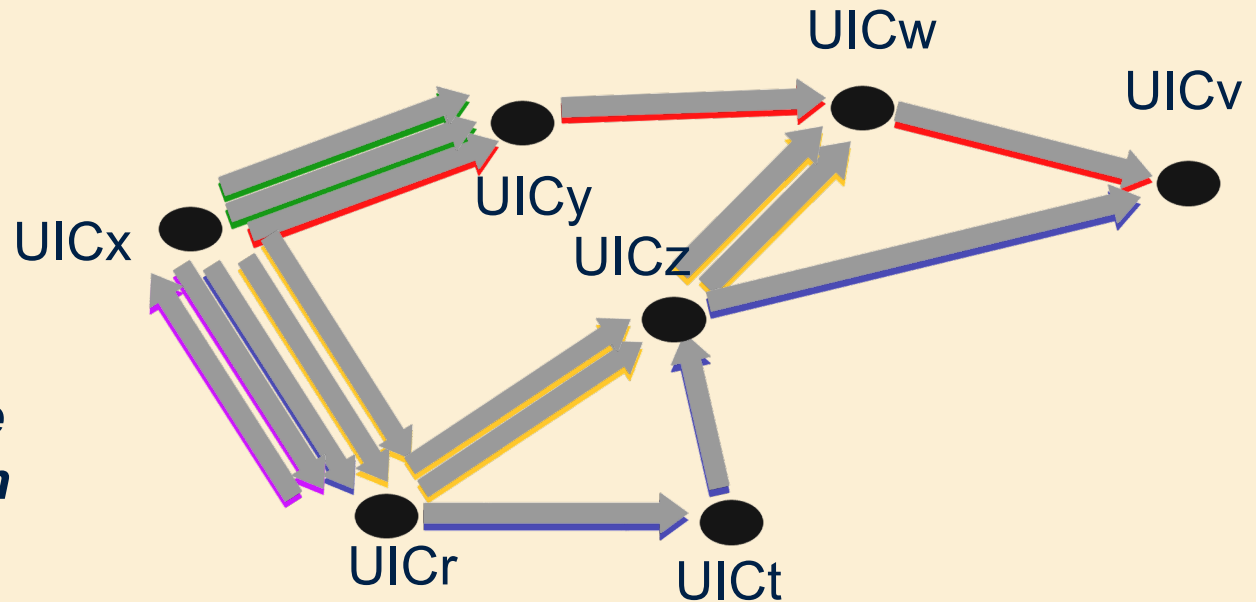
At each step, employees make choices about next step.

How to model choices?

Career Prediction and Forecasting (e.g. UIC)

Memory-less careers

No longer clear where employees come from



Even limited memory returns visibility to career choices

**Our approach: Model careers with and without one-step memory.
Assess performance**

Tracking Model Performance (OC or UIC)

Principle Behind Performance Measures:

- Compare C(Observed Career) vs C(Modeled Career)

Entropy Based (Jensen-Shannon Divergence):

Measures computer bits difference of two collections of careers:

- a) Combine observed + modeled careers
- b) Compute bits to store observed, modeled, combined bits
- c) $JSD(\text{Starting Step}) = b) - a)$

Excess Probability:

