# Work-Item Proposal: IOD for photoacoustic imaging

## Introduction

This work item proposes the development of an information object definition (IOD) for photoacoustic imaging.

Photoacoustic imaging (PAI) is an emerging imaging modality that enables imaging optical absorption in biological tissues with acoustic resolution. Contrast is generated through absorption by chromophores that range from intrinsic absorbers such as hemoglobin and melanin to extrinsic agents such as indocyanine green (ICG) or diverse types of nano-particles. Excitation at multiple wavelengths allows the modality to discriminate individual chromophores. Prospective applications in the space of clinical imaging range from classification of breast cancer lesions through screening of sentinel lymph nodes to assessment of inflammation.

Many implementations integrate active pulse/echo ultrasound in a hybrid imaging system to capitalize on well established contrast for anatomical information. Photoacoustic Imaging is in widespread use in preclinical research labs and is recently being translated to clinical applications in first commercial implementations.

Recently, an academic and industry consortium to establish important standards in photoacoustic imaging ([www.ipasc.science](www.ipasc.science)) has been formed. It has recently accepted a proposal for a META-DATA description format using a consortium-wide consensus vote.

## Limitations of Current Standard and Proposal

- Existing IODs in DICOM support ultrasound imaging, but cannot incorporate important information specific to photoacoustic imaging.
- A specific IOD would enable the inclusion of specific attributes for photoacoustic imaging such as illumination properties (geometry, pulse energy, wavelength) as well as detection properties (bandwidth, center frequency, geometry). This would enable standardized interpretation of images acquired by different vendor platforms.
- Further, accompanying ultrasound images stored under a respective existing IOD could be linked to the respective photoacoustic images to enable standardized image fusion for the two asynchronous streams.
- There exist no established, standardized formats for image exchange of photoacoustic images.

## Details of Proposal

- Add IODs and SOP classes for photoacoustic images as well as metadata necessary to interpret them
- Existing data definitions previously agreed in IPASC can be used as a basis for data definitions

## Parts of Standard Affected

Add Photoacoustic definitions to the following:

- Part 2, Conformance
    - Including UID Values, Abbreviations, Network Services, and SOP Classes
- Part 3, Information Object Definitions
    - Including new Photoacoustic Image IOD(s) and Modality Specific Modules with considerations for single frame, multi-frame, and 3D
- Part 4, Standard SOP Classes
- Part 6: Data Dictionary
    - Including Registry of DICOM Data Elements, and a new SOP class for PA
    - Input from data elements in IPASC Photoacoustic Data and Device Parameters metadata definitions, https://www.ipasc.science/ipasc.science/documents/20200121_Metadata_list.pdf
- Part 11: Media Storage Application Profiles
- Part 15: Attribute Confidentiality
- Part 17: Explanatory Information

- Other sections may be updated where it makes sense to leverage overlap with ultrasound (e.g. concepts such as image regions and contrast agents)

## Workload

The existing IPASC consortium contains an industry board with currently 5 vendors of commercial photoacoustic imaging systems that will sponsor a new working group. They have already expressed their interest in completing the proposed supplement. Based on the effort required for prior agreement of other important aspects under IPASC, it is expected that 6 meetings of 4 hour duration and 2 face-to-face meetings for group review and consensus will be required to complete these efforts.

It is expected that four hours of WG-06 meeting time on each of six occasions during 2020-2021 will be spent for the review and approval of public comment, letter ballot, and final text.

**Appendix**