CUMPC 2024 Guidelines for Abstracts

Thanks for your interest in participating in the third annual Canadian Undergraduate Medical Physics Conference (CUMPC).

In this document we have assembled a guide to helping you to develop your abstract and submit it for consideration. If this is your first time submitting an abstract to a conference, don't worry! Our guidelines and sample abstracts are here to help you learn the anatomy of a good abstract. **We encourage applicants to submit an abstract at any stage of their research.**

1 General Requirements

- As our name suggests, we prioritize submissions from individuals studying at or affiliated with Canadian universities and institutions at the undergraduate level.
- The submitted abstract should be original, based on research conducted in the area of medical physics, and reflect the applicant's contributions to the research.
- There is a limit of *one* unique submission per applicant. There is no requirement on the amount of progress made on the research.
- If your abstract is accepted, any work completed between the time of submission and your presentation time can also be included in the presentation.
- The abstract should be limited to **300 words** with or without **1 Figure** and/or **1 Table**, and have the following structure: *Title, Purpose, Methods, Results,* and *Conclusions*.
- Word count included from the Title, and Figure and Table captions does **not** count towards the 300 word limit. The abstract should be limited to **two pages**.
- Your name, institution, and other identifiers will be collected from the webform during the online submission process when you upload your abstract – **do not include them in the abstract document.**
- Abstract submission is open **July 8** and submission deadline is **July 31**, any abstracts submitted after this date will not be accepted.

2 Submission Instructions

- Before submitting your abstract, please go to the conference's website www.cumpc.ca to create a user account. **Note:** Creating an account does **not** register you for the conference itself. The registration process is separate from the user account creation process.
- After creating an account, you can sign into the conference website. You will then find a link to "Abstract Submission" on the home page near the sign-in button.
- **Upload your abstract in PDF format by saving it as a .pdf file.** In Microsoft Word, go to File > Save As in the Toolbar and select .pdf as the file format. In Google Docs, go to File > Download in the Toolbar and select PDF. Please use the following filename convention: Abstract_FirstNameLastName (Ex. Abstract_JaneDoe). Other formats will **NOT** be accepted.
- During the submission window (July 8 through July 31), you will be able to update your abstract submission by making a subsequent submission. **However**, you should assume that your

previous submission will be overwritten. Therefore it is in your best interest to save your own local versions of your abstract.

3 After Submission

3.1 Abstract Call Window

The abstract submission window is July 8 to July 31. After the end of the submission window, no further submissions or updates will be accepted.

After July 31, we will begin evaluating abstracts, selecting successful applicants, and notifying you about our decision regarding your submission. Therefore we ask you to stay tuned for more information as it becomes available!

3.2 Stay Tuned for Updates

After submitting your abstract, please stay tuned for important information from the CUMPC Organizing Committee. We may contact you via email and be sure to add organizers.cumpc@gmail.com to your allow-list and keep an eye on your junk/spam folder. We also encourage you to follow us on

- Twitter: @CUMPConference
- Instagram: @cumpconference
- LinkedIn: Canadian Undergraduate Medical Physics Conference

4 Contact and Troubleshooting

- For any questions or if the presenter is having difficulty signing into the webpage or with abstract submission, please email the CUMPC 2024 organizing committee at organizers.cumpc@gmail.com with a relevant subject line and a description of the problem you are facing.

5 Writing Guidelines

The following is a breakdown of the components of an abstract with the intention of providing you with guidelines that will help to improve your abstract content and style. **If you are writing an abstract for the first time, don't be discouraged!** Here we have provided advice on what to write and how to write it regarding the key components: title, purpose, methods, results, conclusions, and captions for figures and tables. You may also find it helpful to read sample abstracts that have been reproduced below from successful applicants from last year's CUMPC 2023.

In addition to these guidelines, your research supervisor(s) and other collaborators in your research group could be excellent sources of feedback during the writing process. We encourage you to revise and edit your abstract and welcome you to submit updated versions during the submission window (July 8 to July 31).

Overall, the goal of an abstract is to summarize the main results of a research project or paper succinctly with emphasis on why the work was done, how it was done, what the outcomes were and what they mean in the broader context of the relevant field – in this case, medical physics.

