Translative Neural Team Recommendation

From Multilabel Classification to Sequence Prediction

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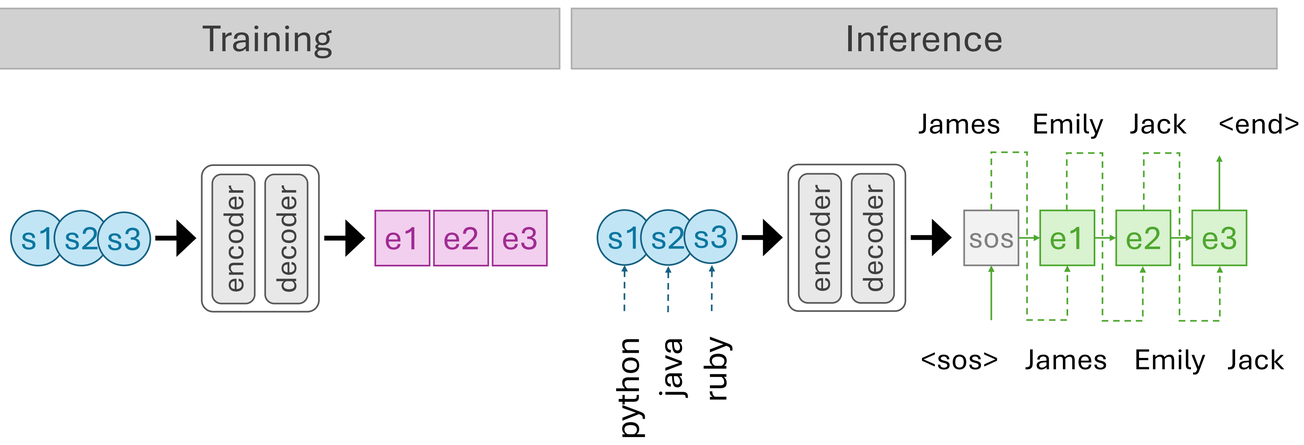
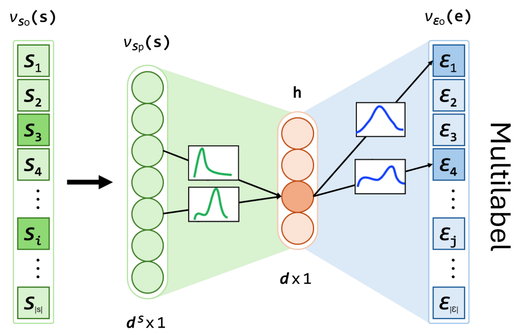
Workflow



Background

Problem: Current neural team recommendation uses multilabel classification (skills → experts) but suffers from **sparsity curse** in high-dimensional expert outputs.



