

# DVA DATA LOADING INTERFACE REQUIREMENT DOCUMENT

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VERSION: 1.00

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## REVISION HISTORY

Author	Date	Version	Changes
Matteo Ruggero Ronchi	29-Dec-2011	1.00	Created
Matteo Ruggero Ronchi	05-Jan-2012	1.00	Edited Summary of Key Capabilities Added high-level features Closed Open Issues Defined Project Schedule

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# 1. INTRODUCTION

## 1.1 REQUEST OVERVIEW

*(This one-paragraph introduction explains the nature of the request by customer)*

The Developmental Vision Agent (DVA) is a Software product developed for tasks of scene understanding.

The DVA must be able to access and manipulate information contained in images and videos of different formats during its execution.

This request addresses the development of an image and video loading and manipulation Software module that can be called by the DVA.

## 1.2 CUSTOMER DESCRIPTION

*(This subsection provides details about the customer)*

Customer is represented by the Artificial Intelligence Laboratory, headed by Professor Marco Gori.

## 1.3 OBJECTIVES

*(This subsection details the project's high-level objectives)*

The goals of this project can be summarized as follows:

- Specify, design, develop, test and deliver a beta release of the new Software module.
- Gather feedback from the project stakeholders.
- Finalize delivery of the production release.

## 1.4 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

ACRONYM	DESCRIPTION
DVA	Developmental Vision Agent
IVPM	Image and Video Processing Module

## 2. SCOPE

### 2.1 BUSINESS DRIVERS

*(This is a brief description of the business elements driving the customer request)*

IVPM is required to enable efficient image and video loading and processing during the learning and execution phases of the DVA.

The successful completion of the DVA tasks requires, therefore, the timely availability of the IVPM.

### 2.2 REFERENCES

*(This subsection lists any reference documents relevant to this customer request)*

- Developmental Vision Agents, AI Lab Technical Report, September 13 2011

## 2.3 PROBLEM STATEMENT

*(A description of the main problem addressed by this request)*

The problem of	Extracting information from images and videos
affects	the overall results provided by the DVA
The impact of which is	the need of developing image and video processing methods
A successful solution would	guarantee efficient and accurate access to information contained in images and videos and allow decoupling the learning phase of the DVA from the image and video processing.

## 2.4 PRODUCT POSITION STATEMENT

*(Explain the main positioning value of the proposed new product)*

For	the AI Lab group
Which	is responsible for the development of the DVA
The	IVPM
Which	provides image and video processing capabilities
Will	support all required image and video processing needs within the DVA project



### 3. STAKEHOLDER AND USER DESCRIPTIONS

#### 3.1 STAKEHOLDER SUMMARY

*(The individuals who will have an active role in evaluating this request and in driving/supporting the related product lifecycle)*

Name	Represents	Position - Role
Stefano Melacci	AI Lab Group	DVA Project Leader
Marco Gori	AI Lab Group	Laboratory Head
Marco Lippi	AI Lab Group	DVA Software Developer
Matteo Ruggero Ronchi	AI Lab Group	IVPM Software Developer

#### 3.2 USER SUMMARY

*(The individuals expected to use the product and their respective stakeholders -  
Somebody who needs to validate the product from the perspective of user experience)*

Name	Description	Stakeholder(s)
DVA Software Developer	The individual interfacing the DVA with the IVPM	Stefano Melacci Marco Lippi

