

PHI 579 SEM

Ontology Engineering and Intelligence Analysis

Semester, Year

3 Credits

**Meeting Pattern**

Asynchronous (optional 2 meetings per week, 1:20)

| Instructor | Email | Office Location & Hours |
| --- | --- | --- |
| **John Beverley** | [johnbeve@buffalo.edu](mailto:johnbeve@buffalo.edu) | 107 Park Hall, T 9-11am |

## Course Description

## This course integrates foundational principles of ontology engineering with contemporary research in intelligence analysis. To that end, we explore ontological dimensions that inform intelligence methodologies, addressing fundamental questions related to knowledge, truth, ethics, and decision-making within this domain.

## The curriculum anchors theoretical concepts in practical intelligence contexts, transforming abstract ideas into actionable tools for analyzing and enhancing intelligence operations. Students will engage critically with a diverse array of topics, including the implications of digital warfare, the nature of cybersecurity in the global sphere, the ontology of terrorism, and the ethical considerations of artificial intelligence in espionage.

## Students will develop a nuanced understanding of innovative applications of semantic web tools, ontologies, and knowledge graphs to intelligence analysis. The goal is for students to emerge with the ability to not only grasp but also critically evaluate and contribute to ongoing discussions and developments in the field. By the end of the course, students will be well-prepared to formulate and advocate their own informed perspectives on pressing intelligence issues.

## Learning Outcomes

| Outcome | Method of Assessment |
| --- | --- |
| Critically evaluate the core literature and central debates straddling the intersection of ontology engineering and intelligence analysis. | Participation, Presentations |
| Conceptualize and advocate ontology-informed perspectives on pressing intelligence issues, showcasing innovation and depth. | Participation, Presentations |
| Demonstrate an in-depth understanding of the philosophical underpinnings that inform intelligence paradigms. | Participation, Presentations |
| Analyze how classical ontological constructs can be integrated into contemporary intelligence analysis frameworks. | Participation, Presentations |
| Identify the ways in which ethical, ontological, and epistemological challenges emerge within intelligence operations and decision-making. | Participation, Presentations |
| Create ontology design patterns representing core aspects of the domain of intelligence analysis, using existing open-source ontologies | Participation, Presentations, Final Project |
| Engage in independent exploration of a chosen ontological issue in AI, producing a well-reasoned and critically reflective result that contributes to the ongoing discourse in the field. | Final Project |

## Required Text(s) & Materials

* See schedule below.

## Course Requirements

* Students will be expected to participate in class discussions boards and watch all lectures.
* Students will be expected to give at least two presentations during the semester.
* Students will be expected to submit one final project.

## Grading Policy

|  |  |
| --- | --- |
| **Weighting** | **Assessment/Assignment** |
| 30% | Attendance and Participation |
| 20% | Presentation 1 |
| 20% | Presentation 2 |
| 30% | Final Project |

*Presentations*

The first step in learning to give stellar talks, is identifying what a stellar talk looks like *for you*. Your stellar talk won’t look like mine, but will be stellar nonetheless (being stellar isn’t a finite resource!). In the interest of practicing, students will be expected to give at least **two** presentations during the semester on topics of their choosing. Given the asynchronous nature of the course, students are permitted to submit a recording of themselves giving presentation.

I strongly encourage students give multiple presentations *on the same topic*, indeed, *the same presentation but improved*. The fastest way I’ve found to identify what a good talk looks like for me is by refining the same talk over time.

Students will select which topics they would like to present on no later than the second week of class, as presentations will begin during the third week.

All presentations must aim to deliver a *design pattern* covering some area of the intelligence analysis domain. Students will be given guidance on how to create design patterns and examples of intelligence analysis design patterns will be provided prior to the second week of class.

Ideally, these presentations will be recorded and posted on one of our many ontology channels. Students are not obligated to have videos recorded or posted, however, so I will always seek permission.

Ideally, the design patterns used in the presentations will be added as contributions – with full citations of the relevant authors – to existing open-source ontology projects.

*Events*

Ontology engineering is a thriving discipline with cutting edge research conducted in various quarters at a rapid pace. Established ontology events are listed in the schedule as opportunities to broaden your exposure to the field. Many of these events will be offered remotely.

The instructor will arrange to have students permitted to participate in these events during normal course meeting hours. Students will not be expected to pay to attend these events and they will not be expected to participate more than the allotted normal course time. Students may, of course, participate in the full event, however.

Minimal attendance at events of the sort described above, counts towards participation and attendance credit. For further questions, please reach out to the instructor.

*Final Project*

Students will be expected to complete a final project covering one or more topics at the intersection of intelligence analysis and ontology engineering. This may take the form of, say, a final paper written for the purposes of publication in a journal or conference proceedings, high-quality video lecture on important research results, or a rigorously evaluated ontology artifact on GitHub. This may also take the form of a series of well-developed, vetted, design patterns to be used in existing open-source ontology projects.

