Embracing Open Source Multimedia Software

The open source software community has been instrumental in pushing state-of-the-art advances in multimedia to millions of users. The VLC video player (www.videolan.org/vlc), for instance, incorporates the latest encoding and decoding techniques and has an average of 24 million downloads per month. The computer vision library OpenCV is widely used by governments and companies to perform automatic facial and object recognition (http://opencv.willowgarage.com/wiki), and Asterisk, an open source telephony software, has often been associated with the rise of voice over IP (www.asterisk.org).

Acknowledging the relevance of such developments, the ACM International Conference on Multimedia (or ACM MM) has held its Open Source Software Competition every year since 2004. As an integral part of the conference, the competition seeks multimedia software contributions that are available at no cost in academic and research settings due to open source licensing agreements.

This competition has steadily grown since its inception, from two finalist entries in 2004 to 14 in 2011. This article reports on the ACM Multimedia 2011 competition that took place from 28 November to 1 December in Scottsdale, Arizona. (Further information about the history of the competition is available at the ACM SIGMM portal, http://sigmm.org/Resources/software.)

In 2011, the organizers adopted new strategies to reenergize the competition. Proactive measures were taken with the intention of increasing awareness in open source communities, which are typically outside of multimedia research circles. First, the coordinators directly contacted numerous potential contributors, resulting in an unprecedented number of submissions of both established and novel projects. Second, the conference included a panel discussion on the relationship between the open source and research communities. The panel aimed at exploiting synergies between these two communities, exploring the possible benefits, and better understanding the existing challenges. Finally, the ACM SIGMM portal now includes a new section dedicated to multimedia-related open source projects to help raise the visibility of such projects within the research community (see http://sigmm.org/Resources/software).

ACM MM 2011 Open Source Software Competition

In 2011, 23 entries were submitted to the competition. From these entries, 14 were selected as finalists for presentation at the ACM MM Conference.

The finalists were selected by a technical review committee that consisted of 11 researchers who evaluated the technical merits, novelty, and potential impact of the submitted entries. In addition, four testers evaluated the

Editor’s Note

This article reports on the Open Source Competition at ACM 2011 International Conference on Multimedia and the associated panel discussion. To help communicate their intention and impact, videos of the winning project (OpenIMAJ and ImageTerrier) and the two honorable mentions (ClassX and Matterhorn) are also available online:

- “OpenIMAJ/ImageTerrier” by Jonathon Hare, Sina Samangooei, and David Dupplaw (University of Southampton, UK)
- “ClassX” by Sherif A. Halawa, Bernd Girod, and Derek Pang (Stanford University)
- “OpenCast” by Michelle Ziegmann (University of California at Berkeley) and Olaf A. Schulte (ETH Zurich)

Visit http://doi.ieeecomputersociety.org/10.1109/MMUL.2012.16 to access the Web extra content.
submitted entries from both the developer and user points of view. They looked at the ease of building, installing, and running the submitted software as well as on the quality of the documentation.

The competition included finalists from both mature and young software projects. On the one hand, the competition recognizes mature projects that have achieved recognition as a result of a significant impact and outreach. On the other, the competition provides opportunities for newer projects with potential impact and novel contributions to help them gain new users and developers.

During the ACM MM Conference, all finalists had the opportunity to showcase their projects during a poster session. Then, during two technical sessions of two hours each, the finalists each had 10 to 20 minutes to present and demonstrate their projects.

This year the finalists were grouped into two technical sessions based on their topics. The first session contained finalists on multimedia content analysis and multimedia systems. That session included the following projects:

- Open Intelligent Multimedia Analysis Toolkit for Java (OpenIMAJ, www.openimaj.org) and ImageTerrier (www.imageterrier.org), a set of Java libraries and tools for scalable multimedia analysis and indexing of images;
- LIRe (www.semanticmetadata.net/lire), a library for retrieving images and photos based on their color and texture characteristics;
- FIT3D (www.fit3d.info), a toolbox built for Matlab that lets researchers obtain a complete 3D model from a set of calibrated images;
- A C++ Library for Handling MPEG-7 Descriptions (http://iiss039.joanneum.at/cms/index.php?id=84), which provides a complete implementation of the MPEG-7 standard;
- FCam (http://fcam.garage.maemo.org), a C++ application programming interface (API) for easy and precise control of digital cameras;
- Tribler (http://dl.tribler.org), a software project that facilitates searching, streaming, and sharing content using peer-to-peer (P2P) technology; and
- Orcc (http://orcc.sourceforge.net), an open RVC-CAL (Reconfigurable Video Coding, Cal Actor Language) compiler that includes a just-in-time adaptive decoder engine.

The second session covered multimedia applications, including these projects:

- GoalBit (http://goalbit.sourceforge.net), a free and open source P2P streaming network;
- A VLC plug-in enabling DASH (www-itec.uni-klue.at/dash), a plug-in for the VLC media player that enables dynamic adaptive streaming over HTTP;
- GPAC (http://gpac.wp.institut-telecom.fr), a multimedia framework that helps developers experiment with different types of multimedia applications;
- OpenMusic (http://repmus.ircam.fr/openmusic/home), a visual programming environment for music composition;
- Timesheets.js (http://wam.inrialpes.fr/timesheets), a JavaScript library for publishing multimedia Web documents that take advantage of the new HTML5 and CSS3 features;
- ClassX (http://classx.stanford.edu/ClassX), an open source interactive lecture streaming service; and
- OpenCast Matterhorn 1.1 (http://opencast.org/matterhorn), a lecture capture platform for both research and production environments.

