

Space Details

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Welcome to the Demonstration Study on Applying AVED to Still Image from Station M

This page last changed on Mar 23, 2010 by [dcline](#).

Welcome to MBARI Project 900905

This is the home page for the 900905 Demonstration Study on Applying AVED to Still Image from Station M space. This space is intended to support 900905 project members over the course of the 2009 year. This space is open to all project members so if you are a project member, please feel free to contribute to it.



(click to enlarge)

Figure 1. A single Station M time-lapse frame processed through the AVED detection software following modifications for still-frame processing. !T-results000005.png|thumbnail!boxes. A movie of the entire AVED processed sequence from this series can be found here: **internal access only** http://nanomia.shore.mbari.org/nanomiaRAID/AVED_StaM_900905/StaM4211PsychroSeriesAVEDEvents.mov



(click to enlarge)

Figure 2. A single Station M time-lapse frame processed through the AVED detection software following modifications for still-frame processing. !T-results000005.png|thumbnail!boxes. A movie of the entire AVED processed sequence from this series can be found here: **internal access only** http://nanomia.shore.mbari.org/nanomiaRAID/AVED_StaM_900905/StaM4211WhiteEchSeriesAVEDEvents.mov

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Introduction

What is this project about ?

This project proposes to apply existing AVED software to demonstrate how computer aided vision can be used to analyze Station M images. Our goal for this demonstration is to ultimately transfer this work to the Smith lab as a tool that they will continue to use in their research. We also intend to make the work available to other MBARI scientists and the general public.

Full details on the project can be found in the project proposal document [here](#).

Documentation and Related Projects

Documentation

Functional requirements ver 0.1 [\[PDF\]](#) [\[DOC\]](#)
Functional requirements ver 0.2 [\[PDF\]](#) [\[DOC\]](#)
[Image formatting](#)
[Condor installation notes](#)

Related Projects

[Pelagic-Benthic Coupling Project](#)
[AVED \(external\)](#)
[AVED \(internal\)](#)

People

[Danelle Cline](#)
[Duane Edgington](#)
[Jacob Ellena](#)
[Linda Kuhn](#)
[Ken Smith](#)
[Mike Vardaro](#)

Project Milestones



(click to enlarge)

Project Budget

Summary:

- 880 hours/110 days allocated for labor
- 1 domestic travel allocated for presenting work

Labor Summary	Expense Summary
 (click to enlarge)	 (click to enlarge)

Latest Project Status

[illegible]

(click to enlarge)

2009-02-03 meeting notes

This page last changed on May 13, 2009 by [dcline](#).

Attendees:

D.Cline, J. Ellena, L. Kuhnz, K. Smith

Notes:

Discussed overall project goals and other administrivia related to project. Meetings will be brief, bi-monthly meeting, and whoever is around will attend. Danelle expects the meetings to be short.

Ken noted two approx. 1 month deployment blocks he and Jake will be gone. Before leaving, Jake will convert a set of reels per Vardano's instructions as a first step.

Discussion on various type of easily identifiable animals we could work with. Linda noted that it would be a good idea to process the first sets through AVED to see what is detected and work from there.

Also various discussion on student projects emerged on exploring the data.

It is expected that the first few months of the project will be focused on modifying AVED for still frame processing with a test set of data from Jake.

2009-02-18 meeting notes

This page last changed on May 13, 2009 by [dcline](#).

Attendees:

D.Cline, J. Ellena, L. Kuhnz

Notes:

Ken, Jake gone Feb 23 returning April 24th from vacation. Good luck on your deployment. Duane gone 2.5 weeks returning March 9th.

Jake digitized one 100 foot reel, which represents one complete deployment. There is one TIFF photo every hour and the size is variable but set to an optimum size. Normal deployment is 400 foot roll, so this was a short deployment.

Mike Vardaro will be here during deployment, shouldn't be leaving until Oct/Nov. should we have questions about his research since we are planning to use his research as a baseline for comparison to computer results.

Danelle is working on modifying AVED to handle still frames. This involves modifying the segmentation algorithms. Following this work, she will process the TIFF images Jake has digitized and will cover the results with Linda.

2009-03-18 meeting notes

This page last changed on May 13, 2009 by [dcline](#).

