

Integrated Curriculum for Socially Responsible Computing

Developed by the Socially Responsible Computing Program at Brown University

Table of Contents

Table of Contents	1
Curriculum Goals	2
Skills	2
I. Data Science and Artificial Intelligence	4
a. Modeling and Analysis	4
b. Automated Decision-Making	4
c. Generative AI	6
II. Data Collection, Protection, and Privacy	7
III. Design and User Experience	9
a. Responsible Design	9
b. Accessibility	9
c. Technology and the Self	10
IV. Technology in Context	11
a. Sustainability	11
b. Technology and Labor	12
c. The Internet and Public Discourse	12
d. Technology, History, and International Relations	13
V. Stakeholder Engagement	14

Curriculum Goals

1. Help courses determine what to teach in terms of SRC
2. Reduce duplication of SRC content across courses
3. Establish the SRC-related skills that a Brown CS graduate should have
4. Allow courses to build on SRC topics across courses and deepen the quality of content

Skills

- I. Be aware of**
Students **have heard of** a concept/idea and how it relates to a given (technical) context. Students are **able to recall** the concept/idea as relevant in a specific context. (“I know X is a thing.”)
- II. Understand**
Students **can explain** the meaning and/or significance of a specific concept/idea. They can articulate **how** it functions and/or **why** it is important.
- III. Identify**
Students are able to **recognize** relevant concerns in a specific technical context **without prompting** and are able to articulate how they would affect relevant technical decisions.
- IV. Analyze**
Students are able to **critically evaluate** a specific concept/idea, either abstractly or in a specific (social or technical) context. They are able to cite and engage with different concerns and/or (conflicting) perspectives on the topic in question.
- V. Implement**
Students are able to **execute concrete technical decisions** or **use specific techniques** to achieve a desired objective.

Example progression for learning goal I.a.1:

- Representing aspects of the world through data is necessarily reductive and incomplete. Developer perspective shapes the choice and design of variables.

I. Be aware of

- a. Students **have heard of** the limitations of data and developer perspective for creating truly representative models. (“I know all models are imperfect.”).
 - i. For example, they have heard of the impossibility of creating a comprehensive climate model.

II. Understand

- a. Students **can explain** the meaning and/or significance of representing aspects of the world through data. They can articulate **how** data and datasets lead to imperfect models, **how** developer choice will shape the design of the model, and **why** data are important to interpreting and building incomplete and reductive models.
 - i. For example, students can explain **why** no dataset can possibly cover all relevant variables when building a model predicting the rise of temperatures in Latin America, and **how/why** the choices of what to include/exclude will impact any model, including a climate model.

III. Identify

- a. Students are able to **recognize** the limitations of a given model or dataset **without prompting**. They are able to articulate how the choice and design of variables affect a model.
 - i. For example, given a dataset of historical temperatures in Latin American countries, students are able to recognize the inclusion/ exclusion of some country or variable, such as cloud cover, wind speed, or time of temperature recorded will impact the accuracy of a climate model.

IV. Analyze

- a. Students are able to **critically evaluate** choice and design of variables in creating an imperfect model. They are able to cite and engage with different concerns and/or (conflicting) perspectives on creating models.
 - i. For example, students are able to critically evaluate whether data on rising sea levels is or is not important to include in a climate model, and how this potentially interacts with other values, such as runtime, transparency, or accessibility.

V. Implement

- a. Students are able to **execute concrete technical decisions** or **use specific techniques** to achieve a desired model for their purposes and within the appropriate context.
 - i. For example, students are able to **execute** feature engineering or hyperparameter tuning to further the accuracy of their model, while recognizing that their model will still be necessarily reductive and incomplete.

I. Data Science and Artificial Intelligence

a. Modeling and Analysis

Objective Identifier	Content Standard <i>Students should:</i>	Suggested Course Location <i>We suggest this content be taught in:</i>
I.a.1	Understand that representing aspects of the world through data is necessarily reductive and incomplete. Developer perspective shapes the choice and design of variables	• Introductory courses
I.a.2	Identify variables in datasets that emphasize a particular perspective and the possible impacts of redesigning those datasets	• Introductory courses • AI courses

b. Automated Decision-Making

	Content Standard <i>Students should:</i>	Course Location <i>This content should be taught in:</i>
I.b.1	Understand different sources of bias in algorithmic and AI systems (societal vs. dataset vs. system parameters) and their interactions	• AI foundations course

