Proposal to Provide Contract Support for Imaging Research Tasks Related to Animal Cancer Studies under the Direction of Dr. Susan Kraft

December 15, 2005
(revision 3)

Purpose of Work

The purpose of the proposed contract work described here is to support a number of research projects currently under the direction of Dr. Susan Kraft, Associate Professor of the Animal Cancer Center at Colorado State's Veterinary Teaching Hospital. As co-director of the Magnetic Resonance Imaging service in the Animal Cancer Center, Dr. Kraft is involved with and provides support to a number of research studies that require the acquisition and analysis of 3D data sets obtained from various imaging modalities, primarily MRI and CT. Due to limited personnel and expertise currently available to Dr. Kraft to support these demands, she has discussed with the contractor, Gary McCauley, the possibility of hiring him to perform the tasks described here. The consultant, Gary McCauley has a M.S. degree in Electrical Engineering and has worked in the areas of 3D graphics, imaging, image analysis and scientific visualization for more than 10 years, with most of that time as a Research Associate at Duke University (see attached CV for details).

Task 1: Segmentation for 3D Quantitation

General Description of Task

Dr. Kraft has purchased a diagnostic software tool, Voxar 3D, that is designed for efficient visualization and analysis of volumetric data. Using the capabilities of this tool, Dr. Kraft would like to develop and implement a set of relatively robust techniques for end-user processing of study data in order to consistently and reliably quantitate certain parameters of interest that characterize tumors.

Subtasks

The task described above may be delineated into the following subtasks and time estimates:

1. Familiarization with Voxar 3D, including data I/O, 3D display and general 3D segmentation capabilities. Investigate Voxar's "programmability", e.g., saving processing steps as scripts. Upon completion of this task, the contractor will provide a demonstration of a simple segmentation process on an actual data set acquired by Dr. Kraft.
    Time Estimate: 12 hrs

2. For a single animal model/study, through experiments with the software package, Voxar 3D, determine an algorithm that will segment the data to meet the study requirements. The algorithm should provide results that are satisfactorily consistent from data set to data set (for this study sample). The deliverable of this task will be a document that describes the processing steps for the determined algorithm and a corresponding discussion explaining the rationale for these steps. Sign off on this deliverable will be based on the review of this document by Dr. Kraft and her collaborators, and their confidence in its validity and utility.
Time Estimate: TBD

    2.1 By phone conversation with a Barco Voxar 3D expert, discuss the capabilities/limitations of the Voxar 3D software package for the purposes of quantifying the data sets of interest to Dr. Kraft. Explain the objectives of Dr. Kraft's work, and learn (if possible) how Voxar 3D may be utilized to meet those objectives. Report these findings to Dr. Kraft by way of a brief, formal memo.
    Time Estimate: 2 hrs

    2.2 Based on the recommendations gathered in Subtask 2.1 above, experiment with Voxar 3D to assess the possibility of using this software package to develop a set of processing steps that will consistently produce results that will be acceptable to the studies of interest to Dr. Kraft. Demonstrate findings to Dr. Kraft by showing her the processing steps used to produce results. Discuss with Dr. Kraft what step to take next in this work, given the results of this task.
    Time Estimate: 26 hrs

    2.3 Based on the results of Task 2.2, continue the development of a method to quantitate the disease process in the guinea pig data based on the processing capabilities of the Voxar 3D software package. Begin by testing the robustness/reliability of the process developed in Task 2.2 by applying it to 4 or more different guinea pig scans; compare volume measurements to known estimates if possible. Adjust the method if required based on testing. Complete the development of the processing method by adding steps to measure total disease-process volume within the lung region identified by the first steps. Test, adjust if necessary, and demonstrate results to Dr. Kraft.
    Time Estimate: 40 hrs

3. Using available (to the Animal Cancer Center) software tools, convert the algorithm developed in Subtask 2 to a software process that would allow Dr. Kraft and her technologists to process future data sets (matching this study model) in a manner that would step them through the algorithm, and that would require a minimum of a manual interaction with the volume display. The deliverable for this task will be a computer process that is a conversion of the algorithm determined in Subtask 2 to a set of automated or semi-automated steps executed by Voxar 3D, either through the Preset functionality or another method TBD'd.
Time Estimate: TBD

4. If the methods developed as described in Subtasks 2 and 3, proof satisfactory, repeat for a second model, and begin looking for ways to generalize the approach. Deliverables will be similar, unless a more generalized algorithm is discovered, and/or all parties agree software tools other than Voxar 3D should be considered for future work.
Time Estimate: TBD

Logistics

The contractor has spoken with the Product Manager for Voxar 3D to learn what hardware requirements are recommended for the use of their product. At this time, the contractor does not personally possess hardware that meets these requirements. Therefore, initially, for Task 1, the contractor will be required to work on-site, using a workstation available for running Voxar 3D, with access to required data sets. If site access of some type is required (badges, building cards, etc.), such access will need to be obtained.

Initially this task will require some of Dr. Kraft's time as follows:

1. The contractor will need information regarding access to Voxar 3D (location of computer, application folder, data folders, application manuals, etc.)

2. The contractor will want to discuss the data set to be analyzed. For example, has it been post-processed (labeling, etc.), how is the target (tumor) identified in general, etc. Any copies of useful references regarding this data might be helpful.

