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New centrality indices in networks and their applications

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We propose new centrality indices to reveal most powerful (central) nodes in networks. These indices take into account the parameters of the nodes in networks, a possibility of group influence from the subset of nodes to single nodes and intensity of short and long interactions among the nodes. We study the properties of these indices and their applications to real-life problems. The first one is the problem of international migration. We obtain information about critical elements for the migration process in different periods. Another application is the international loan market. Our approach allows identifying systemically important elements which cannot be detected by classical centrality measures. Using our approach, we detect two types of key borrowers a) major players with high ratings and positive credit history; b) intermediary players, which have a great scale of financial activities through the organization of favorable investment conditions and positive business climate. The third application deals with the trade relations between countries represented as a network, where vertices are territories and edges are export flows. We consider various groups of substitute goods (cereals, fish, vegetables). We detect key participants affecting food retail with the use of classical and new centrality measures. Many other applications are discussed.

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