Media Management in Vanessa

2018.10.31.ET

Introduction

Media management represents a new subsystem within the Vanessa application. This document describes the current implementation and functionality.

Please note that at the time of this writing (2018.10.31), the media management features were new. Therefore, some features and functionality may not yet be optimized, or may be missing altogether. Nevertheless, this document should provide a useful overview.

Classification of Media

Currently, media resources in Vanessa are tagged at three nested levels.

At the top or outermost level, there are three categories:

1. Incident (i)
2. Vehicle (v)
3. Person (p)

Incident Level Tagging

Within the Incident level, there are two secondary-level tags:

1. Scene photos
2. Scene diagrams

Nota Bene: At the time of this writing, Vanessa is still using older legacy code for the importation of scene diagrams (which appear in the upper left corner of the main application view). Therefore, although you can now use the new generic Media Manager tools to import any number of additional scene diagrams, these new diagrams will currently only appear in the Media Manager “view” tab. No change will occur to the scene diagram present in the upper left-hand corner of the main application interface. This lack of integration will be remedied in the near future.

Scene Photos

Scene photos can be classified into three sub-types, as follows:

1. Generic incident-level scene photos
2. The scene as viewed from an involved vehicle
3. The scene as viewed from an involved pedestrian or bicyclist

As you can see, these three sub-types correspond to the top-level incident (i), vehicle (v), and person (p) categories. Importation of these three sub-types therefore follows the top-level categories.
This affects the way in which photos in these respective sub-types are imported:

- **To import a generic incident-level scene photo**, open up the “Media” form associated with the “Incident”.
- **To import a vehicle view scene photo** (which will typically be a look-ahead or look-behind view), open up the “Media” form associated with a **specific involved vehicle**.
- **To import a pedestrian view scene photo** (also typically a look-ahead or look-behind view), you will open up the “Media” form associated with a **specific involved person**.

Even though these vehicle-specific and person-specific scene view photos are imported at the “vehicle” or “person” level, they will be correctly displayed within the media viewer at the “incident” level, as follows:

```
• Incident
  └ scene diagrams
  └ scene photos
  └ vehicle views
    └ vehicle 1 views
    └ vehicle 2 views
    ...
    └ vehicle n views
  └ pedestrian views
    └ pedestrian 1 views
    └ pedestrian 2 views
    ...
    └ pedestrian n views
```

**VEHICLE DAMAGE PHOTOS**

Excepting scene photos, photos associated with a specific vehicle can be tagged at the secondary level into one of two categories:

1. *exterior*
2. *interior*

Options at the tertiary tagging level are discussed below.
VEHICLE EXTERIOR

Vehicle exterior photos can be tagged at the tertiary level as:

1. front
2. left
3. back
4. top
5. exemplar
6. miscellaneous

VEHICLE INTERIOR

Vehicle interior photos can be tagged at the tertiary level as:

1. row 1 interior
2. row 1 restraints
3. row 1 airbags
4. row 2 interior
5. row 2 restraints
6. row 2 airbags
7. other rows
8. miscellaneous

PERSON INJURY PHOTOS

Photos of people’s injuries are tagged at the secondary level as:

1. external (body)
2. internal (radiology)
3. injury map

NOTA BENE: An injury map is a diagram showing a generic outline of a person’s body with lettered markers indicating the location of various injuries. As of this writing, this diagram is produced in a manual fashion, and for this reason an option to tag this specific type of diagram is provided in Vanessa’s media manager. However, the plan is that eventually Vanessa will be able to generate an injury map diagram from injury information stored directly in the database.
TERTIARY TAGGING OF INJURY PHOTOS USING AIS CATEGORY

Tertiary-level tagging of both external (body) and internal (radiological) injury images is based on the AIS category of the injury, as follows:

0. not injured
1. head, cranium & brain
2. face, eyes & ears
3. neck
4. thorax
5. abdomen & pelvic contents
6. spine
7. upper extremity
8. lower extremity, pelvis & buttocks
9. external skin & thermal injuries

Note the numbering in the list above starts at zero so as to directly correspond with the AIS category assignment digits.

