

Menpo



~~A Comprehensive Platform for Parametric Image Alignment and Visual Deformable Models~~

A bunch of code to make iBUG research easier

Imperial College
London

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Supervised by Stefanos Zafeiriou

Topics

- What Menpo does
- Why we made Menpo
- A tour of the Menpo Libraries
- Demonstration
- How iBUG researchers can use Menpo
- Upcoming talks

SEMANTIC IMAGE ANALYSIS

*is this person
happy?*

*how interested is
this person?*

BEHAVIOURAL ANALYSIS

*does this person
have a medical
disorder?*

*is this person
lying?*

FEATURE POINT TRACKING

*how does the
nose tip move in
this video?*

RECOGNITION

*is this James
Booth?*

RECONSTRUCTION

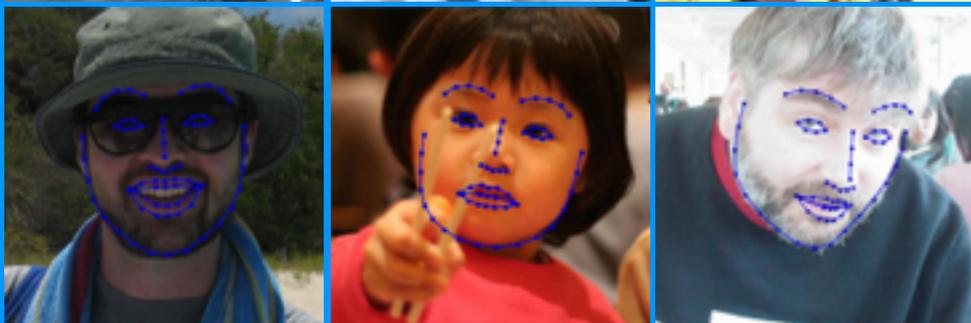
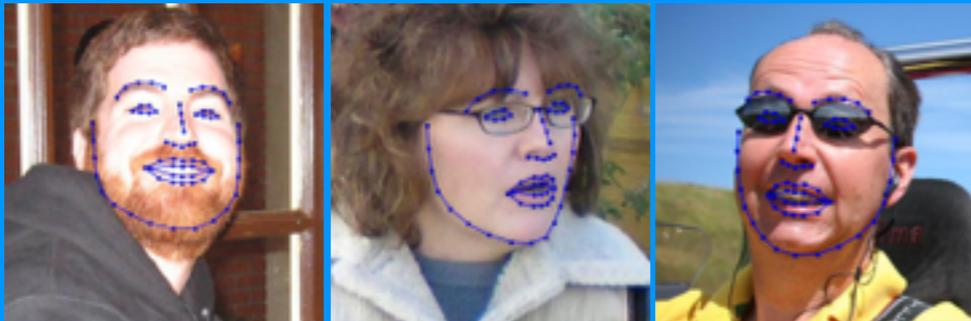
*how would this person
look in 3D?*

*how would this sad person
look if they were happy?*



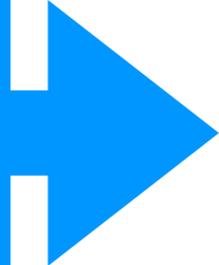
OBJECT DETECTION

where is the face in this image?



FEATURE POINT LOCALISATION

where is the nose-tip in this image?



is this person happy?

how interested is this person?

BEHAVIOURAL ANALYSIS

does this person have a medical disorder?

is this person lying?

FEATURE POINT TRACKING

how does the nose tip move in this video?

RECOGNITION

is this James Booth?

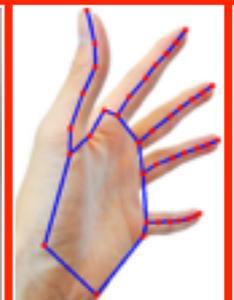
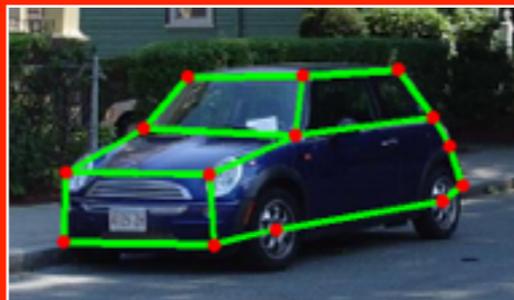
RECONSTRUCTION

how would this person look in 3D?

how would this sad person look if they were happy?



