Assignment: Literature Review and Source Annotation (I=0.1)

Write a brief “literature review” with short annotated bibliography addressing a domain of capabilities or behaviors that could potentially be developed in a bioinspired robot by reference to an annotated bibliography you have developed from the relevant scientific literature.

The review should feature two papers – one from the field of robotics, and the other from the field of biology – that you have established as likely to be significant and credible.

Your discussion of the robotics paper should establish as succinctly as possible the present state of the art in this domain – at least as presented by the authors of that arguably important contribution to the literature. Your discussion of the biology paper should establish as succinctly as possible some potentially promising approach(es) to achieving this capability that take(s) inspiration from the capabilities of some animal as documented by the authors of this paper.

The review should conclude with your speculative hypothesis as to the first line of attack on the problem that is likely to yield an important advance. The hypothesis must be shown to be “educated guess” as suggested by what you have reported about the state of the art in robotics and opportunities for biological inspiration in your review of the two featured papers.

The review should make reference to 5 - 10 relevant and credible publications from the scientific literature whose contributions and relevance to the discussion are established in an annotated bibliography.

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Remarks

This assignment is the last purely individual communications exercise. It entails reading enough of the articles you have collected at enough depth to be able to argue for a hypothetical group project in the area you have chosen. The level or depth of understanding you have achieved is documented through the review of the two featured papers along with a set of annotations to a very few of the most critical papers you’ve collected in C.1 – or subsequently, in the many cases that you refine or shift your search as you learn more about the area of interest.

Well structured and supported reviews will typically present roughly five or six paragraphs (e.g., spanning roughly two pages of text in a traditional hardcopy document) followed by annotated bibliographies for something on the order of 5 – 10 scientific articles.

In pursuing this assignment it is expected that you will use the online search tools and techniques introduced in C.1 to find 2 – 3 of the most highly cited robotics papers in this area as well as 2 – 3 of the most highly cited relevant papers from the biology literature. All the better if you can use some of the papers you turned up in problem C.1, but you need not stick to them.

As a potential extra credit exercise, after groups have formed, you are invited to attempt a collaborative effort to compile all the relevant individual annotated bibliographies into an encyclopedia article on the subject of the group’s study. The resulting group essay could then be posted to the class Wiki (or, for full extra credit, an actual Wikipedia entry) along with the annotated references.

Evaluation Rubric

Structure of Review Essay (~ 5 – 6 paragraphs = ~2 pages)

C.2.1) Behavior or Capability (~ 2 paragraphs)
Your first paragraph should vividly and specifically describe and motivate the desired capability. What is the robot behavior or capability in question and why is it important? The target can be “pie-in-the-sky” science fiction, but it must be very specific and compelling rather than merely descriptive of some vague, general behavioral suite motivated by a “wouldn’t-it-be-nice” style of philosophical musing.

For example, suppose you are fascinated by animals’ amazing ability to hunt their food. You must isolate some specific constituent capability (and one which would be potentially useful, e.g., for a search and rescue or surveillance bot). For this example, you might focus on: the visual-body coordination needed to leap up and grab a hurtled object (think about the dog with a Frisbee or ball); or the ability to follow very sparse and intermittent sensory gradients through complex terrain (think of a pig snuffling around through the forest litter and ground cover to dig up a truffle or some other delicacy); or the ability of a pack of wolves to coordinate their swarming around a stag to bring it down from a run; and so on. Best if you can find in the literature specific quantitative dimensions of performance that set out the animals’ abilities along concrete metric axes that will become the figures of merit for existing and proposed robots. For example: how high can dogs really leap?; how deeply buried or distantly located can the truffles be and still attract the pig?; what ratio of hunters to hunted and individual predator to prey speeds have been measured?
Following the specific capability, the next paragraph should suggest an example or two of exciting behaviors (e.g., that might get your robot video onto YouTube) that are, simultaneously, evidently – or, at least, arguably – useful. In the best situation, a machine with such capabilities would be obviously useful for all the fire departments in the country or all the ski patrol clubs in Colorado or all the Special Operations Quartermasters within the Army - or some other group. Interested groups would be willing to part with the money per platform you would charge them “when your company builds it.” For example, the Frisbee-bot looks like a good way for first responders to get unanticipated supplies or payloads delivered to disaster survivors who are separated by presently impassable obstacles that only the robots can breach (and perhaps, if contaminated, through which they should not immediately return). The truffle-finding behavior should be of great value for mine clearing operations. The swarming behavior may have benefit for automated herding and other agricultural applications. At least you must eventually try to argue so when it comes time for the oral presentation, Assignment C.4, so you will do well to at least consider the merits of such a case right now.