Attendees: D.Cline, D.Edgington, L.Kuhnz

Danelle continues to work on modifying AVED for still frame processing. The time lapse images have non-uniform lighting which has posed some challenges for segmenting the background from the animals to classify.

Linda will be working on annotating some still frames with boxes/circles to help bridge the gap between engineering and science knowledge for Danelle (thank you Linda !).

Next steps include creating a functional requirements document with the team and reviewing it.

2009-05-13 meeting notes

This page last changed on May 14, 2009 by [dcline](#).

Attendees: D.Cline, D.Edgington, J.Ellena, L.Kuhnz, K.Smith, M.Vadaro

Danelle completed work on AVED still frame modifications and processed some test StaM image sets. Thanks for Linda for help on improving the detection results and understanding the animals of interest !

Results were discussed and it was decided to AVED process a 400 foot roll of M.Vardaro's choosing and to look for Echinocrepis rostrata and create a training database from it. This 400 ft. roll will be approximately 3200 individual still images taken in 1 hour time-lapse increments.

Lots of insightful questions were discussed about the AVED results from the Sta4211 dive, including

- why certain objects were not bounded correctly
- how to deal with the timecode overlay (which skews the results because it's salient)
- how the AVED classifier voting works
- how to use size/color/time to tell whether an animal is the same individual or not
- using Photoshop batch processing for some of the necessary pre-processing steps

Next meeting, the functional requirements document will be reviewed in detail.

Linda will be working some test images using Photoshop to erase the timecode overlay for Danelle to test.

Danelle will be working on engineering the workflow to process the data set.

2009-05-27 meeting notes

This page last changed on Jun 18, 2009 by [dcline](#).

Attendees: D.Cline, J.Ellena, L.Kuhnz, M.Vadaro

Danelle is working on installing AVED software on several machines, and reviving some old AVED classifier and image organizer GUIs for use in the project. She is also engineering the workflow to process the data set.

M.Vardaro has chosen a roll to process. Mike and Jake are busy working on higher-priority tasks as a result of the Antarctic cruise expedition.

The functional requirements were discussed and the document was revised and posted to the wiki. Many good questions and a few revisions came out of this discussion. Overall, a better understanding of what the system will do was achieved.

Discussion about what classes to include in the test, which will be compared against human study, concluded that the following classes will be created:

- Echinocrepis rostrata

- Macrourid

- other fish (rattails, etc.)

- Benthocodon

- other (which is everything else found, e.g. marine snow or objects difficult to discern)

Next steps were discussed, including what format to put the digitized data in per the requirements document and using Photoshop batch process to erase the timecode overlay.

2009-06-10 meeting notes

This page last changed on Jun 10, 2009 by [dcline](#).

Attendees: D.Cline, D.Edgington J.Ellena, L.Kuhnz

Administrivia included reminding the team to charge their project meeting time to the project. The project is in good shape in terms of number of hours and dollars available.

Individual updates:

Jake anticipates 2-3 weeks more work on the Antarctic cruise samples, then he may begin digitizing a sample roll. This work will involve cutting the roll into 4 pieces, then a week of digitizing it if everything goes smoothly. This has never been done, so we will be crossing our fingers.

Linda is gone on vacation the first 12 days of July. When she returns she will help test Photoshop batch processing to erase the timecode overlay. Mike will send her some sample images as soon as he has a few.

Danelle continues working on installing AVED software on several machines, and reviving some old AVED classifier and image organizer GUIs for use in the project. She is also engineering the workflow to process the data set.

Duane reminded the team that the MBARI proposal period is beginning and to be thinking about follow-on work since this is a one-year project only. It's too early to state whether follow on work is needed. Follow on work for this project may include support engineering time. Discussion about possible proposals, including work with the Benthic Imaging AUV were discussed.

2009-07-08 meeting notes

This page last changed on Jul 08, 2009 by [dcline](#).

Attendees: D.Cline, M.Vadaro, K.Smith

Administrivia included reminding the team to charge their project meeting time to the project. The project is in good shape in terms of number of hours and dollars available. Also, the Oceans 2009, Biloxi abstract was submitted and we are awaiting word on that which we expect sometime this week.

Individual updates:

Ken and Mike are on travel starting ~8/2/09 to Angola. Ken anticipates having some data from the sample roll digitized by the end of July. This work will involve cutting the roll into 4 pieces, then a week of digitizing it if everything goes smoothly. This has never been done, so we will be crossing our fingers.