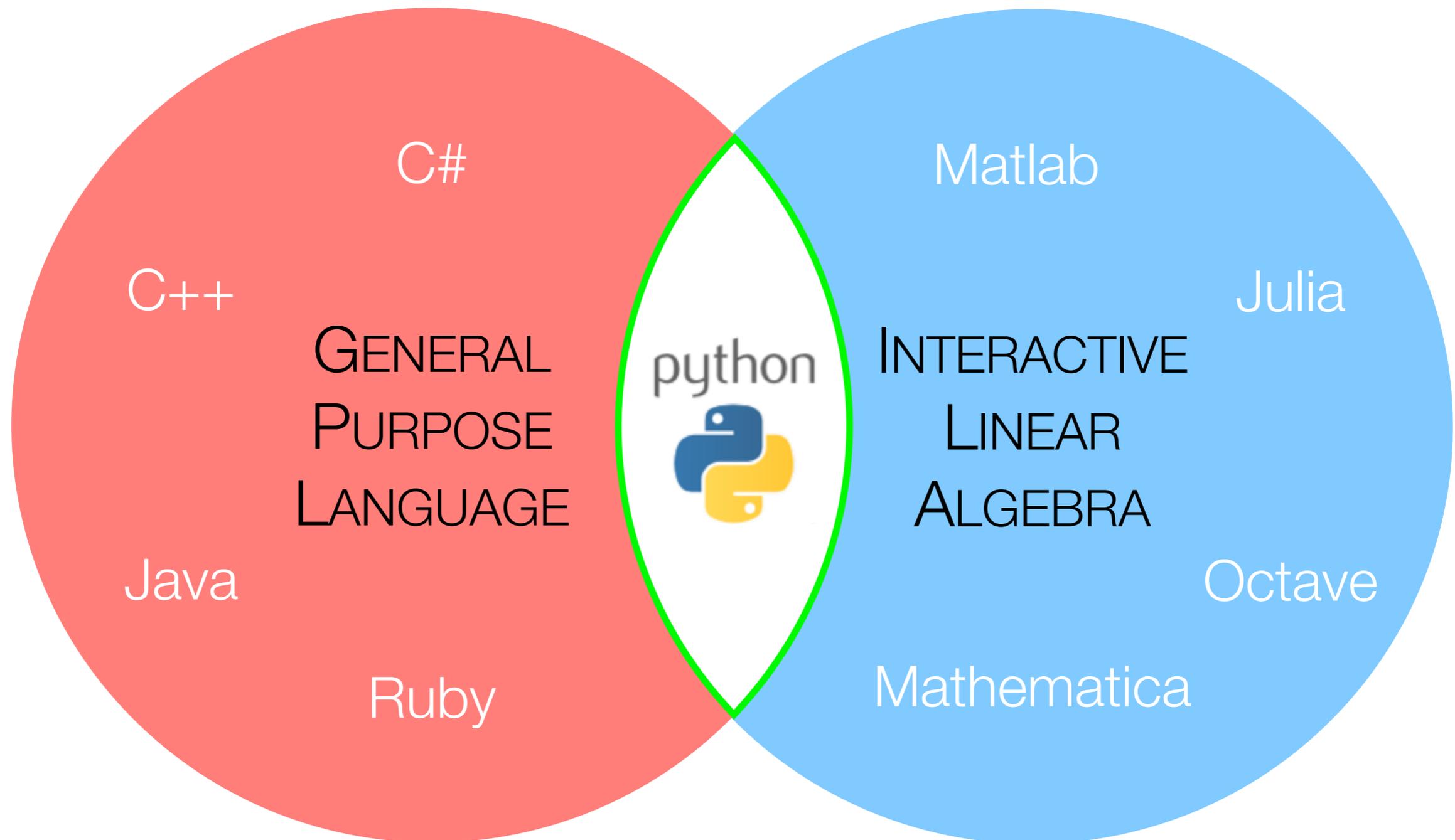
Menpo is not specific to faces



Motivation

- iBUG 💖 Matlab
- Each researcher prepares for papers independently
- Isolated scripts, not reusable frameworks
- Our dream in 2012:
 - *What if we had a shared, well tested, ever improving codebase that we all collaborated on?*
 - *If we did we'd call it Menpo!*

Why Python? - *the best of both worlds*



A P P L I C A T I O N S

emotion
detector

automatic
image
annotation

facial point
tracker

...