C.2.2) Capabilities of Existing Technology (~1 paragraph)

Pick one of the 2 – 3 of the most highly cited robotics papers in this area as the focus of your discourse on present capabilities. What is the scientific contribution and how does it relate to the capability you are focusing on? Consult the “How to Read” Lecture since you are going to have to make this argument on the basis of your still admittedly “superficial” reading of abstracts, introductions and conclusions together with the evidence garnered from the interwoven references in the literature you have explored and relative citation rates reported by the various search engines. Later, when you become an expert in this area (perhaps in a few weeks after you have run your own experiments; perhaps in a decade after you have earned your PhD) you will be entitled to your own judgment and feelings about “importance.” For now, you must make this argument on the basis of evidence gathered from the existing web of science.

C.2.3) Potential Biological Solutions or Bioinspired Approaches (~1 paragraph)

Justify your choice of the focus you have given the biological literature search in terms of your personal judgment about what animal capability might be most useful to the robot task domain you have selected.

Again, now, pick one of the 2 – 3 most highly cited biology papers bearing on this area. Consulting once again the “How to Read” Lecture, read this paper’s abstract, introduction and conclusion well enough to establish what contribution it makes to the literature. Again, you are asked not (yet) for your personal opinions but rather for whatever consensus you can identify in the literature. Or, in case there is a controversy and there is divided evidence in the literature, you are asked to discuss the pros and cons of the archival documented positions.

C.2.4) Value of Quality Sources (~1 paragraph)

Describe some 3 – 5 sources encountered as part of the “automated” (i.e. purely keyword or search-engine driven) early stage search process from assignment C.1 that you eventually realized are less useful in this problem domain as you began to read abstracts and introductions and conclusions and related papers. Often (albeit, with some exceptions) these
Less useful sources are reasonable and intrinsically high quality but ill-suited to the problem at hand—either because the search engine missed the point of the inquiry in bringing them to your attention, or you were not exercising the search engine with the precision you later developed. Describe how your (or others’) future searches for new literature might be structured to get to the most appropriate sources.

**C.2.5) Open Problems (~ 1 paragraph)**

What are the most important open problems in this area? Here, you are asked to summarize the integrated view of the near horizons of knowledge arising from your emerging understanding of what your sources report as “the open challenges” in their conclusions. Again, the focus is not on your personal ideas but rather what has been judged to be hard and important by experts in the area. In contrast, your personal judgment is appropriate (in fact necessary) to motivate the connection you have made between robotic problem and potential bioinspired approach to its solution.

**Structure of the Annotated Bibliography (~ 5 – 10 papers)**

The 2 papers you’ve found and read in C.2.2 and C.2.3 constitute the subjects of your annotated bibliography. You have also identified at least one (likelier ~ 5 and possibly up to ~ 10) more relevant papers in both those steps and these additional papers serve to comprise the surrounding literature that you use to contextualize the contributions of the two papers you have focused on.

**C.2.6) Pre-Cursors**

For both papers being reviewed, cite the two or three most important pre-cursor papers (those papers the entry cites which are themselves highly cited).

**C.2.7) Successors**

For both papers being reviewed, cite the one or two most important successor papers (those papers that cite the entry and which are themselves highly cited or for which you can furnish alternative evidence of their importance). On the basis of these subsequent papers’ abstracts (or possibly their citation text in their introductory sections) make sure to include a sentence about their relationships to the papers you are annotating.

**C.2.8) Bibliographic Data**

Complete citations to these ~10 + (including all pre-cursor and successor papers), following the structure of the class wiki template. For each of these bibliography entries, make certain to incorporate an explicit (live) online link (e.g. a doi number + url) or provide evidence that none exists.

**C.2.9) Brief Annotation of Content and Contribution**

Since this is an annotated bibliography, for each entry in the references list you should provide a sentence or two summary addressing each of: (i) what the reference is about; (ii) why it makes a contribution to the field; and (iii) how it relates to your topic.
Extra Credit Wikipedia Contribution

**C.2.9) Identification of Wikipedia Stub**
Find an existing “stub” in the Wikipedia that comes closest to your topic area.

**C.2.10) Leading Paragraph**
Write a leading paragraph for a Wikipedia entry that relates the stub topic to the area you have researched. Incorporate the motivation for interest to the general Wikipedia readership by summarizing the position presented in C.2.1)

**C.2.11) Review of Literature**
Write a second paragraph for the Wikipedia entry that summarizes the contributions of the papers cited in C.2.2) – C.2.4)

**C.2.12) Wikipedia Submission**
Upload these two paragraphs of text onto the Wikipedia along with all the citations of C.2.2) – C.2.7) developed in C.2.8) taking care to incorporate live hyperlinks for all the online resources.

Submission to Class Wiki (C.2.a; I=0.1)
Mandatory Consultation with Librarian: 1/27 – 2/3
Submission of Draft to Class Wiki: 2/3
Scoring of Mechanics (Librarian scores C.2.1 – C.2.4, C.2.6 – C.2.8)
Scored Draft emailed back: 2/12

Extra Credit Wikipedia Submission (C.2.b; G=0.1)
Uploading step C.2.12) with link to the Wikipedia submission entered into the class Wiki draft of C.2.a: 4/1
Lab Instructor and TA score C.2.5), and C.2.9) – C.2.12).
Scores Entered into Class Records 4/8