SUPPORTED MEDIA TYPES

Currently, the Media Manager knows how to deal with two static image formats:

1. jpeg
2. png

All photographs and radiological images should be in JPEG (Joint Picture Experts Group) format with a .jpg or .jpeg extension.

Electronic diagrams, such as scene diagrams or bodily injury maps should, for the time being, be saved in PNG (Portable Network Graphics) format with a .png extension.

In the near future, support for SVG (Scalable Vector Graphics, .svg) will be added.

NOTA BENE: When SVG support becomes available, any electronic diagrams that are natively SVG should be preferred over conversion to PNG format.

Please do not use TIFF, BMP, or any other obsolete image formats, as Vanessa will not know how to process them.

OTHER MEDIA FORMATS

Other media formats are not currently supported. However, in the future we may support video or other specialized medical image formats, as needs arise.
When a static image is uploaded to Vanessa, a number of things happen, as outlined in the schematic below:

First, Vanessa decides whether the image should be cropped or not. Images that have a single dominant background color are candidates for cropping. Such images are almost always either:

- scene diagrams
- radiological images

Note that Vanessa is smart enough to leave a reasonable margin around the edges of autocropped images.

**NOTA BENE:** As of this writing, the speed of the current algorithm used to detect how much to crop the image has not yet been optimized. Even though the algorithm might seem a tad slow—especially on large images—it is still completes the task much more quickly than a human doing the same task using Photoshop, Lightroom, or a similar image editing program.
See the Appendix for details on Vanessa’s algorithmic approach to cropping images.

**USING THE MEDIA MANAGER**

Along the bottom right margin of each of the *Incident, Vehicle, and Person* forms, you will see the following button:

After pressing this button, you will be presented with the media manager window with two tabs: one for *import*, and one for *view*:

The *import* tab will be pre-selected. This *import* tab will be customized based on whether you clicked the *media* button from an *incident, vehicle, or person* form window.

Here is the incident version:

The part at the top where it says *Media Tags* is the part which will look different in the *vehicle* and *person* versions.
Here is the vehicle version:

<table>
<thead>
<tr>
<th>Media Tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle #5005, 2017 CHRYSLER Pacifica</td>
</tr>
</tbody>
</table>

- **Exterior**
  - Front
  - Left
  - Right
  - Back
  - Top
  - Exemplar
  - Miscellaneous

- **Interior**
  - Row 1 Interior
    - Row 1 Restraints
    - Row 1 Airbags
  - Row 2 Interior
    - Row 2 Restraints
    - Row 2 Airbags
  - Other rows
  - Miscellaneous

- Scene view from vehicle

And here is the person version:

<table>
<thead>
<tr>
<th>Media Tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person #5049, 37yo female ISS</td>
</tr>
</tbody>
</table>

- **External body**
  - Internal radiology

- **not injured**
  - head, cranium & brain
  - Face, eyes & ears
  - neck
  - thorax
  - abdomen & pelvic contents
  - spine
  - upper extremity
  - lower extremity, pelvis & buttocks
  - external skin & thermal injuries

- Injury map
- Scene view from pedestrian
To import images, first carefully select the relevant tags by clicking on the appropriate check boxes shown in each version. Then simply drag and drop one or more images onto the large plus sign, “+” in the center of the form:

The plus sign will turn green when you are hovering over it with a set of one or more dragged images. The plus sign will then turn yellow as the images are being uploaded.

If all goes well, the plus sign will revert to its normal gray color when uploads are complete.

A message may also appear at the top of the screen if the image was autocropped:

The uploaded images themselves will now appear as thumbnails in the tray below the plus sign on the Import tab:
Clicking on a thumbnail will display the image in a separate window:

Comparing the original source image with the image processed by Vanessa, we see that the cropped and processed image uses only 13.4% of the storage space of the original file:

**Original Raw Image**

- 3288 x 3319 pixels
- 1,405,436 bytes (100%)

**Cropped & Processed**

- 1667 x 2178 pixels
- 187,753 bytes
  
  13.4%
Clicking on the view tab will then show all images that have been uploaded so far for this incident. Incident scene photos will be shown first. Scene photos may include photos as seen from specific vehicles, as in this example:

The scene photos will be followed by photos of damage incurred by each vehicle:
Finally photos and radiological images of injuries sustained by each involved person will be shown:

![Radiology images of injuries](image)

In all cases, thumbnail images will be arranged based on their primary, secondary and (if present) tertiary tags.