3. Any building rules regarding access will need to be discussed.

Task 2: Organizational Methods for Research Projects

General Description of Task

In addition to Dr. Kraft's clinical responsibilities, she and her staff are involved with and support numerous research projects that require the acquisition, storage and management of large collections of animal scans. Such work requires the documentation and recording of all pertinent information that is important to any research study, e.g., the study identifier, budgeting, acquisition protocols, notes taken, etc. Dr. Kraft and her staff are also often asked to provide copies of imaging scans, analyze scans, and draft reports at the requests of contractors and collaborators. Due to limited time and personnel, a uniform, organizational approach to the aspect of managing these fine details of Dr. Kraft's research projects has not been established to her satisfaction and she would therefore like to put forth effort to establish a standardized and more automated method for managing the aforementioned project requirements.

Subtasks

The task described above may be delineated into the following subtasks and time estimates:

1. Meet with Dr. Kraft to learn from her specifically what project management/organizational tasks are required by the objectives of her research projects. From this meeting the contractor will generate a document that is a translation of this discussion into the organizational goals for Dr. Kraft's projects. Sign-off on this deliverable will occur after Dr. Kraft's review, revisions if required, and her final approval.
   Time Estimate: TBD

2. Meet with all of Dr. Kraft's current team/staff responsible for the project details listed above in the General Description. The contractor recommends doing this on an individual basis to assure the most accurate picture of the current methods. The contractor will be asking about resources used by team members, from simple log books, to software applications, to data storage and transfer methods. The contractor will note-take to compare with the reference provided by Dr. Kraft in Subtask 1. The contractor will deliver to Dr. Kraft a simple

document (perhaps PowerPoint), that will provide information regarding this information gathering task. Sign-off will be based on whether Dr. Kraft believes sufficient information has been gathered.
Time Estimate: TBD

3. The contractor will examine the results of Subtasks 1 and 2 to:

   a. determine if there are current practices in place that are efficient, that satisfy the requirements outlined by Dr. Kraft, and for which the resources exist to employ these practices for all projects
   b. find single tools (preferably existing software applications) that can be used to accomplish project requirements that are currently accomplished by a range of tools across the team
   c. look for other efficiencies where multiple details may be combined into a single user task using a single resource., e.g., a database

   Based on the analysis performed above the contractor will provide a written report to Dr. Kraft describing recommendations for tools and procedures to meet the overall objective of this task as explained in the General Description. Sign-off will be based on Dr. Kraft's satisfaction with the level of detail and whether the report sufficiently addresses the objectives of the document created in Subtask 1.
   Time Estimate: TBD

Logistics
Subtask 1 will obviously require Dr. Kraft's time to meet with the contractor to provide the information described by that task.

Subtask 2 will require at a minimum Dr. Kraft's time to provide a list of the necessary team contacts and where they may be located. Perhaps a group meeting could be arranged to simply introduce the contractor and explain the contractor's task; allow the contractor an opportunity to explain he will do his best to work with staff schedules, etc.

The contractor may need occasional access to computing systems to understand how they are currently used to manage/organize project details.

The contractor may need to meet with current technical staff responsible for software applications employed in these projects to better understand their intent when applications were purchased and to discuss feasibility of reconfiguring if Subtask 4 recommends this.

Task 3: Scan File Data Utilities

General Description of Task
Often, image acquisition systems (MRI, CT) are designed to provide very specific data sets, in very specific computer file formats. Usually these file formats are a common standard that has been established to allow a range of vendor software to readily display and process the data to ease visual analysis. In research, information in addition to the scan data, may also be desired, and depending on the acquisition system, this information may not be readily accessible. This

task pertains to developing software utilities or determining system methods for providing Dr. Kraft's research staff access to specific, non-standard acquisition data.

Subtasks

The task described above may be delineated into the following subtasks and time estimates:

1. Develop a software utility or discover a built-in system function that will allow the saving of specified MRI acquisition parameters to an agreed-upon file storage system. The contractor will deliver the desired utility or function, if feasible. Sign-off will be based on Dr. Kraft's testing and approval of deliverable.
   Time Estimate: TBD

2. Develop a software utility or discover a built-in system function that will extract specified "raw" data from specified "analytical files" from the GE system and load that data into a specified spreadsheet format. The contractor will deliver the desired utility or function, if feasible. Sign-off will be based on Dr. Kraft's testing and approval of deliverable.
   Time Estimate: TBD

Logistics

This task will require the following:

- access to personnel familiar with the goals of Subtasks 1 and 2
- access to all available documentation for the systems in questions
- contact information for technical support (if available) for the systems in questions
- access to the actual systems at times that would minimize impact on their primary use

Estimated Cost of Work

Primarily due to the contractor's unfamiliarity with the software package Voxar 3D, and with Dr. Kraft's staff and specific imaging systems and computing equipment, estimating time for the tasks described is difficult. Estimates of time required for *initial* Subtasks should be within a 20% margin, however, time required for each Subtask that follows the initial Subtask, will be dependent on what is learned during the initial task and each preceding task, hence the difficulty in these estimates. Still, the contractor will in good faith provide best estimates prior to beginning any agreed upon contract work. The table below provides best estimates at this time:

Task 1: Segmentation for 3D Quantitation		
Subtask		**Estimated Time**
1		12 hours
2.1		2 hours
2.2		26 hours
2.3		40 hours
3		tbd
4		tbd
Task 2: Organizational Methods for Research Projects		
Subtask		**Estimated Time**
1		tbd
2		tbd
3		tbd
4		tbd
Task 3: Scan File Data Utilities		
Subtask		**Estimated Time**
1		tbd
2		tbd
total time estimate:		

Billing

Due to the contingent nature of the work described in this proposal, i.e., the completion of any given Subtask depends largely on the outcome of the preceeding Subtask, Dr. Kraft has suggested the proposed work be submitted as incremental contracts, with work beginning on Task 1: Segmentation for 3D Quantitation. The contractor has agreed to this method of billing and will submit contracts on a Subtask (as described here) basis, with the agreement that payment will be made upon completion of each such contract.