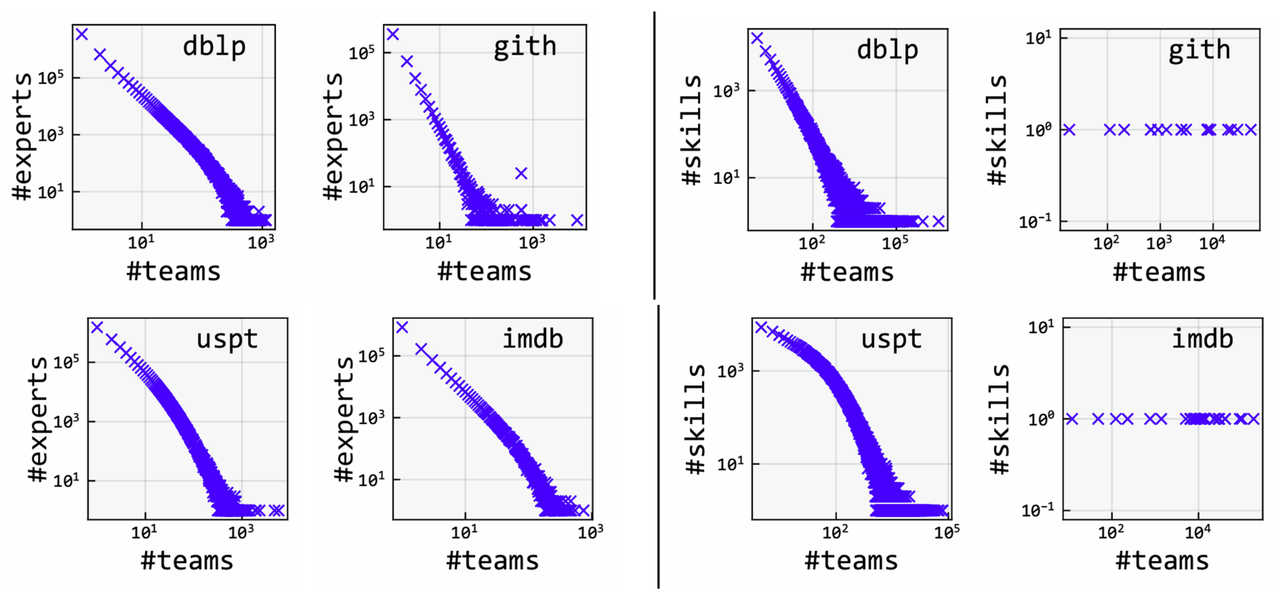
Solution: Reformulate as **sequence prediction** using seq-to-seq models

- Input: sequence of required skills
- Output: sequence of optimal experts
- Captures team dynamics through autoregressive modeling

Advantage: Sequential approach overcomes sparsity limitations and models real team formation patterns.

Datasets

	dblp		uspt		imdb		gith	
teams $\mathcal{T}$	publications		patents		movies		software repos	
experts $\mathcal{E}$	authors		inventors		cast & crew		developers	
skills $\mathcal{S}$	keywords		subclasses		(sub) genres		prog. lang.	
success	published		issued		produced		released	
statistics	raw	prep.	raw	prep.	raw	prep.	raw	prep.
$\lvert\mathcal{T}\rvert$	4.9M	99K	7.1M	152K	507K	32K	133K	46K
$\lvert\mathcal{E}\rvert$	5.0M	14K	3.5M	13K	877K	2.0K	453K	1.2K
$\lvert\mathcal{S}\rvert$	90K	30K	242K	67K	28	23	20	20
#teams w/ one expert	769K	**0**	2.6M	**0**	323K	**0**	**0**	**0**
avg. #experts/team	3.06	3.29	2.51	3.79	1.88	3.98	5.52	7.53
avg. #skills/team	8.57	9.71	6.29	9.97	1.54	1.76	1.37	1.57