## 4. PRODUCT OVERVIEW

### 4.1 PRODUCT PERSPECTIVE

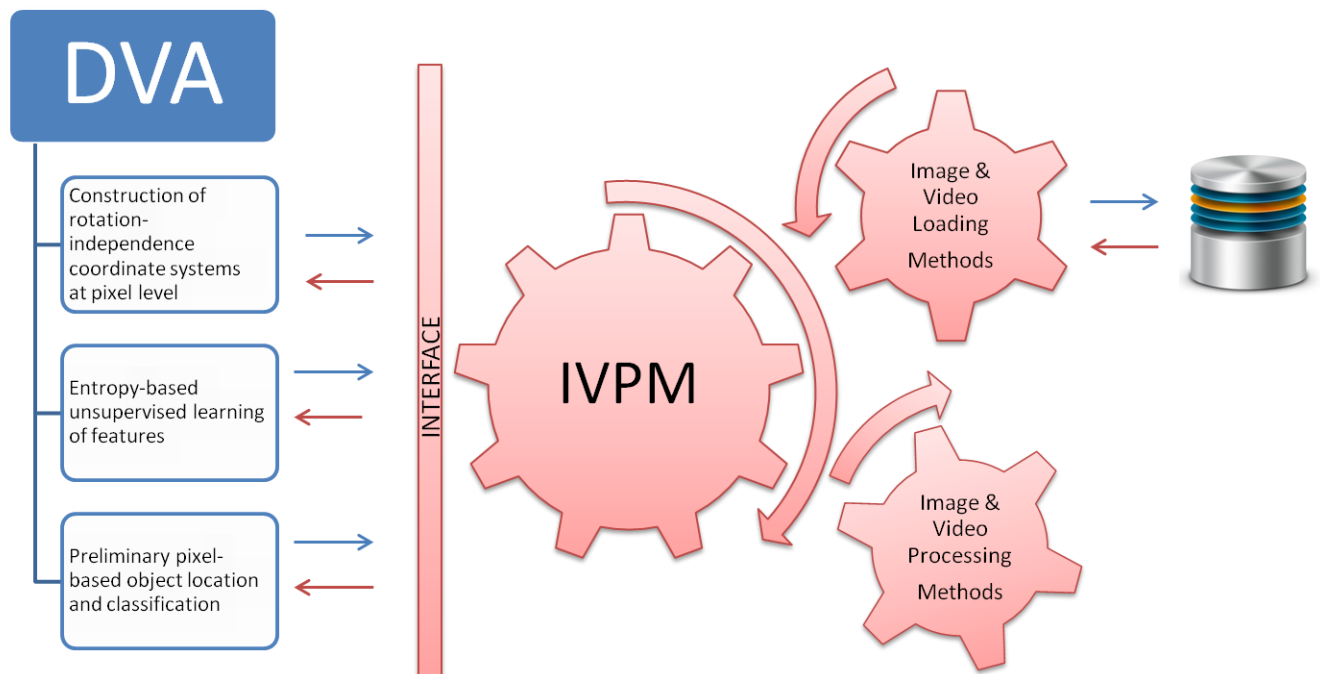
*(How does the customer think this product should look like? Is the product totally self-contained? If it is part of a larger system then describe the interactions with the other parts and the relevant interfaces. You can use a block diagram.)*

The IVPM is required to be an independent Software module developed in C++ language.

The IVPM must expose methods, in its interface, for manipulating the information contained in images and video files located on a mass storage repository.

An object of class IVPM will be instantiated by an object of class DVA by means of its constructor method.

After instantiation of an IVPM object, interaction with the DVA is realized through the offered interface: when the DVA object needs to access information contained in an image or video in one of its development phases, it will call the corresponding method exposed by the IVPM that implements the desired operations.



## 4.2 SUMMARY OF KEY CAPABILITIES

*(Summarize the major benefits and features the product will provide)*

Benefit	Supported Features
Ability to load multiple image formats	The following formats will be supported: JPEG – PNG – BMP
Ability to load multiple video formats	Uncompressed Audio Video files (AVI) will be supported.  Future extensions will consider compressed formats such as: WMV – MPEG-2 – MPEG-4
Ability to handle multiple color space representations for images and videos	The following representations will be supported: Grayscale – RGB – YUV
Ability to access pixel level information in an image	Returns a vector with the value of intensity of the selected pixel in the image, according to the applied color space representation.
Ability to access frame level information in a video	Extracts the image(s) corresponding to a video frame at specified time input(s).  Possibility to save the extracted image or return it for further processing.
Ability to parse a video according to a given frequency	Selects from a video stream all images separated by a given sampling interval.  Possibility to save the extracted images or return them for further processing.

## 4.3 SYSTEM AND PERFORMANCE REQUIREMENTS

*(List any system and performance requirements necessary to support the application)*

The IVPM should be compiled with GNU Compiler G++ on Linux systems.

Performance requirements in terms of processing time are not explicitly specified.