R E S E A R C H

boothiccv2016 ...

menpofit

menpo3d

menpodetect

menpo

M E N P O L I B R A R I E S

menpo

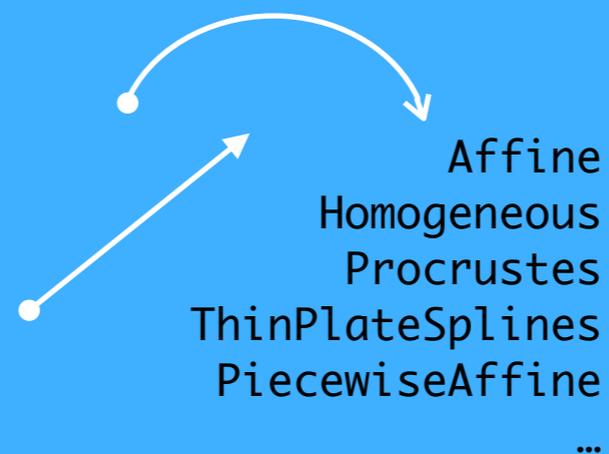
IO

.JPG .PTS
 .PNG .LM2
 .BMP .GIF
 .TIFF .LAN

Images



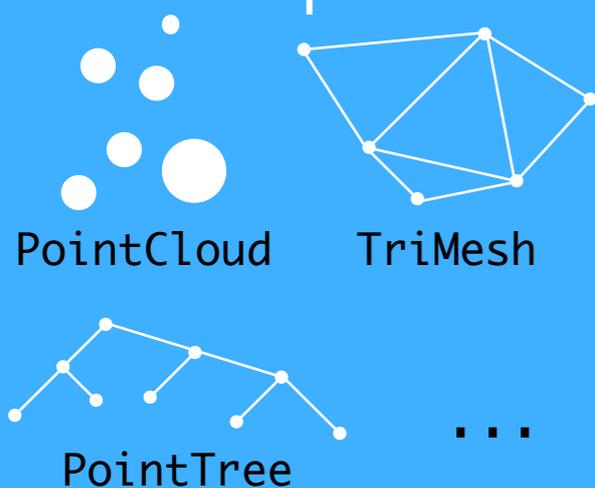
Transforms