5.1 General Guidelines

See also the **General Requirements** section at the beginning of this document.

An abstract is typically written in past tense. Your goal is to succinctly report what *was* done in the research and what *were* the results, with perhaps the exception of the conclusions that may be written to explain what future work *will* be done. Secondly, an abstract is typically written in the passive voice: “the data was collected,” as opposed to “I collected the data”. Sometimes research articles are written using the collective “we,” as in: “we collected the data”, in which case you are referring to you and any others involved in the research program as a team, where appropriate. This is also acceptable in an abstract. Finally, your abstract should be succinct, yet detailed enough to stand alone from your presentation.

5.2 Dos, and Don'ts

Do…

- be specific;
- be quantitative (where possible and appropriate);
- be concise;
- stay within the 300 word count;
- edit your work for proper spelling, grammar, punctuation, and syntax;

Don’t…

- include your name, institution, associations, or any obvious identifiers (the online submission form will have a place for this!)
- use references (this is not a typical practice and is often discouraged for abstracts!)

5.3 Style

We recommend using Arial font size 12, single space, which is the same style that this document has been prepared with.

5.4 Title and Subtitles

Do not contribute to the word count.

The title of the abstract should, in isolation, reflect the aims and approaches of the study, and should not report results or conclusions. Avoid abbreviations and acronyms and be sure to use up-to-date terminology that readers experienced in that area of research would recognize. The goal is twofold: accurately represent your research topic and attract interest using just a handful of words.

Subtitles refer to the words “Purpose”, “Methods”, “Results”, and “Conclusions” that are used to delineate their respective paragraphs. This style is typically used for the abstract submissions to many conferences and several academic journals.

5.5 Purpose

Contributes to the word count.
New paragraph beginning with “Purpose: ”

The purpose of a research project or paper is the reason behind doing it in the first place.

Consider the following…

- What was the objective of your research? Was there a goal to make a particular measurement, collect a certain data set, analyze existing data, build on an existing theory, or conduct a literature search or review?

5.6 Methods

Contributes to the word count.
New paragraph beginning with “Methods:”

Physics research is typically conducted according to a method, whether it is experimental, analytical, or some combination of those two. The method is a description of what was actually done in the research: describe the key equipment, apparatus, or theoretical considerations that were used to obtain, analyze, or interpret data or models that led to the results of the work.

Consider the following…

- What chemicals, radionuclides, or energy sources (x-ray, gamma ray, particulate, nuclear, etc.) were used, if any at all? Include the amount or energy of each if it is critical to the experimental results.
- What equipment, including hardware and software, was used, created, or modified in the course of the research, if any at all? Were any human or animal subjects involved?
- What were the conditions or parameters of any experimental or theoretical (e.g. computer simulations) work that was done?
- What were the methods of analyses used, if any? What kinds of statistical analysis were used?
- Details such as the manufacturer of key equipment (e.g. linear accelerator) may be necessary to help the audience contextualize your work.
- Data sets may have been used in the course of your research, whether obtained through collaborators, privately, or through open source platforms. **Typically abstracts do not contain references, and in general we discourage from using them in an abstract**, therefore in this special case we suggest using the official or common name of the data set (e.g. CanCOLD, which is well-known by this acronym).

5.7 Results

Contributes to the word count.
New paragraph beginning with “Results:”

The outcomes of an experiment, simulation, theoretical calculation, or literature search may be many and varied. The abstract is intended to highlight the key results that translate into the significance, importance, and impact of the work. The results section should be the bulk of your abstract, such as the detail and length should not be compromised due to other sections. Typically the results section contains only the most important quantitative statements. Occasionally these can be summarized in a sentence or two, but often they are best represented in table or graphical form. Your abstract can include figures, tables, and captions (see Figures subsection ahead).

Consider the following…

- Report the results that answer your primary objective, followed by any results that address any other objectives stated. If any, report negative results that failed to support the objective.
- Reporting “Gene expression significantly varied between malignant and benign tissues.” is not very specific, whereas “Gene expression was significantly higher in malignant tissue than benign tissue (75% vs 10%, respectively; $p < 0.05$)” is more detailed. Use numbers!!

