Second-order logic and definability

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In addition to algebraic characterizations, regular languages can be characterized logically as languages definable in (so-called) Monadic Second-Order Logic (MSO). The well-known correspondence between regular languages and MSO can be regarded as an early result in Descriptive Complexity Theory. The objective of Descriptive Complexity Theory is to characterize complexity classes in terms of related logical formalisms. Another early result in Descriptive Complexity is the characterization of NP as exactly the collection of classes of relational structures definable in Existential Second-Order Logic (Fagin 1973). This talk is an accessible survey of Descriptive Complexity Theory. We first survey the classical results of the field. We then take a look at some of the more recent developments. These include the uses of linear algebra in descriptive complexity, logical characterizations of PTIME over restricted classes of structures, and characterizations of complexity classes of distributed computing.