I.b.2	Be aware of and Understand metrics to mathematically interpret fairness	• AI foundations course (Be aware of) • Upper-level AI courses (Understand)
I.b.3	Be Aware of approaches for bias mitigation	• AI foundations course
I.b.4	Be Aware of and Understand different concepts of justice as they relate to automated decision-making systems	• AI foundations course (Be Aware of) • Upper-level AI courses (Understand)
I.b.5	Understand context-specific limitations of automated decision-making and Analyze when the use of such systems is appropriate and when human decision-making is preferable or required	• AI foundations course • Upper-level AI courses
I.b.6	Understand and Analyze different standards for interpreting algorithmic and AI decisions: e.g., transparency, explainability	• AI foundations course (Understand) • Upper-level AI courses (Analyze)
I.b.7	Understand different methods and strategies for AI governance	• AI foundations course • Upper-level AI courses

c. Generative AI

	Content Standard	Course Location
	<i>Students should:</i>	<i>We suggest this content be taught in:</i>

I.c.1	Understand the distinct mechanisms by which AI systems can produce harm • Understand how the unpredictability of generative AI systems and the contexts in which they are deployed means that they cannot, at present, be designed to reliably avoid harmful outcomes	• AI foundations course
I.c.2	Be aware of strategies to identify, evaluate, and mitigate harms stemming from unpredictability in AI systems	• Upper-level AI courses • Socio-technical courses
I.c.3	Be aware of the effects of widespread use of synthetic content on one's ability to control their likeness and public perception	• Upper-level AI courses
I.c.4	Be aware of the legal frameworks governing copyright and intellectual property as they relate to generative AI • Be aware of questions regarding the copyrightability of AI-generated outputs • Be aware of questions regarding the legality of training models on copyrighted data	• Upper-level AI courses
I.c.5	Be aware of opportunities and risks of generative AI in the future of work (e.g., deskilling, lack of connectivity).	• AI foundations course • Upper-level AI courses

II. Data Collection, Protection, and Privacy

Objective Identifier	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>
II.1	Be aware of the extent of data collection and reliance of technologies on large volumes of personal data • Understand the concept of surveillance capitalism and alternative economic models	• Introductory courses
II.2	Understand and Identify different mechanisms of data collection—overt, covert, and from other sources (i.e., via sharing)—and their implications on privacy	• Introductory courses
II.3	Understand the limitations of the distinction between sensitive and non-sensitive data, especially considering the potential for re-identification	• Introductory courses
II.4	Understand the value and functions of privacy (including how both short-term and long-term privacy risks may threaten those)	• Introductory courses
II.5	Understand (and Implement) key aspects of major privacy regulations, standards, etc. (e.g., CCPA, GDPR, ...)	• Systems foundation course
II.6	Analyze trade-offs between privacy and other values, such as transparency, accountability, safety, or security	• Systems courses
II.7	Understand surveillance and Identify instances of data collection that enable surveillance	• Introductory courses • Upper-level systems courses
II.8	Understand different conceptions of consent, and its potential and limitations as an instrument for data protection	• Upper-level courses

II.9	Be aware of widely-used privacy-preserving/enhancing technologies (e.g., encryption, differential privacy) • Understand their limitations • Analyze prominent controversies surrounding them	• Software Engineering courses • Upper-level courses
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III. Design and User Experience

a. Responsible Design

Objective Identifier	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>
III.a.1	Understand (and Implement) different design processes for evaluating the needs of diverse users and Analyze their appropriateness in various contexts	• Upper-level courses
III.a.2	Understand and Identify how different biases can influence one's judgment and shape design decisions	• Upper-level courses

b. Accessibility

Objective Identifier	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>

III.b.1	Understand varying definitions and conceptions of accessibility	• Introductory courses
III.b.2	Identify opportunities to apply and Implement standards and best practices for accessibility	• Introductory courses • Software Engineering courses • HCI courses
III.b.3	Identify and Analyze intersections between accessibility and other values such as privacy, security, or sustainability	• Software Engineering courses • HCI courses

c. Technology and the Self

	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>
III.c.1	Be aware of how technology is used to direct users' attention and shape their interests, preferences, and desires	• Introductory courses
III.c.2	Be aware of how psychological mechanisms and cognitive biases can be exploited by technical means to direct user attention and behavior (e.g., nudging via deceptive patterns)	• HCI courses
III.c.3	Analyze the value of attention and the consequences of yielding control over it	• Socio-technical courses
III.c.4	Analyze the effect of technologies on our self-perception and relationship with ourselves	• Socio-technical courses
III.c.5	Analyze the effect of technologies on the nature and quality of interpersonal relationships	• Upper-level courses

