**Scientific Writing**

**Importance of Scientific Writing**
- Scientists need to communicate their research results & findings with other scientists/experts
- There are different ways for sharing information:
  - Personal communication
  - Oral/poster presentations at conferences
  - Science blogs
  - Data warehouses
- Peer reviewed articles are the most effective way to contribute to the body of scientific knowledge
  - Information is shared in a systematic manner, so that researchers can build upon the work of others
- Sir William Osler (physician):
  - "In science, the credit goes to the man who convinces the world, not to the man to whom the idea first occurs"

**What Makes Good Writing?**
- Good writing communicates an idea clearly & effectively
- Good writing is elegant & stylish
- What makes a good scientific writer?
  - Having something to say
  - Logical & clear thinking
  - A few simple, learnable rules of style
- Clear, effective writing can be learned!

**Structure of Scientific Papers**
- The goal of most scientific papers in Computer Science is to tell readers that:
  - You have solved the problem X using the approach Y
- Typical structure:
  - Introduction
  - Related work
  - Proposed method
  - Experimental results
  - Conclusions & Future work

**Introduction**
- Explain what you did
  - What is the problem that you try to address in the paper?
  - Provide strong motivations on why you do it
  - Why the problem that you work on is important?
  - What are the applications?
- Demonstrate your thorough understanding to the research area
  - How was the problem addressed in the recent literature?
  - What are the limitations of state-of-the-art approaches?
  - State the significance of your work
  - Do not let your readers make guesses
**RELATED WORKS**

- Cite & discuss in detail related techniques/algorithms
- Organize these techniques by their fields
- A given paper often connects to multiple fields
- Group related research by threads
- Highlight the differences between your approach & existing work
- How is the problem you studied different from existing ones?
- What is the advantage of the approach you proposed?
- Do you address any known limitations of existing work?

**ALGORITHM/METHODOLOGY**

- Explain the algorithm you proposed
- Know your audience
- Always make sure that your readers work harder than they have to!
- Move logically from one point to the next
- Make sure your writing shows the progression of your ideas
- Provide unbiased review to existing approaches
- State both their contributions & limitations
- Highlight the differences between your approach & existing work
- Why use the approach Y?
- Support everything with evidence, and distinguish fact from possibility
- State clearly the constraints

**EXPERIMENTAL RESULTS**

- Design experiments to support the claims you made
- Try to include both qualitative & quantitative evaluations
- Perform direct comparison with existing approaches on standard datasets, if possible
- Conduct user studies if the finds are subjective
- Discuss and explain your findings

**WORDINGS IN SCIENTIFIC PAPERS**

- Be concise!
  - “But the secret of good writing is to strip every sentence to its cleanest components. Every word that serves no function, every long word that could be a short word, every adjective that carries the same meaning that’s already in the verb, every passive construction that leaves the reader unsure of who is doing what — these are the thousand and one adulterants that weaken the strength of a sentence. And they usually occur in proportion to the education and rank.”

**AT WORDS LEVEL**

- Rules to follow:
  - Reduce dead weight words & phrases
  - Cut, cut, cut
  - Learn to part with your words
  - Be specific
  - Hunt down & cast out all unneeded words that might slow your reader
  - Very, very, quite, basically, generally
  - These words seldom add anything useful
  - Try the sentence without them and see if it improves

**REMOVE CLUNKY PHRASES**

<table>
<thead>
<tr>
<th>Clunky phrase</th>
<th>Equivalent</th>
<th>Clunky phrase</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A majority of</td>
<td>most</td>
<td>All three of the words</td>
<td>the three</td>
</tr>
<tr>
<td>A number of</td>
<td>many</td>
<td>Fewer in number</td>
<td>fewer</td>
</tr>
<tr>
<td>Are of the same opinion</td>
<td>agree</td>
<td>Give rise to</td>
<td>cause</td>
</tr>
<tr>
<td>At the present moment</td>
<td>now</td>
<td>In all cases</td>
<td>always</td>
</tr>
<tr>
<td>By means of</td>
<td>by</td>
<td>In a position to</td>
<td>can</td>
</tr>
<tr>
<td>Less frequently</td>
<td>rare</td>
<td>In close proximity to</td>
<td>near</td>
</tr>
<tr>
<td>Attempt</td>
<td>try</td>
<td>Due to the fact that</td>
<td>because</td>
</tr>
<tr>
<td>Referred to as</td>
<td>called</td>
<td>Until such time as</td>
<td>until</td>
</tr>
<tr>
<td>With the possible exception of except</td>
<td>For the purpose of</td>
<td>for</td>
<td></td>
</tr>
</tbody>
</table>
**AT SENTENCES LEVEL**

- Rules to follow:
  - Follow: subject + verb + object (SVO)
  - Use strong verbs & avoid turning verbs into nouns
  - Eliminate negatives
  - Use positive constructions instead
  - Avoid passive tense when it makes reader wonder who is the subject

**USE STRONG VERB**

- A sentence uses one main verb to convey its central action
- Without it the sentence would collapse
- The verb is the engine that drives the sentence
- Dull, lifeless verbs slow the sentence down
- Action verbs reflect the action they were chosen to describe, and help bring the reader into the story

<table>
<thead>
<tr>
<th>Clunky phrase</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain estimates of</td>
<td>estimate</td>
</tr>
<tr>
<td>Has seen an expansion in</td>
<td>has expanded</td>
</tr>
<tr>
<td>Provides an emphasis on</td>
<td>emphasizes</td>
</tr>
<tr>
<td>Take an assessment of</td>
<td>assess</td>
</tr>
<tr>
<td>Provide a review of</td>
<td>review</td>
</tr>
<tr>
<td>Offer confirmation of</td>
<td>confirm</td>
</tr>
<tr>
<td>Make a decision</td>
<td>decide</td>
</tr>
<tr>
<td>Shows a peak</td>
<td>peaks</td>
</tr>
</tbody>
</table>

**ELIMINATE NEGATIVES**

- Constrain yourself from using negative constructions
- Try to use positive constructions instead to deliver the same meaning
- Easier to read

<table>
<thead>
<tr>
<th>Negatives</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not honest</td>
<td>dishonest</td>
</tr>
<tr>
<td>Not important</td>
<td>trivial</td>
</tr>
<tr>
<td>Does not have</td>
<td>lacks</td>
</tr>
<tr>
<td>Did not remember</td>
<td>forgot</td>
</tr>
<tr>
<td>Did not pay attention to</td>
<td>ignored</td>
</tr>
<tr>
<td>Did not have much confidence</td>
<td>distrust</td>
</tr>
<tr>
<td>Did not succeed</td>
<td>failed</td>
</tr>
</tbody>
</table>

**SCIENTIFIC MISCONDUCT**

- Definition:
  - Intention or gross negligence leading to fabrication of the scientific message or a false credit or emphasis given to a scientist
  - Includes plagiarism, data manipulation & fabrication
  - In the academic community, any form of scientific misconduct is considered to be a very serious offense and will be treated as such

**PLAGIARISM**

- Copying of someone else’s work or ideas without proper reference and present it as an own piece of work

- To avoid plagiarism:
  - Do not literally copy any phrases from source materials (article, book, or report)
  - Always give a proper reference to the original source from which you borrow insights and knowledge