DICOM Correction Item

Correction Number	CP-667
Log Summary: Slice orientation for cross-sectional IODs	

Type of Modification	Name of Standard
Clarification	PS 3.3 2006 + CP 668

Rationale for Correction
Hanging protocols for cross-sectional images need to be able to select images in the commonly used orthogonal transverse, saggittal and coronal planes, yet it is not obvious how to obtain this information from images. Neither the original nor the enhanced image IODs provide a categorical description of the plane, only a mathematical description in the form of patient-relative row and column direction cosines. It is proposed to add informative text to suggest to implementers what is necessary to extract this information.

Sections of documents affected
PS 3.3 C.23.3.1.1

Correction Wording:

Amend PS 3.3 C.23.3.1.1 Filter Operations Sequence, as already amended by CP 668

C.23.3.1.1 Filter Operations Sequence

The items in the Filter Operations Sequence (0072,0400) determine which subset of the images in the identified Image Set are to be displayed in the associated Display Set image boxes. If there are multiple Items in the Filter Operations Sequence (0072,0400), the filter operations shall be applied in Item order, and the output of the preceding filter shall serve as the input to the succeeding filter (i.e., an AND operation).

When Filter-by Category (0072,0402) has a value of IMAGE_PLANE, Selector Attribute VR (0072,0050) shall have a value of "CS", and abstract enumerated values shall be used for the value of the associated Selector CS Value (0072,0062) attribute, which may be computed from the values of Image Orientation (Patient) (0020,0037) or Patient Orientation (0020,0020). Enumerated Values: TRANSVERSE, CORONAL, SAGITTAL, OBLIQUE.

> **Note:** **Cross-sectional images do not normally contain a categorical description of the image plane, but rather only a patient-relative row and column direction cosines that are unit vectors. The category of image plane can be determined first by categorizing the row and column major directions (or detecting if the orientation is oblique according to a pre-specified threshold), and then using those categories to select a plan category.**
>
> **The following pseudo-code can be used to determine the major axis (R or L, A or P, H or F) from a single direction cosine that is an (x,y,z) tuple (as defined in C.7.6.2.1.1):**

```
if (abs(x) > threshold)
        axis = "RL"
else if (abs(y) > threshold)
        axis = "AP"
else if (abs(z) > threshold)
```

           axis = "HF"

      else

           is OBLIQUE

Having determined the major axis of the row and column, the category of plane can be obtained from a table lookup:

Column	Row		
	RL	**AP**	**HF**
RL		**TRANSVERSE**	**CORONAL**
AP	**TRANSVERSE**		**SAGITTAL**
HF	**CORONAL**	**SAGITTAL**	

Alternatively, one can obtain a single vector that is the normal to the orientation (cross product of the row and column unit vectors), then find which of the x, y and z components has the maximum absolute value that is above threshold; if x then SAGITTAL, if y then CORONAL, if z then TRANSVERSE; if all of the components are below threshold then the orientation is OBLIQUE.

Since it is also necessary to determine whether or not to flip or rotate the image into the preferred orientation (as specified by Display Set Patient orientation (0072,0700)) for the category of plane (e.g., sagittals are normally viewed with row direction posteriorly and column direction towards the feet), the categorical row and column direction to use can be obtained as above, additional accounting for the sign of the direction cosine, e.g.:

    if x < 0 then orientationX = "R" else orientationX = "L"

    if y < 0 then orientationY = "A" else orientationY = "P"

    if z < 0 then orientationZ = "F" else orientationZ = "H"

    if (abs(x) > threshold)

        orientation = orientationX

    …