IV. Technology in Context

a. Sustainability

Objective Identifier	Content Standard <i>Students should:</i>	Course Location <i>This content should be taught in:</i>
IV.a.1	Be aware of and Identify potential environmental impacts of a specific technology: • Natural resource consumption • Energy consumption • E-waste production • Pollution	• Introductory courses ○ natural resource consumption ○ pollution • Hardware-focused courses (computer architecture, embedded systems) ○ e-waste production • AI courses ○ energy consumption
IV.a.2	Understand how the environmental impacts of technology have disproportionate socioeconomic effects on different populations	• Introductory courses
IV.a.3	Understand the need for infrastructural sustainability and the means and challenges of ensuring hardware and software maintenance and preservation	• Systems foundation course
IV.a.4	Understand the need for and challenges of ensuring data sustainability	• Introductory courses

b. Technology and Labor

Objective Identifier	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>
IV.b.1	Identify skills and roles that advancements in specific technologies (e.g., automation, generative AI) are likely to displace, create, or evolve, and Analyze the (socio-)economic implications of these changes	• Introductory courses • Software Engineering courses • AI courses
IV.b.2	Be aware of the human labor involved in and the physical and psychological effects of: • Training AI models (including data labeling and curation) • Surveillance • Content moderation • Hardware fabrication and resource collection • Data generation	• Introductory courses • Hardware-focused courses (computer architecture, embedded systems) • Upper-level AI courses

c. The Internet and Public Discourse

	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>
IV.c.1	Understand the effect of content moderation on social pluralism • Analyze the tensions between free expression of ideas and user	• Computer Networks courses • Introductory courses

	safety/comfort in online spaces	
IV.c.2	Understand the effects of algorithmic/AI-based curation of information on public discourse (e.g., filter bubbles, echo chambers)	• Introductory courses
IV.c.3	Understand the role of specific technologies (e.g., social media, generative AI) in spreading misinformation or disinformation • Be aware of the effect of specific technologies on erosion of trust in individuals, institutions, and providers of information	• Introductory courses (Understand) • Upper-level AI courses (Be aware of)
IV.c.4	Be aware of the potential and limitations of technical and non-technical mitigation approaches to curb the spread of mis-/disinformation	• Socio-technical courses
IV.c.5	Understand how technical infrastructure and regulation of that infrastructure shapes the ways in which we communicate and consume information	• Computer Networks courses
IV.c.6	Be aware of how easy access to recording devices and social networks for distribution creates transparency and enables individuals and social movements to hold institutions and other powerful actors accountable (i.e., sousveillance)	• Introductory courses • Socio-technical courses

d. Technology, History, and International Relations

IV.d.1	Understand how global power structures shape technological development and how technological development, in turn, reshapes global power structures	• Software Engineering courses • AI foundations course
IV.d.2	Be aware of the long-term history of technological development and Analyze the impact of current changes in light of that history	• Introductory courses • AI-courses

IV.d.3	Analyze the impact of technology on military capabilities and conflict	• Upper-level courses • Security, AI, and robotics courses
IV.d.4	Identify the underlying epistemological assumptions of Computer Science and Be aware of how concepts such as abstraction, scalability, measurability, and efficiency shape technological design and value systems. • Analyze the limitations and potential harms of naturalizing these assumptions and Implement computing practices that acknowledge these limitations.	• Foundations courses • Upper-level courses

V. Stakeholder Engagement

Objective Identifier	Content Standard <i>Students should:</i>	Course Location <i>We suggest this content be taught in:</i>
V.1	Understand the concept of a stakeholder and Identify various stakeholders in a given project	• Introductory courses
V.2	Identify and Implement stakeholder needs	• Intermediate-level courses
V.3	Analyze how different stakeholders' needs may conflict, and potential resolution strategies	• Intermediate- and upper-level courses
V.4	Understand how to communicate technical content to non-technical stakeholders	• Upper-level courses

V.5	Analyze the alignment of a project with stakeholders' intended goals • Analyze conflicting positions on the extent to which stakeholder requests should be implemented in cases where stakeholder requests may diverge from what might benefit them (i.e., paternalism versus libertarianism)	• Upper-level courses
V.6	Identify and Analyze techno-solutionist attitudes and approaches	• Intermediate-level courses
V.7	Analyze the potential negative impacts (e.g., unintended consequences, externalities) of technologies that are ostensibly designed for social benefit	• Upper-level courses
V.8	Be aware of responsible disclosure • Be aware of the existence of mechanisms for reporting technological vulnerabilities to responsible organizations • Analyze possible impacts of releasing security vulnerabilities publicly	• Security courses