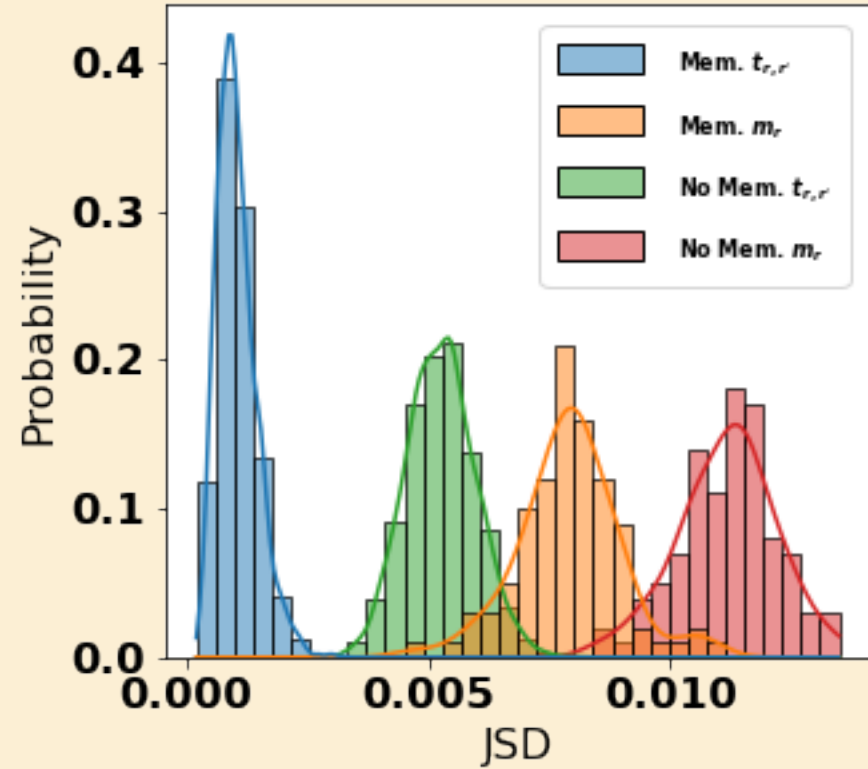
- $d(\text{Career}) = C(\text{Modeled Career})/C(\text{Observed Career})$

Jaccard Index (only track careers seen - not their count):

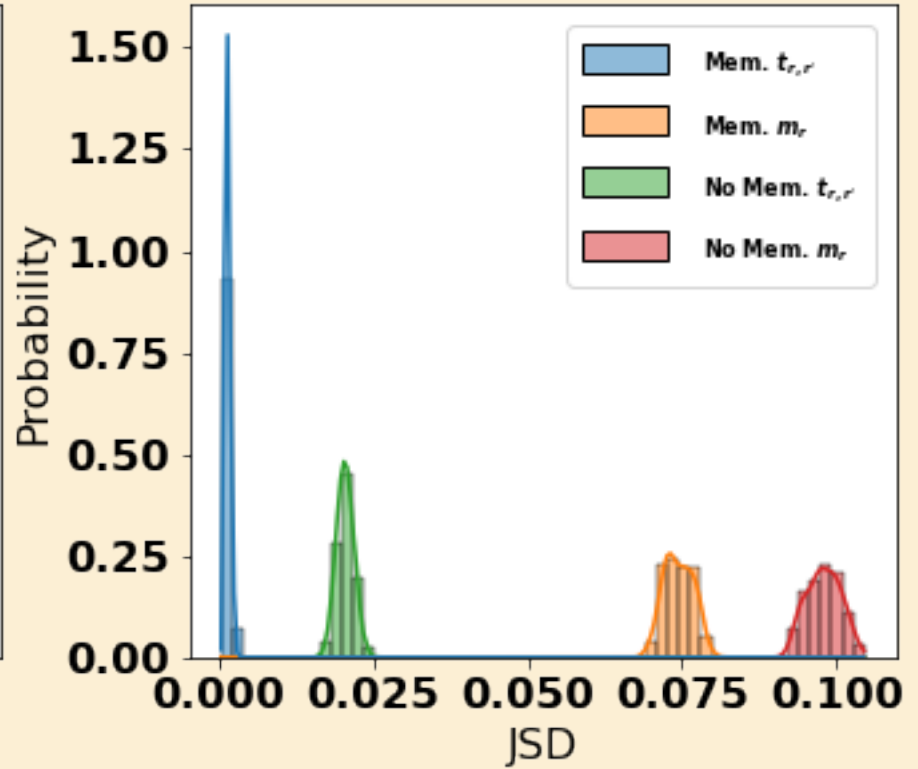
$$J(\bullet) = \text{Size} \left(\text{Venn Diagram of two overlapping circles (one blue, one red)} \right) / \text{Size} \left(\text{Venn Diagram of two overlapping circles (both purple)} \right)$$