5.8 Conclusions

Contributes to the word count.
New paragraph beginning with “Conclusions:”

The conclusion of your abstract should clearly, yet concisely, indicate the main implications of your findings. Most conclusions are one to three sentences long. This section has the most impact on the reader, so you should ensure that your take-home message is clear and demonstrated by your results (i.e., don’t make inferences that your reported data does not indicate).

5.9 Figures, Tables, and Captions

Optional.
Does not contribute to the word count.

Figures are a great way to display trends, mechanisms, and items, which may entail images, data plots, or schematics, however all should be accompanied by a clear legend and concise caption. Ensure to include the following, where appropriate:

- Scale bars
- Labels on axes, curves, important items
- Specified units and appropriate font size

Tables are an effective method to display large amounts of data using legends, clear category names, sufficient spacing, appropriate font size, and provided units.

Captions should be concise but detailed enough to explain the figure or table in isolation from the abstract and often contain a legend. By convention, the caption for a table should be written above the table, while for a figure the caption should be written below the figure.

6 Submission Checklist

Before submitting, use this checklist to ensure a successful submission that meets our requirements to help make yours a competitive submission.

You have read and understood the **General Requirements** (Section 1 above).
You have read and understood the **Submission Instructions** (Section 2 above).
You reviewed your PDF file to ensure that it was converted properly from any document format it was originally processed with and has a proper filename.
You are following our social media channels for updates as laid out in **After Submission** (Section 3 above).

7 Sample Abstracts

Sample #1 (Reproduced with permission from the author, Jessica de Kort.)

Localizing catheter tips in prostate brachytherapy ultrasound images through a deep learning and feature extraction pipeline

Purpose: Prostate cancer is the leading male cancer in Canada with approximately one in nine men receiving a diagnosis in their lifetime. High-dose-rate brachytherapy is a treatment using multiple catheters (typically 16–18) inserted into the prostate and surrounding tissues. A radioactive source is passed through the catheters to destroy cancerous cells. Although transrectal ultrasound (TRUS) images are often used to guide catheter placement, it can be difficult and time-consuming to localize catheters, especially as they may bend during insertion. To reduce risks associated with prolonged anesthesia, advanced intraoperative tools that decrease procedure time are necessary. The objective of this work was to improve the automatic localization of the tips of curved catheters in three-dimensional (3D) TRUS images using a deep-learning and feature extraction pipeline.

Methods: The training dataset included 67 patients and the testing dataset included 15 patients. TRUS images were passed through a 3D U-Net architecture to generate point-cloud predictions, which were refined using the 3D Hough transform. The point-cloud output provided a predicted segmentation for each point in the TRUS images, then the feature extraction step produced a curve fitting line, forming a catheter prediction. Predictions were compared to ground truths manually identified by medical physicists.

Results: Following the U-Net step, the average Dice coefficient was 0.42, indicating a moderate pixel-wise overlap between the ground truth and predicted catheters (n = 343). After refinement with curve-fitting, the average difference in catheter shaft positions was 1.9 mm and the average tip difference was 3.0 mm (Figure 1).

Conclusions: Further improvement of the tip identification is necessary with ongoing work being conducted to reduce this source of error. Integrating automated tools into prostate brachytherapy procedures can reduce the patient's time under anesthesia, decreasing the associated risks, and reduce both human variability and uncertainties in the clinical workflow.

