

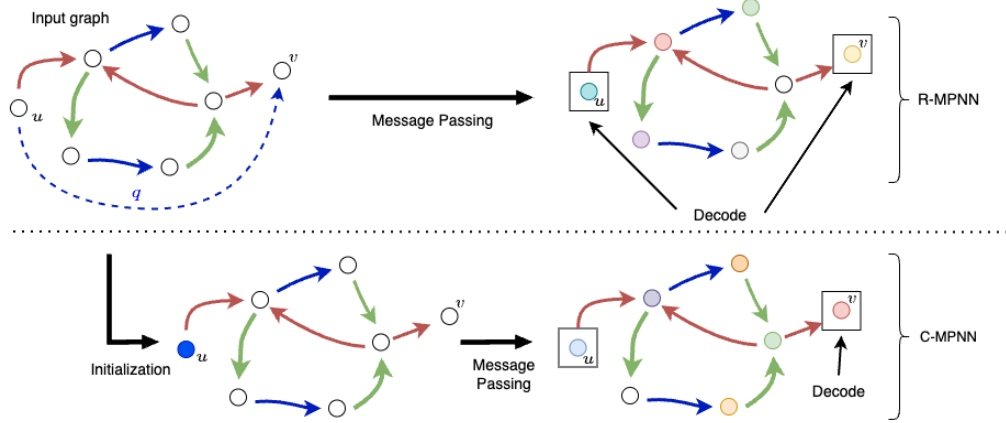


Figure 1: Visualization of R-MPNN and C-MPNN. The dashed arrow is the target query $q(u, v)$. Arrow colors indicate distinct relation types, while node colors indicate varying hidden states.

Table 1: Inductive relation prediction baseline. We use *basic* C-MPNN architecture with AGG = sum, MSG = MSG_r¹, and INIT = INIT² with no readout component.

Model	WN18RR				FB15k-237			
	v1	v2	v3	v4	v1	v2	v3	v4
NeuralLP	0.744	0.689	0.462	0.671	0.529	0.589	0.529	0.559
DRUM	0.744	0.689	0.462	0.671	0.529	0.587	0.529	0.559
RuleN	0.809	0.782	0.534	0.716	0.498	0.778	0.877	0.856
GraIL	0.825	0.787	0.584	0.734	0.642	0.818	0.828	0.893
C-MPNN	0.932	0.896	0.900	0.881	0.794	0.906	0.947	0.933

Table 2: Transductive knowledge graph completion baseline.

Model architectures	WN18RR			FB15k-237		
	MR	MRR	Hits@10	MR	MRR	Hits@10
NeuralLP	—	0.435	0.566	—	0.240	0.362
DRUM	—	0.486	0.586	—	0.343	0.516
RGCN	3069	0.367	0.405	210	0.205	0.387
CompGCN	3590	0.433	0.519	217	0.334	0.514
C-MPNN	687	0.534	0.643	121	0.400	0.583

Table 3: Transductive biomedical knowledge graph completion. OOM stands for out of memory.

Model	Hetionet			OGB-Biokg		
	MRR	Hits@1	Hits@10	MRR	Hits@1	Hits@10
RGCN	0.120	0.067	0.228	0.636	0.511	0.884
CompGCN	0.152	0.083	0.292	OOM	OOM	OOM
C-MPNN	0.479	0.394	0.649	0.790	0.718	0.927

Table 4: Model complexities. The addition of the readout component in C-MPNN does not affect the asymptotic complexity. $|V|, |E|, |R|$ represents the size of vertices, edges, and relation-types. d is the hidden dimension of the model, and T is the number of layer in the model.

Model	Complexity of a forward pass	Amortized complexity of a query
R-MPNN	$O(T(E d^2 + V d^2))$	$O(T(\frac{ E d^2}{ R V ^2} + d))$
C-MPNN	$O(T(E d + V d^2))$	$O(T(\frac{ E d}{ V } + d^2))$
GraIL	$O(E d^2)$	$O(E d^2)$