Results

JSD for OC and UICs



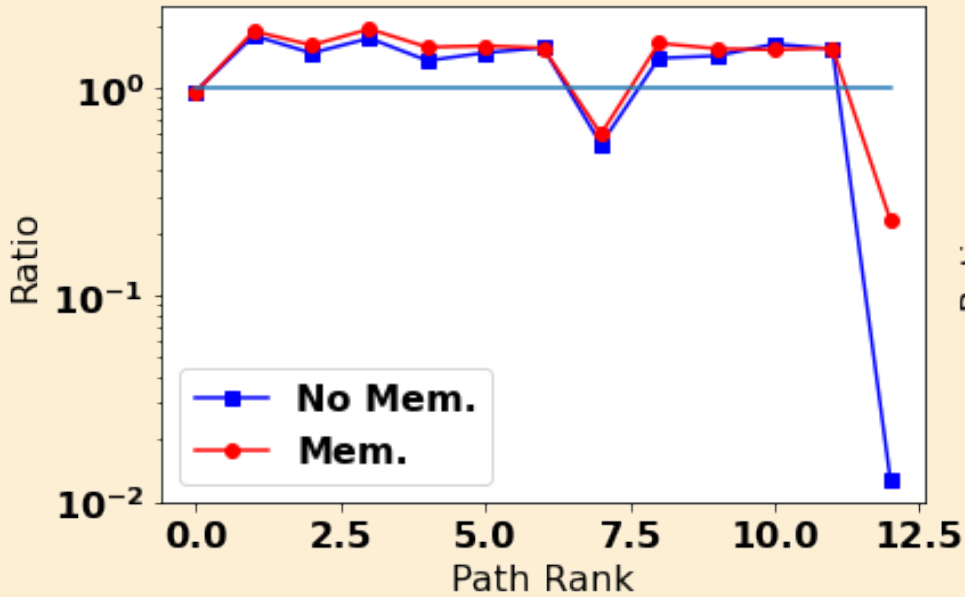
OC 0802



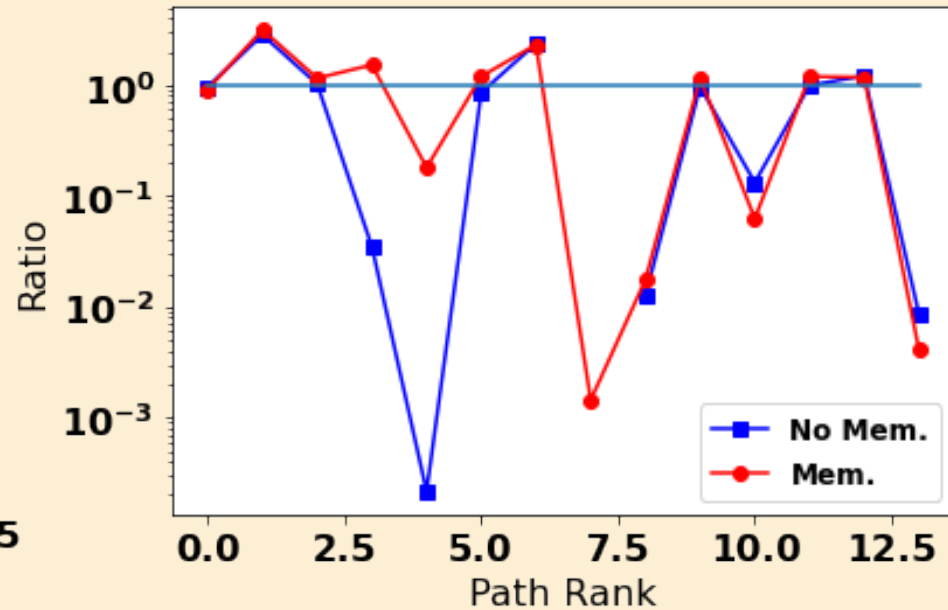
UIC W2SJ02

Results

d profile for OC and UICs



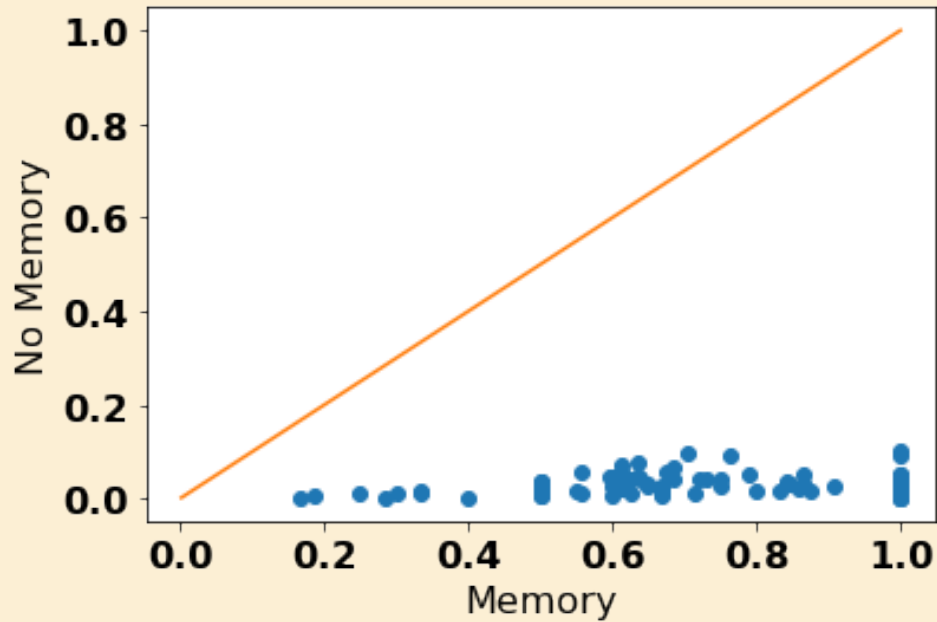
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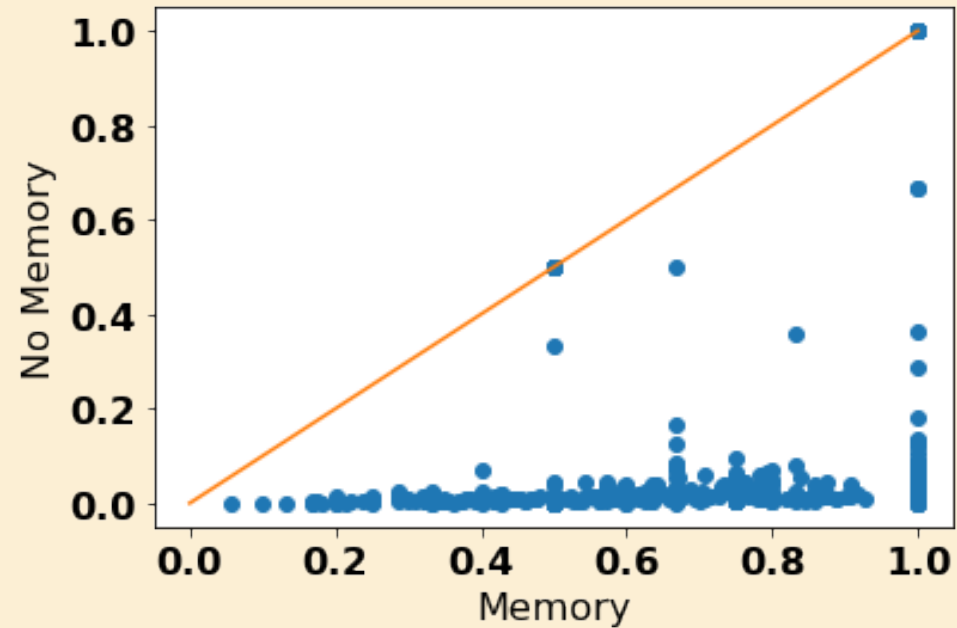
UIC W2SJ02

Results

Jaccard for OC and UICs



All OC



All UICs

Discussion & Conclusions

Discussion:

- Current model of career data insufficient (driven by budget, HR, and created top-down, no employee input)
- Better forecasting requires tracking skills needs, occupation tasks, budgets at level of employing units

Conclusions:

- Most career sequences are generated by one-step memory model
- Model avoids most spurious careers generated without memory effect
- Model provides ingredients of first order career forecasting model
- Unusual career sequences detected for $\log(d) \approx \pm 1$