Students should confer with the instructor as to the nature of their final project by the mid-point of the semester.

The final project will be graded based on viability of the project, presentation, proper use of intelligence analysis and ontology engineering research as discussed in class, clarity, and creativity.

GitHub projects must be publicly available, and students must be responsive to change requests and issues raised by the instructor.

*Incompletes*

A grade of incomplete (“I”) indicates that additional course work is required to fulfill the requirements of a given course. Students may only be given an “I” grade if they have a passing average in coursework that has been completed and have well-defined parameters to complete the course requirements that could result in a grade better than the default grade. An “I” grade may not be assigned to a student who did not attend the course. Prior to the end of the semester, students must initiate the request for an “I” grade and receive the instructor’s approval. Assignment of an “I” grade is at the discretion of the instructor.

## Schedule

| Week | Topic | Readings | Assignment |
| --- | --- | --- | --- |
| Week 1 | * Foundations | * [National Security Intelligence Activity: A Philosophical Analysis](https://www.tandfonline.com/doi/epdf/10.1080/02684527.2022.2076329?needAccess=true) * [Ontology for the Intelligence Analyst](https://apps.dtic.mil/sti/tr/pdf/ADA591720.pdf) * Design Patterns 101 (**pdf provided in Brightspace**) |  |
| Week 2 | * Intelligence Analysis: Top-Down | * [Philosophical Foundations of Intelligence Collection and Analysis](https://philarchive.org/archive/SMIPFO-4) * [Rethinking Intelligence Practices and Processes](https://www.tandfonline.com/doi/full/10.1080/02684527.2022.2113679?src=recsys) * Design Patterns 102 (**pdf provided in Brightspace**) |  |
| Week 3 | * Intelligence Analysis: Top-Down | * [Aboutness: Towards Foundations for the Information Artifact Ontology](https://ceur-ws.org/Vol-1515/regular10.pdf) * [Document Acts](https://ontology.buffalo.edu/smith/document-acts.pdf) * [On Credentials](https://www.degruyter.com/document/doi/10.1515/jso-2019-0034/html) * [Ontology of Information Artifacts in the Intelligence Domain](https://philpapers.org/archive/SMII-16.pdf) | Presentation |
| Week 4 | * Intelligence Analysis: Bottom-Up | * Whitesmith, Part 1 (**pdf provided in Brightspace**) * [Understanding Bias in Twitter-Based Intelligence Analysis](https://ieeexplore.ieee.org/document/10345941) * [Ontology and Cognitive Outcomes](https://arxiv.org/pdf/2005.08078.pdf) | Presentation |
| Week 5 | * Intelligence Analysis: Bottom-Up | * Whitesmith, Part 2 (**pdf provided in Brightspace**) * [Towards Handling Bias in Intelligence Analysis with Twitter](https://ieeexplore.ieee.org/abstract/document/10302618?casa_token=nH21mS5x4MIAAAAA:rjE4RrAbEu8PrlZtB1bvIwQ7XOwx8GcSTHvfGcyHidUB7593ZZ0uHJsx74_aRuILO8BFvT7sTg) | Presentation |
| Week 6 | * Military Intelligence Domain | * [Joint Doctrine Ontology](https://stids.c4i.gmu.edu/papers/STIDS_2015_T01_Morosoff_etal.pdf) * [Command and Control](https://philpapers.org/archive/TOLCAC.pdf) | Presentation |
| Week 7 | * *ONTOBRAS EVENT* |  |  |
| Week 8 | * Military Intelligence Domain | * [Complexity in Military Intelligence](https://www.tandfonline.com/doi/full/10.1080/08850607.2023.2209493?src=recsys) | Presentation  Final Project Format |
| Week 9 | * *STIDS EVENT* |  |  |
| Week 10 | * Cybersecurity Domain | * [Cybersecurity Knowledge Graphs](https://link.springer.com/article/10.1007/s10115-023-01860-3) * [A Common Core-Based Cyber Ontology for Support of Cross-Domain Situational Awareness](https://www.spiedigitallibrary.org/conference-proceedings-of-spie/10635/106350F/A-common-core-based-cyber-ontology-in-support-of-cross/10.1117/12.2307719.full) * [(Alternate Link)](https://search.lib.buffalo.edu/permalink/01SUNY_BUF/8gn4ce/cdi_spie_proceedings_10_1117_12_2307719) * [Cybonto: Towards Human Cognitive Digital Twins for Cybersecurity](https://arxiv.org/pdf/2108.00551.pdf) * [Toward a Knowledge Graph of Cybersecurity Countermeasures](https://d3fend.mitre.org/resources/D3FEND.pdf) | Presentation |
| Week 11 | * Cybersecurity Domain | * [Ontology for ATT&CK](https://dl.acm.org/doi/pdf/10.1145/3577923.3585051)   [(Alternate Link)](https://search.lib.buffalo.edu/permalink/01SUNY_BUF/8gn4ce/cdi_acm_books_10_1145_3577923_3585051)   * [A deliberately insecure RDF-based Semantic Web application](https://dl.acm.org/doi/10.1016/j.cose.2015.11.004) * [(Alternate Link)](https://search.lib.buffalo.edu/permalink/01SUNY_BUF/8gn4ce/cdi_proquest_miscellaneous_1800491309) | Presentation |
| Week 12 | * External and Internal Threats | * [An Ontological Framework for Understanding the Terror-Crime Nexus](https://www.casede.org/BibliotecaCasede/SOF_RoleCombatingTOC.pdf#page=157) * [A Simple Ontology for the Analysis of Terrorist Attacks](https://digitalrepository.unm.edu/cgi/viewcontent.cgi?article=1040&context=ece_rpts) | Presentation |
| Week 13 | * External and Internal Threats | * [An Insider Threat Indicator Ontology](https://apps.dtic.mil/sti/pdfs/AD1128874.pdf) | Presentation |
| Week 14 | * Ontology of Secrets | * [Falsehoods Programmers Believe](https://github.com/kdeldycke/awesome-falsehood) * [Lies and Deception: An Unhappy Divorce](https://www.jstor.org/stable/24671096) | Presentation |
| Week 15 | * Ontology of Secrets | * [The Logic of Secrets](https://link.springer.com/article/10.1007/s10472-022-09815-0) * [Commonsense Theory of Secrets](https://ebooks.iospress.nl/volumearticle/55796) | Presentation Final Project |