Linda is gone on vacation. She is ready to help test Photoshop batch processing to erase the timecode overlay whenever Mike sends her some sample images.

Danelle continues working on installing AVED software on several machines, and reviving some old AVED classifier and image organizer GUIs for use in the project. She is also engineering the workflow to process the data set. Things are moving along in that front and a total of 4 machines has been made available for use in this project which will help speed along the AVED processing.

2009-07-22 meeting notes

This page last changed on Jul 23, 2009 by [dcline](#).

Attendees: D.Cline, M.Vadaro, K.Smith, L.Kuhnz

Individual updates:

Ken and Mike are on travel starting ~8/2/09 to Angola. Ken will be back 8/14/09 and Mike will be gone all of August.

First 100 ft section of a roll was digitized (thanks Jake !) which took around 11 hours and resulted in 671 images. Three additional 100 ft sections will be the roll will be digitized in the coming weeks and used to extract a training data set.

Linda presented some Photoshop batch processing to erase the timecode overlay and crop black bars out on the first images from the 100 ft roll. There is some variation in both width and height of the black bars on each frame, making the batch processing difficult, but she did a great job, and reports only ~8% loss of pixels over the masked timecode area from the processing.

Danelle finished installing AVED software on several machines, and is working on some modifications to the AVED scripts to handle still frames, instead of video. She will send some information to Linda on frame sizes and resolutions to test and an ISO standard naming convention to use.

The raw digitized images are large at 4504x2790 and 72 pixels per inch. AVED has never processed images these large. There may be limitations on computational time and/or memory so we will be doing some test on these to see if we need to scale them back to HD size, which may be more reasonable. All previous testing was done on resized 1120x720 images.

More pixels are generally better for AVED classification. There are no hard cut lines, because it depends on the animal, its features etc.. However, based on previous classification testing on images of Poebious, it was found that images smaller than 20x20 pixels are be too small for effective classification. Linda will find an animal that is reasonable to count and get an average pixel size to determine how much we could scale down images, if needed, before loosing accuracy.

Lots of interesting discussion in this meeting on how the film was analyzed, the importance of grid overlays, whether the black images (strobe mis-fires) are included in the digitized reels, etc.

2009-08-05 meeting notes

This page last changed on Aug 11, 2009 by [dcline](#).

Attendees: D.Cline, D.Edgington, J.Ellena, L.Kuhnz

Individual updates:

Linda discussed Photoshop batch processing to erase the timecode overlay and crop black bars out on the first images from the 100 ft roll. There are red dot artifacts in some frames because variation in the digitizing makes it difficult to have exactly centered images. The only way to remove the red dots is by over-estimating the mask (with Photoshopt cut and paste), which in turn produces hard edges, so it was decided to live with the red dots which would be, perhaps, less salient than hard edges.

The scanner occasionally skips frames, leaving no images. This represents difficulty in trying to automate the processing and subsequent time code management of frames. Jake is working with a scanner technician to resolve this issue before moving forward with scanning the remainder of the roll.

Duane reports the Ocean Science conference help in February 2010 is a good science audience to present this work. We will keep our eye open for submission to this later in the year.

Because of the large sizes of the Station M iamges (4504x2790 and 72 pixels per inch), Danelle has ordered more memory for the AVED compute servers for processing. It was decided the smallest animal, even at full resolution, would only be 100x100 pixels and would reduce AVED classification accuracy, therefore we will process the images at full resolution.

Ken and Mike are on travel starting ~8/2/09 to Angola. Ken will be back 8/14/09 and Mike will be gone all of August.

2009-09-16 meeting notes

This page last changed on Oct 14, 2009 by [dcline](#).

Attendees: D.Cline, K.Smith, J.Ellena, M. Vardaro, L.Kuhnz

Individual updates:

Jake got word from the scanner technician that he knows what is wrong with the scanner and a fix is forthcoming.

Initial processing of the first 1/4 roll brought up two issues:

- 1) More detection points are needed, so the default of 20 was increased to 50. This is primarily because schools of Benthocodon were not always detected. Increasing detection points should improve the hit rate for these animals.
- 2) Processing at full resolution is taking too long and taking too much memory (> 14 hours for 60 frames), so the frames have been reduced to 30% of their original size to 1376x843.

