Additional File 1

Description of 21 algorithm used in the study

No	Algorithm	Description
1	Fluid	Fluid Communities (FluidC) is based on the simple concept of fluids (i.e., communities) expanding and contracting within an environment (i.e., a non-complete graph). It is a propagation-based algorithm that allows for the specification of the desired number of communities (k). It is also asynchronous, with each vertex update computed using the graph's most recent partial state. Type/approach: propagation based algorithm Type Graph: Undirected Complexity : O(m)
2	Belief	The community of belief seeks consensus among numerous partitions with a high degree of modularity. This is accomplished through the use of a scalable message-passing algorithm derived by considering modularity as a Hamiltonian and applying the cavity method Type/approach: Statistical inference Type Graph: Undirected Complexity : O(kn)
3	CPM	CPM is a quality function optimization model Type/approach:Modularity Maximation Type Graph: Undirected , Weighted Complexity : -
4	Chinese Whisper	A method for clustering graphs that generates an intermediate representation of the input graph that reflects the "ambiguity" of its nodes and then employs hard clustering to discover crisp clusters in this "disambiguated" intermediate graph Type/approach: propagation based algorithm Type Graph: Undirected, Weighted Complexity : O(km)
5	DER	DER is a graph clustering algorithm based on the Diffusion Entropy Reducer principle. The algorithm embeds the graph in a space of measures using random walks, followed by a modification of k-means in that space. It generates the walks, initializes the algorithm, and then extracts the communities. Type/approach: random walks Type Graph: Undirected , Weighted Complexity : -
6	Eigenvector	Newman's leading eigenvector approach for finding modularity-based community structure. This is the fundamental structure of the recursive, divisive algorithm: each split is achieved by optimizing the modularity of the original network. Type/approach: Hierarchical clustering Type Graph: Undirected Complexity : -

7	EM	The EM technique is based on a mixing model.The technique detects network structure by employing the expectation–maximization algorithm Type/approach: Statistical inference Type Graph: Undirected, Directed Complexity : -
8	GA	A genetic method to community discovery in social networks. GA optimizes a simple but effective fitness function capable of identifying clusters of nodes that are densely connected but have sparse connections between them. Type/approach: Modularity Maximation Type Graph: Undirected Complexity : -
9	Girvan Newman	By gradually eliminating edges from the original graph, the Girvan–Newman method discovers communities. At each stage, the algorithm discards the "most useful" edge, generally the one with the highest betweenness centrality. The graph's fragmentation reveals the tightly interwoven community structure, which can be shown as a dendrogram Type/approach:Girvan Newman Type Graph: Undirected Complexity : -
10	Greedy Modularity	This algorithm makes advantage of modularity to determine the structures of communities. At each stage of the process, two communities with the highest positive contribution to global modularity are merged. Type/approach: Modularity Maximation Type Graph: Undirected Complexity :
11	Kcut	An Efficient Spectral Algorithm for Identifying Network Communities. Kcut is a one-of-a-kind combination of recursive partitioning and direct k-way methods that guarantees the efficiency of a recursive approach while maintaining the accuracy of a direct k-way method Type/approach: minimum cut method Type Graph: Undirected Complexity : -
12	Label Propagation	The Label Propagation algorithm (LPA) identifies communities only on the basis of network structure. The algorithm is not pre-defined in terms of objective function or prior knowledge about the communities. It operates in the following manner: -Each node is assigned a unique label (an identifier) at startup. -These labels spread throughout the network. -At the end of each propagation iteration, each node updates its label to the one that has the greatest number of its neighbours. Ties are broken in a consistent and random manner. -LPA converges when each node has the majority label assigned to it by its neighbors. Type/approach: propagation based algorithm Type Graph: Undirected Complexity : -

13	Leiden	The Leiden algorithm is a modification of the Louvain algorithm. The Leiden algorithm is divided into three stages: (1) local node relocation; (2) partition refinement (3) aggregation of the network utilizing the refined partition as the initial partition for the aggregate network Type/approach: Modularity Maximation Type Graph: Undirected
14	Louvain	Louvain optimizes each community's modularity score. In two elementary phases, the algorithm optimizes modularity: (1) local node movement; (2) network aggregation. Individual nodes are transferred to the community that results in the greatest increase in the quality function during the local moving phase. The aggregation phase establishes an aggregate network from the partition produced during the local moving phase. Each community within this division is connected to the aggregate network via a node. The two steps are repeated until no more improvement in the quality function is possible. Type/approach:Modularity Maximation Type Graph: Undirected
15	Markov Clustering	Markov clustering (MCL) is a technique for simulating (stochastic) flow in graphs. Through a mathematical bootstrapping method, the MCL algorithm discovers cluster structure in graphs. The technique deterministically computes (the probability of) random walks around the graph and transforms one set of probabilities into another using two operators. It accomplishes this through the use of stochastic matrices (also known as Markov matrices), which mathematically represent the concept of random walks on a graph. By alternating between two operators called expansion and inflation, the MCL algorithm replicates random walks within a graph. Type/approach: Statistical inference / random walks Type Graph: Undirected
16	RBER Pots	RBER Pots is a model for optimizing the function of quality Type/approach: Modularity Maximation Type Graph: Undirected , weighted
17	RB Pots	RB Pots is a model used to improve the quality of a function Type/approach: Modularity Maximation Type Graph: Undirected , Directed, Weighted
18	Significance	Significance is a model for enhancing the function of quality Type/approach: Modularity Maximation Type Graph: Undirected
19	Spinglass	Spinglass is based on an analogy between a statistical model called Potts spin glass and the structure of a community. Simulated annealing is used to improve this model's modularity by making it more efficient Type/approach: Statistical inference Type Graph: Undirected
20	Surprise	Surprise is a model for maximizing the function of quality

		Type/approach: Modularity Maximation Type Graph: Undirected, Directed, Weighted
21	Walktrap	Walktrap is a technique that relies on random walks. The general idea is that if random walks are performed on the graph, the walks are more likely to remain within the same community, as there are only a few edges that lead outside a given community. Walktrap generates short random walks and uses the results of these random walks to bottom-up merge separate communities. Type/approach: random walks Type Graph: Undirected