

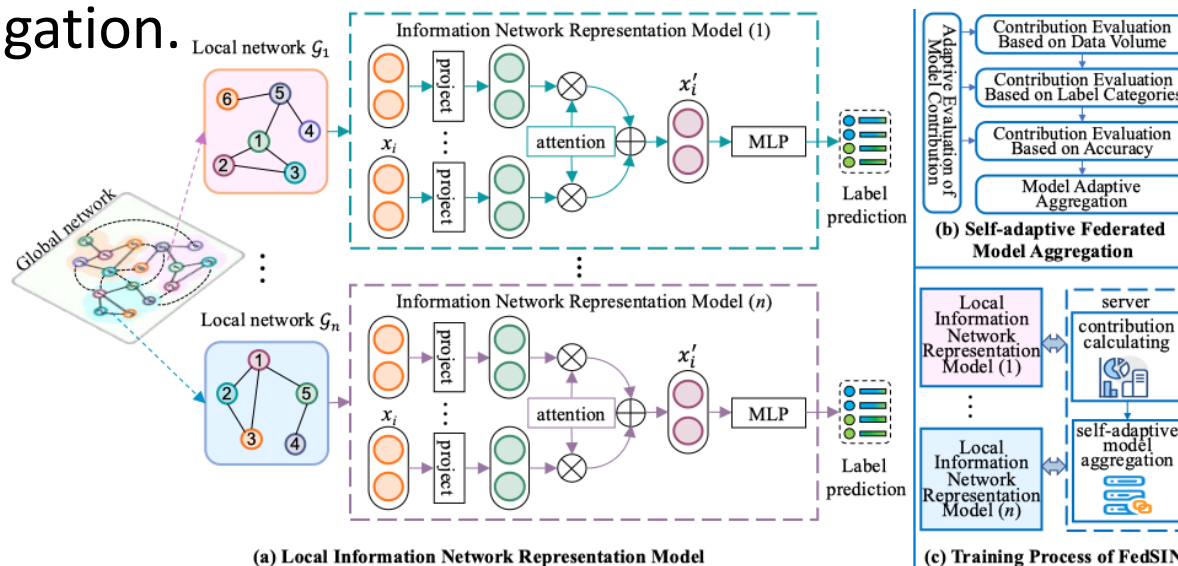
FedSIN: Information Network Representation based on Federated Self-adaptive Learning

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Problems & Ideas

- Problems of conventional federated learning approaches:
 - primarily addresses non-Euclidean data, where data heterogeneity becomes a significant challenge when applied to information networks.
 - assume that the contributions of multiple parties are fixed.
- Ideas: A Information Network representation method based on Federated Self-adaptive learning, which leverages the importance of neighboring nodes in the network to learn node representations and performs adaptive federated model aggregation.



The overall framework of FedSIN. (a) Illustrates the local information network representation method. (b) Shows the self-adaptive federated model aggregation. (c) Depicts the training process of FedSIN.

Main Contributions

- Contributions:
 - A novel Information Network representation method based on Federated Self-adaptive learning (FedSIN), which considers the importance of neighboring nodes and performs self-adaptive federated model aggregation to address the data silo issue;
 - An self-adaptive federated model aggregation mechanism that dynamically aggregate clients' model according to contribution;
 - Experimental results demonstrate that our FedSIN outperforms state-of-the-art information network representation methods.

Table 1 Performance of node classification of FedSIN and baselines on the Cora dataset.

Splitter	Method	Accuracy			Precision			Recall			F1		
		client A	client B	client C	client A	client B	client C	client A	client B	client C	client A	client B	client C
Louvain	GCN	0.8093	0.7290	0.7809	0.5472	0.5764	0.4709	0.5996	0.6336	0.5298	0.5629	0.5351	0.5441
	GraphSage	0.8047	0.7239	0.7865	0.5331	0.5871	0.4841	0.5771	0.6241	0.5350	0.5466	0.5220	0.5503
	GAT	0.7967	0.7135	0.7418	0.5444	0.5799	0.4575	0.5974	0.6234	0.5173	0.5597	0.5142	0.5311
	FedAvg(GAT)	0.8793	0.8089	0.8706	0.5916	0.6225	0.6001	0.6531	0.7048	0.6844	0.6150	0.5747	0.6298
	FedOpt	0.8787	0.7935	0.8681	0.5853	0.6139	0.5968	0.6422	0.6992	0.6791	0.5935	0.5699	0.6128
	FedSIN	0.8844	0.8126	0.8727	0.5978	0.6301	0.6134	0.6542	0.7137	0.696	0.6186	0.5840	0.6380
Random	GCN	0.7934	0.7278	0.7883	0.5250	0.4912	0.5451	0.5701	0.5099	0.5928	0.5306	0.4932	0.5582
	GraphSage	0.7826	0.7573	0.7619	0.5241	0.5165	0.5492	0.5773	0.5386	0.5755	0.5337	0.5223	0.5519
	GAT	0.7864	0.7423	0.7671	0.5184	0.4896	0.5355	0.5532	0.5043	0.5778	0.5211	0.4885	0.5451
	FedAvg(GAT)	0.8152	0.7647	0.8042	0.5674	0.5488	0.5649	0.5762	0.5420	0.6037	0.5669	0.5349	0.5772
	FedOpt	0.8089	0.7633	0.7949	0.5531	0.5472	0.5530	0.5699	0.5305	0.5991	0.5575	0.5235	0.5672
	FedSIN	0.8206	0.7714	0.8106	0.5760	0.5705	0.5915	0.5582	0.6166	0.5718	0.5390	0.5871	

Table 2 Performance of node classification of FedSIN and baselines on the CiteSeer dataset.