Danelle is making changes to the AVED Editor to support still frames. She is also adding a few capabilities requested by the team to the AVED Image Organizer to make it easier to create training libraries.

Danelle will request a Mac Desktop loaner from IS for the Smith lab to use to run AVED tools for this demonstration project.

Danelle will be out of the office 9/22-9/30 on medical leave, returning October 5th. She will be checking email during that period.

2009-10-14 meeting notes

This page last changed on Oct 14, 2009 by [dcline](#).

Attendees: D.Cline, J.Ellena, M. Vardaro, L.Kuhnz

Individual updates:

Budget for the project is on target with approximately 36% remaining for direct labor. The travel budget will be consumed this month. No further travel is scheduled for 2009.

A Mac Desktop loaner (thanks to the IS department) is now in the Smith Lab. The AVED Editor was installed on it for the team to test.

Jake is having difficulty getting a hold of the scanner technician. He will continue to pursue this communication to get the team more data to process.

A demo of the changes to the AVED Editor to simplify creating training classes resulted in several additional changes.

Danella will wrap up the changes necessary in the coming few weeks and get them to Jake and Mike for review.

The next steps are for the team to create the training libraries; after that the testing against these training libraries will occur.

Travel plans:

Danella will be on travel to Oceans 2009 in Biloxi, MS the last week of October.

Linda will be out of the office until November 1st.

2009-11-11 meeting notes

This page last changed on Dec 01, 2009 by [dcline](#).

Attendees: D.Cline, J.Ellena, M. Vardaro, L.Kuhnz

Individual updates:

The team will meet next week, Tuesday at 2pm to go over the AVED Editor changes like the undo/redo, and additions of identifier reference, tag, and class fields.

Given most of the cruise data is analyzed, Jake is freed up to focus on the project for the remainder of the year. No word from the scanner technician, despite repeated attempts to contact him. This is a change from the technicians willingness earlier in the year to help.

The next steps are for the team to create the training libraries; after that the testing against these training libraries will occur.

Presentation of the project at the Oceans Conference was well received. Questions at the end of the talk ran over time and a potential collaborator for the AVED project from the Sandia Research Labs will be visiting MBARI in the coming weeks to discuss this work with Danelle.

2009-12-15 meeting notes

This page last changed on Dec 15, 2009 by [dcline](#).

Attendees: D.Cline, J.Ellena, M. Vardaro, L.Kuhnz

The team is now working on creating the training libraries for the Station M site, including:

- Benthocon
- Coyphaenoides
- Echniocrepis rostrata
- marine organism (any animal that we are not keeping track of in the processed reels)
- trash (used for artifacts like the corner of a frame)
- physical object(anything organic)
- black frame
- gray frame
- shadow
- hydroida

Some of these concepts were added to the VARS knowledge base.

Lots of strategies were discussed on how to best sort, tag, and identify the objects. In the end, a spreadsheet will be maintained to flag any

Following this, classifier tests will be run.

Condor installation notes

This page last changed on Jan 27, 2010 by [dcline](#).

A small, two-node [Condor](#) pool was setup for this project. These are the installation notes for the computers AVED was installed on for this project.

Installing Condor As Execute-Only Node on Linux

Add group and user aved

```
[root@nanomia condor\]# groupadd -g 300 aved
[root@nanomia condor\]# useradd -c "AVED" -g aved -u 300 aved
```

RPM installation

* As root install condor RPM

```
[root@nanomia condor\]# rpm -ivh condor-7.2.3-linux-x86-rhel3-dynamic-1.i386.rpm
Preparing; ##### [100%] condor
##### [100%]
```

* Run configure script to setup installation as a submit and execute only node to the central manager nanomia.

```
[root@nanomia condor]# /opt/condor-7.2.3/condor_configure --type=submit,execute --central-
manager=nanomia.shore.mbari.org --owner=aved --install-dir=/opt/condor-7.2.3
```

* Edit /opt/condor-7.2.3/etc/condor_config changing the lines to allow READ/WRITE access and an address where email should be sent when something goes wrong

```
HOSTALLOW_WRITE = *.shore.mbari.org
CONDOR_ADMIN = dcline@mbari
MAIL = /bin/mail
```