The IVPM should allow smooth image processing, without any sensible system performance degradation, and avoiding numerous input output disk operations.

#### 4.4 ASSUMPTIONS AND DEPENDENCIES

*(Is this customer request hinging on some assumptions or dependencies?)*

Images and videos of all sizes and resolutions should be supported by the IVPM for processing.

#### 4.5 LICENSING, INSTALLATION AND INTEGRATION

*(How will the product be licensed, installed and integrated?)*

Licensing conditions will be determined by the terms of use of the third party Software libraries' used in the development of the IVPM.

The IVPM should be compiled as an independent Software module and be included as a library in the DVA's Source Code.

Integration between the interface exposed by the IVPM and the needs of the DVA will be eventually handled by third party developed bridge Software module.

#### 4.6 SOFTWARE LOCALIZATION

*(What languages will be supported by the software?)*

All User Interface elements of the IVPM will be localized in English.

#### 4.7 CUSTOMER SUPPORT

*(How will the product be supported in the field before and after delivery?)*

Any questions or support requests regarding the IVPM can be entered by signing up on the Google Group named "IVPM Unisi", or sending an email to the address [ivpm\\_unisi@googlegroups.com](mailto:ivpm_unisi@googlegroups.com).

#### 4.8 TIMELINE FOR MARKET READINESS

*(At what time does the customer request that this product be ready for production?)*

The IVPM should be ready for deployment no later than the 29-th of February 2012.

## 5. PRODUCT FEATURES

*(List and describe here the high-level product features as provided by the customer)*

### 5.1 HIGH-LEVEL REQUIREMENTS AND FEATURES

- 5.1.1 The IVPM will be able to access all the information related to a single image stored on a mass storage repository.
- 5.1.2 The IVPM will be able to access all the information related to a pool of images contained in a directory stored on a mass storage repository.
- 5.1.3 The IVPM will be able to access all the information related to a video stored on a mass storage repository.
- 5.1.4 The IVPM will be able to parse a video stream into multiple frames separated by a given sampling interval, making single frames accessible for successive analysis.
- 5.1.5 The IVPM will be able to perform conversion between any two given color space representations among the ones defined in section 4.2.
- 5.1.6 The IVPM will be able to access and return the value of a single pixel in an image when given in input its position inside of the frame.
- 5.1.7 The IVPM will be able to access and return the value of the neighborhood of a single pixel in an image when given in input its position inside of the frame and the size of desired neighborhood.
- 5.1.8 The IVPM will be able to carry out sub-sampling of an image given in input a mask of the desired pixels to select.
- 5.1.9 The IVPM will give the opportunity to save on a mass storage repository an image.

## 5.2 OPEN ISSUES

OWNER	Issue Description	STATUS
Matteo Ruggero Ronchi	Decision of which Open Source Library to use for the implementation of the IVPM	CLOSED

Software Library to be used for the implementation of the IVPM is Open-CV.

The main reasons that brought to this decision are the following:

- Great quantity of reliable and easily available documentation and support
- High number of high-level features and methods included in library, alongside with low-level coding opportunity
- Best guarantee of performance with respect to other Visual Software Libraries, as indicated in Fig. 1.4 (page 28 of 577) of reference book:

**Learning OpenCV**

by Gary Bradski and Adrian Kaehler.

- Same Visual Software Library used in the development of the DVA.

## 6. PRELIMINARY PROJECT SCHEDULE

Milestone	Owner	Complete By
Requirements Document approved	SM	5-Jan-2012
Closure of all Open Issues	MRR	5-Jan-2012
Delivery of Design Specification Document	MRR	16-Jan-2012
Design Specification Document approved	SM	20-Jan-2012
Start of the IVPM Development	MRR	20-Jan-2012
Delivery of beta release	MRR	13-Feb-2012
Feedback on the beta release	SM – MG	17-Feb-2012
Delivery of final release	MRR	29-Feb-2012

## 7. SIGN-OFF

Approval date: 7 January 2012

Approved by:

*Stefano Melacci*  
Name

*DVA Project Leader*  
Title

*Matteo Ruggero Ronchi*  
Name

*IVPM Software Developer*  
Title