**A FASTER AND BETTER WAY TO UPLOAD INJURY IMAGERY FOR PEOPLE**

In addition to the general method shown above for importing images, Vanessa also has alternate streamlined way to import injury imagery for people.

Instead of pressing the *media* button, press the *injury* button at the bottom of the *person* form. This will display a table of injuries for the person:

![Table of injuries](image)

Although some information is missing from the table shown in this example, *note that the AIS codes and injury descriptions are present*. You can now just drag and drop one or more image files directly
onto a row in the injury table. When you hover a dragged image over the row, the row will appear green:

![Image of injury table]

After you drop the image or images onto the row, Vanessa will process them exactly as we have already seen, and the Media Manager window and import tab will appear. However, what is different in this case is that there is no need to manually tag the image. Instead, Vanessa automatically tags the image or images for you based on the AIS codes. The description is also conveniently imported as well:

![Image of automatically tagged media]

**NOTA BENE:** Vanessa automatically decides whether the image is an external (body) or internal (radiology) image based on the AIS codes. However, the lookup table that Vanessa uses may not be 100% accurate. If you should happen to notice any miscategorization between “external” body and “internal” radiology images, please let me know immediately so that I can revise the lookup table appropriately. Thanks!
Appendix: Algorithmic Approach to Image Cropping

Vanessa’s decision tree and algorithms for automatically cropping images currently work as follows:

**Detecting Images with a Dominant Background Color**

First, simple summary statistics are calculated for small (currently $n<50$) random sample of pixel values (an average of the red, green, and blue channels) gathered from a uniform narrow band along all four edges of the image.

The standard deviation of the sample is used as a proxy for how much the color values vary across the margins of the image. Since the sample is taken only from a fairly narrow band around the edge of the image, if the standard deviation in color value is low (or even exactly zero), it implies that there is a dominant background color.

Only images that have a dominant background color according to this test are chosen for autocropping. Images in which the color values vary greatly along the margins of the image are assumed to be photographs without a dominant background color.

Although one can construct edge cases where the above decision algorithm will fail, these may never occur in practice. For example, an image with a background consisting of a smooth linear gradient from black to white might fail the test. But in practice, backgrounds are usually uniformly white (scene diagrams), uniformly black (radiological scans) or uniformly dark gray (x-rays on photographic emulsions).

**Determining the Crop Region**

For candidate images that passed the above test, the algorithm for detecting where to crop the image is simple.

Starting at one edge of the image, we simply look at successive rows of pixels moving from the edge in toward the center of the image until we find a pixel whose value is substantially different from the background value determined previously.

This process is repeated on the remaining three edges. In each case, we note the orthogonal distance from the edge to the substantially different pixel.

Currently a threshold of 30 (out of 255) is used to define “substantially different.”
With this threshold, even an image with substantial background noise, such as the image shown below:

... will be very easily cropped to this:

After cropping the image, a small margin or border is added back onto the image so that important image features will not be colliding with the edge of the image. Normally, this border will be completely seamless: the border happens to be visible in the above image only because the original source image had a lot of noise in the background. In practice, most images will not have this much noise.

**FINAL STEPS**

After possibly cropping an image, the full size images are saved to disc storage. In order to use space efficiently, JPEG images are saved with a quality value of 60. PNG images are saved with maximum compression.
For display within the Vanessa application, “mid size” images are also saved to disc. Mid size images currently have a width of 2250 pixels (or less, if the original image was smaller than 2250 pixels across).

Finally, thumbnails are also created.

For images such as photos of vehicle damage or scene images, the storage requirements of the $60Q_{fullsize} + midsize + thumbnail$ images are still substantially less —on the order of 10 times less— than the original raw JPEGs coming directly off the camera. Of course for PNG images, the savings are less. Autocropping also contributes to saving storage space.