Results

	k	transformer	convs2s	rnn-att	rrn	bnn	bnn_emb
				dblp			
%precision	2	**10.4119**	2.4998	3.6176	0.0570	0.0570	0.1124
	5	**7.0113**	1.6122	2.3581	0.0391	0.0663	0.1290
	10	**3.5392**	0.8242	1.1992	0.0472	0.0710	0.1251
%recall	2	**6.3457**	1.5071	2.1698	0.0380	0.0351	0.0668
	5	**10.5477**	2.4177	3.5115	0.0630	0.0993	0.1909
	10	**10.6397**	2.4760	3.5753	0.1552	0.2118	0.3699
%ndcg	2	**10.3611**	2.4770	3.5822	0.0478	0.0538	0.1083
	5	**10.4597**	2.4276	3.5184	0.0523	0.0806	0.1555
	10	**10.4824**	2.4487	3.5391	0.0959	0.1330	0.2397
%map	2	**5.9463**	1.3554	1.9412	0.0217	0.0242	0.0474
	5	**9.2909**	2.0008	2.8791	0.0281	0.0411	0.0792
	10	**9.3210**	2.0127	2.8930	0.0446	0.0558	0.1033
				uspt			
%precision	2	**41.7289**	28.5717	23.9729	0.0239	0.0657	0.3663
	5	**31.0677**	24.6530	17.7873	0.0383	0.0769	0.4123
	10	**16.5169**	15.2382	9.4717	0.0654	0.0910	0.3748
%recall	2	**23.1038**	13.9104	12.9871	0.0140	0.0353	0.1608
	5	**41.1643**	28.8167	23.0358	0.0500	0.0976	0.4509
	10	**42.6086**	33.7595	23.8896	0.1370	0.2212	0.8141
%ndcg	2	**41.6095**	28.3606	23.9146	0.0221	0.0655	0.3652
	5	**42.0309**	30.0325	23.8227	0.0408	0.0883	0.4531
	10	**42.1435**	31.4137	23.8270	0.0868	0.1481	0.6094
%map	2	**22.4053**	13.0305	12.4784	0.0096	0.0266	0.1212
	5	**38.6272**	24.4598	21.3567	0.0186	0.0433	0.2027
	10	**39.7591**	27.1994	22.0112	0.0340	0.0592	0.2583
				imdb			
%precision	2	1.5454	1.6097	**1.6985**	0.0000	0.2128	0.4255
	5	1.4574	1.4552	**1.4804**	0.8511	0.5106	0.5106
	10	**0.9035**	0.8998	0.9027	0.8511	0.4255	0.6383
%recall	2	0.7669	0.7952	**0.8193**	0.0000	0.1418	0.2837
	5	**1.8093**	1.8013	1.8043	1.4184	0.8511	0.8511
	10	**2.2085**	2.1926	2.1792	2.8369	1.3050	1.9574
%ndcg	2	1.5479	1.6173	**1.7003**	0.0000	0.1646	0.3292
	5	1.7364	1.7595	**1.7883**	0.8163	0.5699	0.5923
	10	1.9039	1.9222	**1.9333**	1.4606	0.7848	1.1358
%map	2	0.6172	0.6506	**0.6650**	0.0000	0.0709	0.1418
	5	1.0327	**1.0487**	1.0450	0.3191	0.2600	0.2813
	10	1.0914	**1.1041**	1.0975	0.6265	0.3148	0.4389
				gith			
%precision	2	**32.1596**	25.0590	29.7008	0.0000	3.0693	7.3267
	5	**21.6055**	16.9509	20.1806	0.1980	2.8515	4.7129
	10	**12.7104**	9.9503	12.0029	0.0990	2.6931	3.3861
%recall	2	**13.8543**	11.0787	12.8103	0.0000	1.2164	3.5441
	5	**22.2914**	18.0735	20.7963	0.0619	2.8846	5.1580
	10	**24.0868**	19.4837	22.6186	0.0619	5.1174	6.1885
%ndcg	2	**32.4291**	25.3569	29.7647	0.0000	3.1365	6.4753
	5	**28.2538**	22.3664	26.1975	0.1679	3.2893	5.8418
	10	**26.9900**	21.5849	25.1263	0.1090	4.2340	6.2665
%map	2	**12.9552**	10.5164	11.9759	0.0000	1.0104	2.3424
	5	**19.3215**	15.5615	17.9982	0.0206	1.5706	3.0822
	10	**20.7984**	16.6428	19.4844	0.0206	2.1633	3.3837

	transformer	convs2s	rnn-att	rrn,bnn bnn_emb
batch size	128	8^{+}, 128	128	128
learning rate	-------	Vaswani et al. [56]	--------	0.1
epochs	20	1^{+}, 20	20	20
optimizer	------------	Adam	------------	
hidden layer size	512	128	128, 512*	128
hidden activation	relu, softmax	glu	tanh, sigmoid	relu
output layer	128	128	128	$\lvert\mathcal{E}\rvert$
output activation	----------	softmax	----------	sigmoid

$^{+}$: convs2s model setting for uspt dataset.

Paper

Codebase