Open the local configuration file /opt/condor-7.2.3/local.<hostname>/condor_config.local. Modify/add the following variables:

```
CONDOR_ADMIN = dcline@mbari
## What machine is collecting statistics ?
CONDOR_VIEW_HOST = $(CONDOR_HOST):9619
FILESYSTEM_DOMAIN=$(FULL_HOSTNAME)
```

```
## Define as having mbarivision capability for the class ads
HAS_MBARIVISION = True
STARTD_EXPRS = HAS_MBARIVISION, $(STARTD_EXPRS)
```

```
## Reduce the number of advertised CPUS
NUM_CPUS = 1
```

```
## Change START AND SUSPEND defaults
START = True
WANT_SUSPEND = False
```

Quigley and Espadon machines only Open the local configuration file /opt/condor-7.2.3/local.<hostname>/condor_config.local. Define execute directory as the spare disk

```
EXECUTE = /disk2
```

- Change the disk directory permissions

```
chown -Rf aved:aved /disk2
```

Sherman machine only

- Do not include HAS_MBARIVISION - this machine is dedicated for classification work only
- Instead, add HAS_AVEDCLASSIFIER, e.g.

```
## Define as having the AVED classifier capability for the class ads
HAS_AVEDCLASSIFIER = True
STARTD_EXPRS = HAS_AVEDCLASSIFIER, $(STARTD_EXPRS)
```

Installing Condor as a service on Linux

* Copy condor.sh and condor.csh files to /etc/profile.d:

```
cp /opt/condor-7.2.3/condor.*sh /etc/profile.d/
```

* Add to /etc/profile.d/condor.sh/csh file the following:

```
CONDOR_ROOT=/opt/condor-7.2.3
```

- Install condor service script to execute condor on bootup

```
[root@nanomia condor]# cd /opt/condor-7.2.3/etc/examples
[root@nanomia condor]# cp condor.boot /etc/init.d/condor
```

- Edit /etc/init.d/condor and insert . /etc/profile.d/condor.sh
before the line MASTER and replace the MASTER line with the following:

```
. /etc/profile.d/condor.sh
MASTER=$CONDOR_ROOT/sbin/condor_master
```

- Add soft links to the condor startup script

```
ln -s /etc/init.d/condor /etc/rc5.d/S100condor
ln -s /etc/init.d/condor /etc/rc5.d/K100condor
```

- Fix file permissions

```
chown -Rf aved /opt/condor-7.2.3/local.beowulffish/
```

- Start the condor service

```
[root@nanomia condor]# service condor start
```

The condor service should now start upon boot.

Image formatting

This page last changed on Aug 26, 2009 by [dcline](#).

About image formatting

Station M time-lapse images contained on 400ft reels need to be in digital format for AVED to process them. Once they are digitized, then are then sent to the AVED process for analysis. The requirements for image formatting are described below.

Image file format

The image file format AVED supports is, in large part, determined by what image format the Saliency Toolkit supports, as it is the primary software used in AVED. However, ~~AVED has many components, including the ability to create an mpeg of the results, which is one of the last steps in the AVED processing workflow. This step only supports up to HD size and will not work for images larger than 1080x720. If images larger than 1080x720 are processed, this mpeg will simply not be created, which is probably fine for this application of AVED, but worth mentioning.~~

After some minor modification it is now possible to rescale the output for mpeg encoding only into a size compatible with the mpeg encoder, without modifying the raw input images in their full resolution. This is good news !!

The image formats supported are:

.pnm, .pgm, .ppm, .pbm, .pfm, .png, .jpeg, .jpg, .rgb555, .rgb565, .rgb24, .rgb32, .yuyv, .uyvy, .yuv444, .yuv422, .y or, any of the above with an additional .gz or .bz2 extension, in which case the image file will be transparently decompressed.

Directory naming convention

All images directories will be named for the time of the first frame following a modified form of the the [ISO8601](#) convention, without any - or : characters.

For example, **20080607T120256Z_4516** represents a recording on June 7th, 2008 (06-07-2008), and the recording started at 12:02:56 UTC of **reel 4516**. Frames are assumed to be taken exactly 1 hour apart in each reel and AVED processed results will reference both the ISO time stamp and frame number appropriately in each detected event.

.bookmarks

This page last changed on Nov 18, 2010 by .



900905 Demonstration Study on Applying AVED to Still Image from Station M Bookmarks

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