Splitter	Method	Accuracy			Precision			Recall			F1		
		client A	client B	client C	client A	client B	client C	client A	client B	client C	client A	client B	client C
Louvain	GCN	0.737	0.7575	0.6825	0.6516	0.6523	0.6035	0.5887	0.6014	0.5748	0.6078	0.6139	0.5867
	GraphSage	0.7452	0.7616	0.7056	0.6435	0.6362	0.6227	0.5830	0.6082	0.6003	0.6055	0.6150	0.6083
	GAT	0.7616	0.7533	0.6917	0.6571	0.6473	0.6049	0.6040	0.6057	0.5781	0.6208	0.6141	0.5897
	FedAvg(GAT)	0.7841	0.8105	0.7330	0.6873	0.6889	0.6521	0.6137	0.6535	0.6191	0.6371	0.6622	0.6334
	FedOpt	0.7806	0.8073	0.7303	0.6839	0.6842	0.6590	0.6046	0.6494	0.6163	0.6268	0.6619	0.6283
	FedSIN	0.8060	0.8285	0.7481	0.6947	0.6967	0.6642	0.6232	0.6639	0.6230	0.6377	0.6676	0.6345
Random	GCN	0.6901	0.8017	0.6533	0.6103	0.7029	0.5856	0.5805	0.6758	0.5478	0.5927	0.6878	0.5634
	GraphSage	0.6948	0.7841	0.6711	0.6128	0.6951	0.6016	0.5847	0.6527	0.5586	0.5941	0.6728	0.5771
	GAT	0.7136	0.7929	0.6666	0.6406	0.6926	0.6095	0.6015	0.6604	0.5531	0.6167	0.6752	0.5751
	FedAvg(GAT)	0.7840	0.8061	0.6933	0.6847	0.7131	0.6275	0.6599	0.6826	0.5783	0.6698	0.6971	0.5994
	FedOpt	0.7830	0.7941	0.6877	0.6769	0.7045	0.6193	0.6470	0.6708	0.5690	0.6638	0.6857	0.5806
	FedSIN	0.7934	0.8151	0.7024	0.6915	0.7276	0.6295	0.6678	0.6970	0.5844	0.6798	0.7056	0.6016

Table 3 Performance of node classification of FedSIN and baselines on the PubMed dataset.

Splitter	Method	Accuracy			Precision			Recall			F1		
		client A	client B	client C	client A	client B	client C	client A	client B	client C	client A	client B	client C
Louvain	GCN	0.8532	0.8082	0.7570	0.6337	0.6355	0.6660	0.7742	0.7956	0.7999	0.6468	0.6405	0.6697
	GraphSage	0.8651	0.8143	0.7652	0.6388	0.6481	0.6711	0.7807	0.7970	0.8081	0.6479	0.6485	0.6674
	GAT	0.8385	0.8168	0.7542	0.6237	0.6316	0.6650	0.7649	0.8055	0.7984	0.6278	0.6352	0.6671
	FedAvg(GAT)	0.8736	0.8103	0.7637	0.6491	0.6442	0.6724	0.7942	0.8157	0.8233	0.6530	0.6469	0.6806
	FedOpt	0.8698	0.8088	0.7570	0.6352	0.6309	0.6671	0.7850	0.8099	0.8118	0.6477	0.6373	0.6767
	FedSIN	0.8766	0.8124	0.7817	0.6675	0.6533	0.6806	0.7964	0.8226	0.8375	0.6580	0.6535	0.6855
Random	GCN	0.8434	0.8170	0.8345	0.6859	0.6589	0.6728	0.8540	0.8253	0.8763	0.7111	0.6740	0.6980
	GraphSage	0.8501	0.8193	0.8309	0.6893	0.6644	0.6808	0.8657	0.8281	0.8790	0.7231	0.6794	0.7043
	GAT	0.8426	0.8178	0.8308	0.6851	0.6592	0.6651	0.8533	0.8256	0.8608	0.7103	0.6755	0.6857
	FedAvg(GAT)	0.8488	0.8217	0.8335	0.6869	0.6623	0.6764	0.8604	0.8284	0.8734	0.7297	0.6891	0.6996
	FedOpt	0.8301	0.8178	0.8162	0.6767	0.6585	0.6617	0.8535	0.8155	0.8631	0.7064	0.6715	0.6840
	FedSIN	0.8524	0.8277	0.8485	0.6981	0.6789	0.6872	0.8790	0.8379	0.8891	0.7350	0.6953	0.7091

Performance of node classification of FedSIN and baselines on different datasets. Upper Left: on Cora dataset; Upper Right: on CiteSeer dataset; Lower: on PubMed dataset