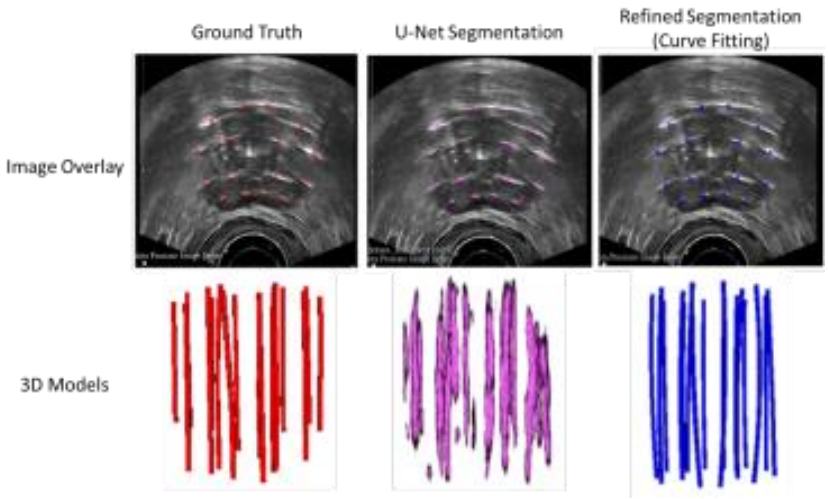

Figure 1: Example of ground truths and segmentations at each step of the pipeline shown at the mid-level of the prostate for one patient in the testing dataset. The top row shows the intersections of the segmentations overlaid on the corresponding slice of the TRUS image and the second row shows 3D renderings of the segmentations.

Sample #2 (Reproduced with permission from the author, Marcus Milantoni.)

CT-Based Radiomics Models for Predicting Early-Stage Esophageal Adenocarcinoma

Purpose: Esophageal adenocarcinoma (EA) is a devastating disease that has seen a significant increase in incidence, particularly in Western countries. Despite progress in therapeutic approaches, prognosis for EA remains poor due to inaccurate diagnosis, which may lead to inappropriate tumour management. Using radiomics, an emerging field that extracts quantitative features from medical images, additional information can be obtained compared to visual inspection alone. Radiomics may improve the accuracy of EA staging, guiding effective treatment decisions and improving patient outcomes. This study aims to develop and evaluate non-invasive radiomic machine learning models to predict early stage versus advanced-stage EA using diagnostic computed tomography (CT) images.

Methods: A retrospective study of 105 patients with EA who underwent esophagectomies was conducted. Clinical tumor stage post-esophagectomy was noted (early-stage T0-T2, advanced-stage T3-T4). Esophageal volumes were auto-segmented from contrast enhanced CT images and radiomic features were extracted from the volumes. The dataset was split into training and testing cohorts based on a 70%/30% split (n=67/29). The least absolute shrinkage and selection operator (LASSO) method was applied to select the four most predictive radiomic features from the training dataset. Based on the selected features, logistic regression (LR) and support vector machine (SVM) models were developed. Performances were evaluated on the testing dataset.

Results: In the testing dataset, the LR model showed superior performance, with an accuracy of 58.6%, precision of 55.6%, sensitivity of 71.4%, specificity of 46.7%, and area under the receiver operating characteristic (AUC) curve of 0.724. The SVM model had an accuracy of 65.5%, precision of 67.7%, sensitivity of 57.1%, specificity of 73.3%, and AUC of 0.629 (Figure 1).

Conclusions: The results demonstrate the potential of radiomics to aid clinicians in determining the EA stage. Further refinement and validation are required before clinical implementation. Future directions include incorporating multi-modal imaging to enhance the models' performances.

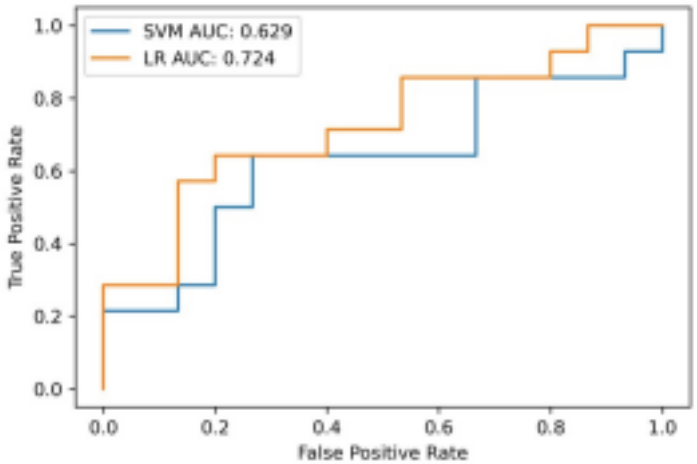

Figure 1. The ROC curves plotted for the LR model (AUC = 0.724) and the SVM model (AUC = 0.629) demonstrating the performance of each classifier.

Sample #3 (Reproduced with permission from the author, Jamiel Nasser.)