## Academic Integrity

Academic integrity is critical to the learning process. It is your responsibility as a student to complete your work in an honest fashion, upholding the expectations your individual instructors have for you in this regard. The ultimate goal is to ensure that you learn the content in your courses in accordance with UB’s academic integrity principles, regardless of whether instruction is in-person or remote.  Thank you for upholding your own personal integrity and ensuring UB’s tradition of academic excellence. The academic integrity policy is available at [buffalo.edu/academic-integrity.](https://ubcms-author.buffalo.edu/content/undergrad/faculty-staff-pw/curriculum/course/buffalo.edu/academic-integrity)

## Course Policy on the use of Artificial Intelligence

Please see guidance on the use of AI tools in academic work here: <https://www.buffalo.edu/academic-integrity/about/artificial-intelligence.html>

## Accessibility Resources

If you have any disability which requires reasonable accommodations to enable you to participate in this course, please contact the Office of Accessibility Resources in 60 Capen Hall, 716-645-2608 and also the instructor of this course during the first week of class. The office will provide you with information and review appropriate arrangements for reasonable accommodations, which can be found on the web at: <http://www.buffalo.edu/studentlife/who-we-are/departments/accessibility.html>.

**Protecting Course Materials Disclaimer**

All materials prepared and/or assigned by me for this course are for the students’ educational

benefit. Other than for permitted collaborative work, students may not photograph, record,

reproduce, transmit, distribute, upload, sell or exchange course materials, without my prior

written permission. “Course materials” include, but are not limited to, all instructor-prepared and assigned materials, such as lectures; lecture notes; discussion prompts; study aids; tests and assignments; and presentation materials such as *PowerPoint* slides, *Prezi* slides, or transparencies; and course packets or handouts. Public distribution of such materials may also constitute copyright infringement in violation of federal or state law. Violation of this policy may additionally subject a student to a finding of “academic dishonesty” under the Academic Integrity Policy and/or disciplinary charges under the Student Code of Conduct.

## Counseling Services

Students may experience a range of issues that can cause barriers to learning or reduce their ability to participate in daily activities. These might include strained relationships, anxiety, high levels of stress, alcohol/drug problems, feeling down, health concerns or unwanted sexual experiences. Counseling, Health Services, and Health Promotion are here to help with these or other concerns. Students can learn more about these programs and services by contacting:

* **Counseling Services:** 120 Richmond Quad (North Campus), phone 716-645-2720 and 1st Floor Michael Hall (South Campus), phone: 716-829-5800
* **Student Health Services:** 4350 Maple Rd., Amherst, NY 14226, phone: 716-829-3316
* **Health Promotion**: 114 Student Union (North Campus), phone: 716-645-2837

## Sexual Violence

UB is committed to providing a safe learning environment free of all forms of discrimination and sexual harassment, including sexual assault, domestic and dating violence and stalking. If a student has experienced gender-based violence (i.e., intimate partner violence, attempted or completed sexual assault, harassment, coercion, stalking, etc.), UB has resources to help. This includes academic accommodations, health and counseling services, housing accommodations, helping with legal protective orders, and assistance with reporting the incident to police or other UB officials if the student so chooses. Contact UB’s Title IX Coordinator at 716-645-2266 for more information. For confidential assistance, students may also contact a Crisis Services Campus Advocate at 716-796-4399.