Semantic Web Course Research Topics

The research topics, which can be chosen by students, are but not limited as follows:

- **Scalable reasoning:** reasoning has always been a hot topic in the SW community, but now there is increasing demand for reasoners that can scale into the billions of triples and handle messy data. Distributed reasoning has been a hot topic for a while, as have new languages (like the profiles of OWL), and ways to deal with provenance.

- **Live/decentralised querying:** centralised public endpoints often groan under the amount of data and users they try to support. Furthermore, their local indexes can often become stale or out of date. Live querying techniques look to get data directly from sources at runtime. Sources can be another endpoint that closer to the raw data (e.g., federation), or even just documents themselves (e.g., link traversal).

- **SPARQL performance:** also, there has been increased demand for high performance SPARQL engines. This continues to be a hot topic.

- **Instance matching / entity matching / consolidation / linking:** we now have lots of data on the Web about all sorts of instances. As such, mechanisms to (semi-)automatically link descriptions of related (or possibly even equivalent) resources is becoming more and more important (more so, I feel, than the more traditional ontology matching field).

- **Linked Data "science":** How can we interact with Linked Data? How can we consume it? How can be link it? How dynamic is it? How big is it? How useful is it? How correct is it? What kind of quality can we expect? Linked Data topics are seeing more and more attention.

- **Policies/authentication:** Not all data is open, esp. in key areas like enterprises or "smart cities". Policies and authentication mechanisms are being proposed that use rules or RDF to represent policies, and control access to data annotated with control mechanisms.

- **Semantic sensor streams:** If more and more devices are connected to the internet, how can semantic tech. help to make sense of the data streams they produce? How can we reason and query over such data? Topics include temporal reasoning, window-based querying/continuous SPARQL querying, etc.

- **Machine Learning & combining inductive/deductive methods:** Perhaps a little bit more vague, but for a long time, machine learning and related techniques have been applied at large scale to make sense or extract "knowledge" from messy, unstructured corpora. With resources like Linked Data and topics like Big Data growing, there is now renewed interest in how to combine deductive reasoning with inductive/statistical/heuristic methods in various areas.
• **Ontology Alignment (Ontology Matching)**
  Two parties may develop separate Ontologies which talks about similar things. Then an agent wants to be able to process and find similar data in two sites should be able to draw correspondence between entities of two or more ontologies. The problem is how an agent should do such matching.

• **Ontology Integration**
  Having some ontologies the aim is to build a new ontology, which integrates the existing ontologies. Ontology alignment (matching) techniques can be used here, but other mechanism is needed to build appropriate structure for the integrated ontology.

• **Application of Ontology in Other Environments**
  The application of ontological representation of information is not restricted to the web. In this topic advantages and disadvantages of using ontology for knowledge representation in the other environments is investigated. Contextual information modeling is one of foremost example which used in the context-centric environments such as pervasive computing environments.

• **Ontology Engineering**
  With developing large ontologies, we encounter problems similar to ones that we tried to solve with software engineering. For example, developing techniques to make modular ontologies or adding versioning capabilities, will make developing and using ontologies easier.

• **Knowledge Acquisition**
  Many domains do not have a well formed structure that can be easily converted into ontologies. Most of these domains are very large and need automatic ontology creation. In knowledge acquisition, many techniques will be developed to extract useful information from domains to create required ontologies.

• **Semantic Web Services**
  Web service is a technology deployed on the web which can be located and called on the web. However, human should interfere in every step of locating and usage of web services, because web service descriptions in traditional forms do not contain semantics. With semantic web services, we hope that by adding semantics to the descriptions, we may delegate some of the human works to machines. These involve web service discovery and composition.

• **Reasoning and Inference Techniques for SW Languages**
  There are some standard reasoning tasks for Ontology languages (e.g. Subsumption). However, some other forms of reasoning are needed for many applications.
• **Extensions of Description Logics**
  Description logic is a family of logics. Based on the requirements developed in different computing environments, different types of DLs are developed. Adding modal operators, rules, etc. to the existing DLs or combining them with other types of logics are topics which are considered in recent years.

• **Security and Trust Models for Semantic Web**
  Security of data, metadata, and services provided on the web as well as trust management in this environment are complicated issues in semantic web in comparison with the current web. Security mechanisms provided for semantic web (or more generally in semantic-aware environments) as well as formal models for trust management and authorizations are interested research issues in this field.

• **Applications of Semantic Technology**
  Semantic technology has been used in different environments (semantic grid, semantic cloud, ...) and different applications (semantic social networks, semantic virtual organizations,...). The usage of semantic technology for solving the problems arises in other applications and environments are the research issues, which can be considered.

• **Semantic Web Mining**
  Web mining helps to find new patterns and knowledge from the web information. Semantic Web Mining can be used to find semantic patterns or use the semantics to guide mining for better knowledge extraction from the web.

• **Semantic-Based Recommendation System**
  Recommender systems play a major role in the satisfying user needs in a variety of web applications. However, as most of the information is present in a textual form, recommender systems face the challenge of efficiently analyzing huge amount of text. It seems that semantic technology can help to the recommender systems to have semantic-based analysis.

• **Named Entity Recognition**
• **Decidability in OWL and SWRL**
• **Managing Uncertainty in Semantic Web**
• **Other Related Topics**
  You can choose other related topics by taking permission from TA or the Instructor of the course.

**Important Notes:**
- Research proposal deadline: 94-8-25.
- Proposal must be written in the attached template. It can be a survey on some papers.
- Send your proposal to masalehi@ce.sharif.edu.

**Teacher Assistance**
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