Feasibility of Radiation Planning on Three-Dimensional Ultrasound Images for Gynecological Brachytherapy Procedures

Purpose: Radiation therapy is the typical treatment course for cervical cancer, with brachytherapy considered curative. Medical imaging is vital during brachytherapy, as the precise placement of the radioactive source is necessary for successful treatments. Therefore, computed tomography (CT) or magnetic resonance (MR) imaging is used to confirm applicator placement and plan the radiation dose. However, these imaging modalities are expensive and typically unavailable in the operating room, reducing their widespread accessibility. Our goal is to use newly developed 3D trans-abdominal ultrasound (US) and 3D trans-rectal US systems concurrently to produce cervical brachytherapy radiation plans on combined 3D US images, potentially eliminating the need for advanced imaging during procedures.

Methods: Preliminary testing with a custom female pelvic phantom has been performed. The phantom contains relevant internal anatomical structures and an embedded brachytherapy applicator. The fused 3D US image of the phantom was then contoured and compared to CT as a gold standard. Treatment planning software was subsequently used to create brachytherapy dose plans using each imaging modality to analyze the differences in clinical plan objectives.

Results: The dose-volume histograms for the 3D US plan and the CT plan are shown in Figure 1, indicating low doses to organs at risk (OARs) relative to the doses delivered to the treatment sites. The clinical plan objectives are shown in Table 1. Both the US and CT plans met two of the plan objectives but failed the OAR constraints, likely due to the simplicity of our phantom. However, the consistency of results between both plans suggests the feasibility of our technique.

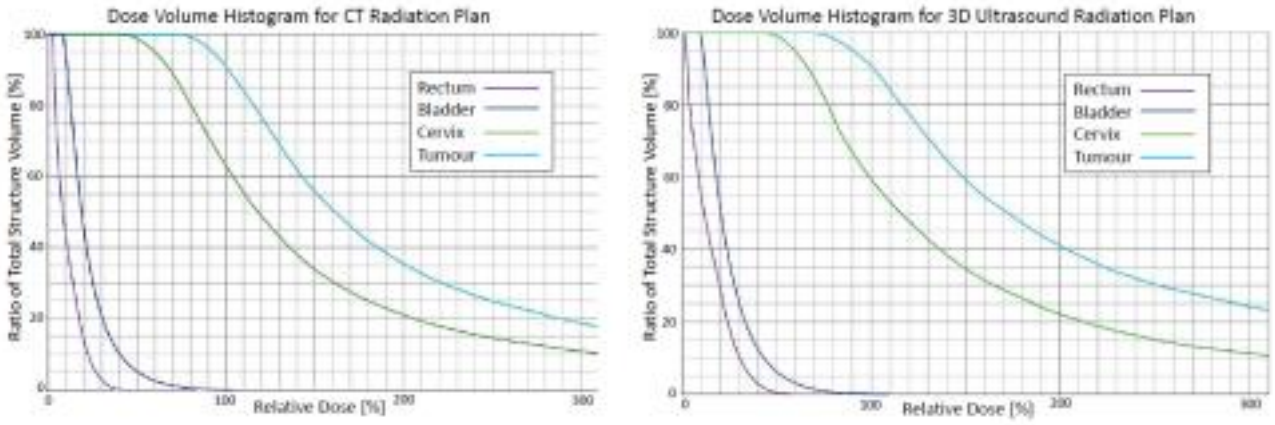

Figure 1: Dose-volume histograms of radiation plans using the CT image (left) and 3D US image (right). Steep drop-offs in the OARs indicate a low dose to most of their volume while the cervix and tumour exhibit higher doses to most of their volume.

Table 1: Primary clinical plan objectives for cervical brachytherapy, used at the London Regional Cancer Program. Both plans met the dose objectives to the clinical treatment volume (CTV) but failed the objectives to the organs at risk (bladder and rectum).

Objective	Target	CT Plan	US Plan
CTV D90[%]	> 100%	101.4%	101.2%
CTV V100[%]	> 90%	91%	90.8%
Bladder D2.0cc[cGy]	< 740 cGy	1397.7	1286.4
Rectum D2.0cc[cGy]	< 590 cGy	757.9	852.2

Conclusions: Our 3D US radiation plans had similar dosimetric performance to those created on CT, indicating the clinical viability of our method. Future work includes a case study using patient images acquired at the London Regional Cancer Program.