The OpenIMAJ and ImageTerrier project was proclaimed the winner of the ACM MM 2011 Open Source Software Competition (see Figure 1). Two other projects, ClassX and Matterhorn, received honorable mentions. The winning projects received generous prizes in the form of books and book vouchers sponsored by Cambridge University Press and the Springer’s Multimedia Tools and Application Journal.
ACM MM 2011 Open Source Software Competition Winners

Three judges evaluated the competition finalists to select the winner and two honorable mentions. The judging criteria included the evaluations by the reviewing committee and testers as well as the presentations made during the conference. The judges unanimously selected the OpenIMAJ and ImageTerrier entry as the winner and awarded the ClassX and Matterhorn projects the honorable mentions. Along with this article, each of these winning projects has an associated video published in the IEEE Computer Society Digital Library (see http://doi.ieeecomputersociety.org/10.1109/MMUL.2012.16).

The winning entry presents two closely related software projects. The first, OpenIMAJ, consists of a collection of Java libraries for multimedia analysis. OpenIMAJ includes a comprehensive list of image processing algorithms and has a Hadoop-based implementation that scales the toolkit up to processing of millions of images. The second, ImageTerrier, is a high-performance content-based image retrieval engine that can search through a million medium-resolution images in under 400 ms on a standard PC.

The two honorable mentions, ClassX and Matterhorn, are projects on lecture webcasting. The projects complement each other in features and targeted users.

ClassX is a relatively new project that aims to provide an inexpensive solution to lecture webcasting with a single, mobile off-the-shelf video camera. ClassX presents a novel feature that lets users digitally zoom into a video. Matterhorn, on the other hand, aims to be a comprehensive enterprise-level product that includes software for acquiring, processing, and distributing the content from hundreds of classrooms on a single campus to many students. The system also supports automated scheduling; a set of flexible, open APIs; and a modular component-based architecture. Matterhorn has been deployed to 13 institutions and includes hardware vendor support.

ACM MM 2011 Panel on Open Source Software

In addition to the competition, the conference included the open source software panel entitled “Towards Synergy between the Open Source and the Research Multimedia Communities.” The panelists were among the leading figures from the multimedia research and open source communities. Figure 2 shows the speakers invited to participate:

Ben Moskowitz represented the Open Video Conference and Mozilla Foundation. Mozilla has developed open source libraries such as Popcorn.js (http://popcornjs.org), which
lets users integrate the Web into video productions.

- Zohar Babin represented Kaltura (http://corp.kaltura.com), a New York-based software company that helps publishers and content owners publish, manage, monetize, and analyze their video and other rich-media content.

- Dick Bulterman (CWI and Vrije Universiteit in the Netherlands) represented Ambulant (http://ambulantplayer.org), an open-source media player with support for SMIL 3.0.

- Rainer Lienhart (University of Augsburg in Germany) represented OpenCV, a library of programming functions mainly aimed at real-time computer vision.

- Mathias Lux (Klagenfurt University in Austria) represented LIRe and Caliph & Emir (www.semanticmetadata.net/features). The latter are MPEG-7-based Java prototypes for digital photo and image annotation and retrieval.

The goal of the panel was to provide a shared space for discussion and interaction among multimedia researchers and consolidated and new open source projects. The intention was to foster synergy between these groups and better understand the challenges ahead. To achieve these goals, the panel discussion was informally divided into three topic areas. After the introductory statement by each participant, the discussion focused on established open source projects and how the research community could more actively participate in them. The second area focused on publishing and how to find a balance between developing software and publishing in relevant conferences and journals. The final area included a discussion on the future of the competition.

The panel discussions first evolved around the challenges for the research community to create and maintain open source software projects. One of the identified challenges was funding and manpower. OpenCV, one of the most successful open source software projects rooted in the research community, had strong backings from Intel Research in its early years and had a team of dedicated software engineers supporting the researchers in the development. This model is difficult to replicate elsewhere, especially in the university environment, due to the lack of incentives. In the university environment, the performance indicators for a researcher are generally publications. Even though releasing open source research code can help to boost the impact of one’s research, maintaining the code and fostering user or developer communities for the long term takes significant additional effort that only the most passionate researchers can undertake.

The discussion then focused on the lack of published code for most of the research articles in the research community. Typically, only an algorithm description is published, but not the code that generated the results in the article. This trend makes it difficult, if not impossible, for other researchers to reproduce and validate the results. Because one of the pillars of science is reproducibility, some argued that this practice is unscientific! The panelists discussed how the research community should move away from this trend. One recommendation for a first step in this direction is to ask open source oriented companies to get involved in the ACM Multimedia Grand Challenge. The ACM MM Grand Challenge is a set of problems presented from industry to the research community in an attempt to solve relevant interesting and challenging questions.

The panelists encouraged both the multimedia research and open source communities to explore each other’s venues (such as the ACM
MM and Open Video Conferences) for increasing the awareness of each other’s work and for fostering synergy between the two communities.

**Conclusion**

Last year, the ACM SIGMM community took a number of actions to welcome open source projects, including a more encompassing open source software competition, a panel at the ACM MM conference, a new section in the SIGMM portal, and a new regular column in *SIGMM Records*. This is an important step toward synergy between research and open source that will increase awareness and visibility within the community. The message being, “We are embracing open source multimedia projects.”

Given these efforts, the ACM SIGMM community anticipates more involvement from the open source community. The competition will continue to grow, providing a shared space for discussion. Finally, and most importantly, open source projects will become more visible as they are invited to actively participate in the community.

**Acknowledgments**

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