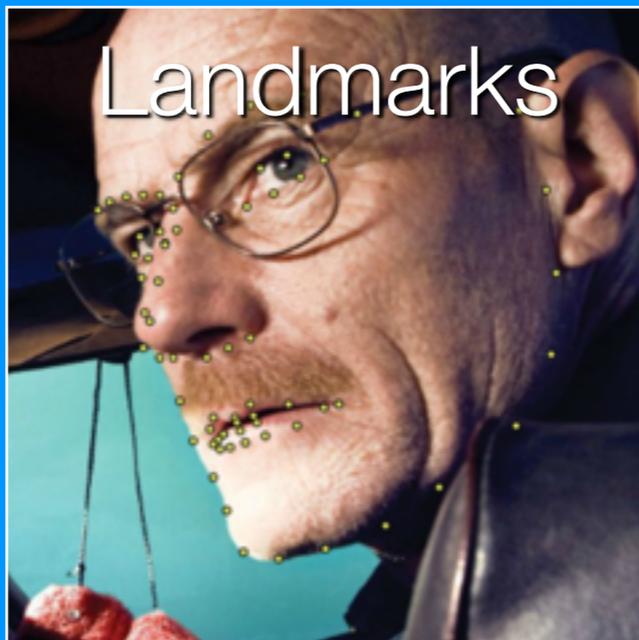
Statistical Models

$$x^* = \bar{x} + \sum_i \alpha_i x_i$$

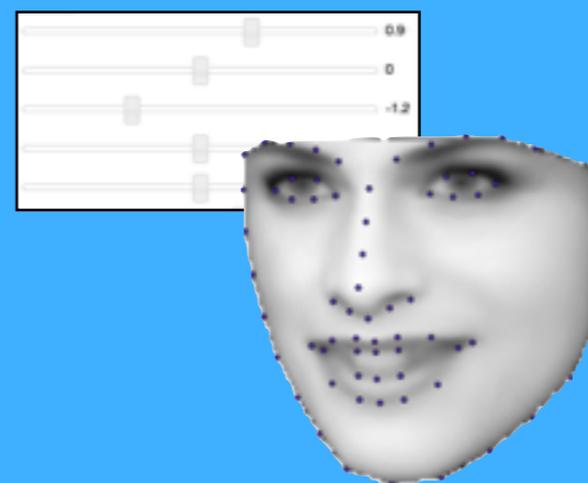
Shapes



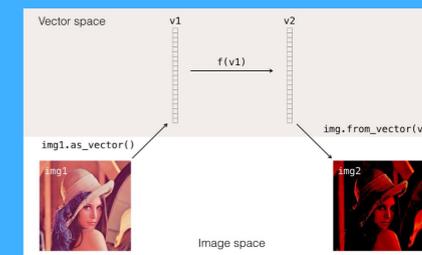
Landmarks



Visualization

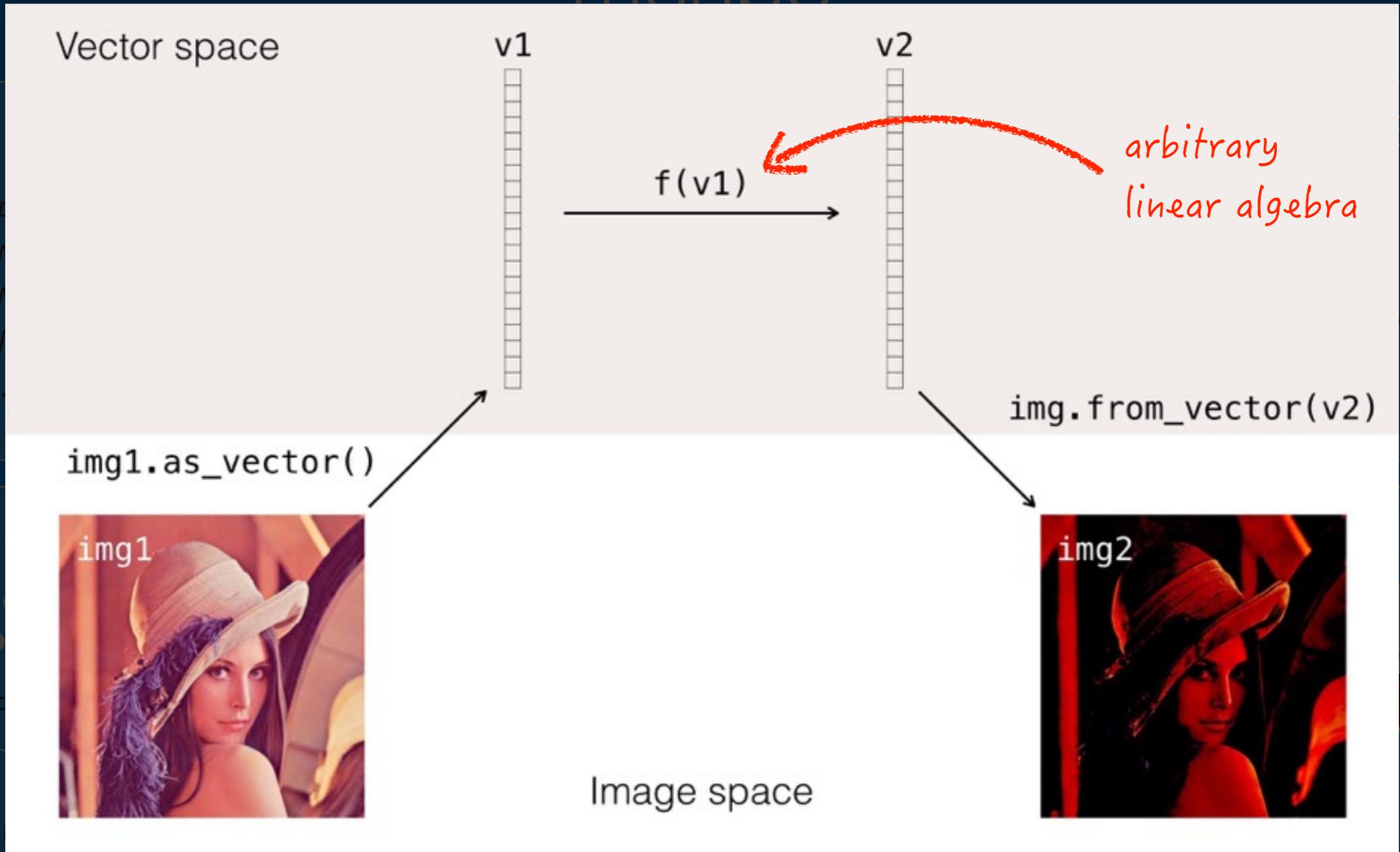


Vectorization

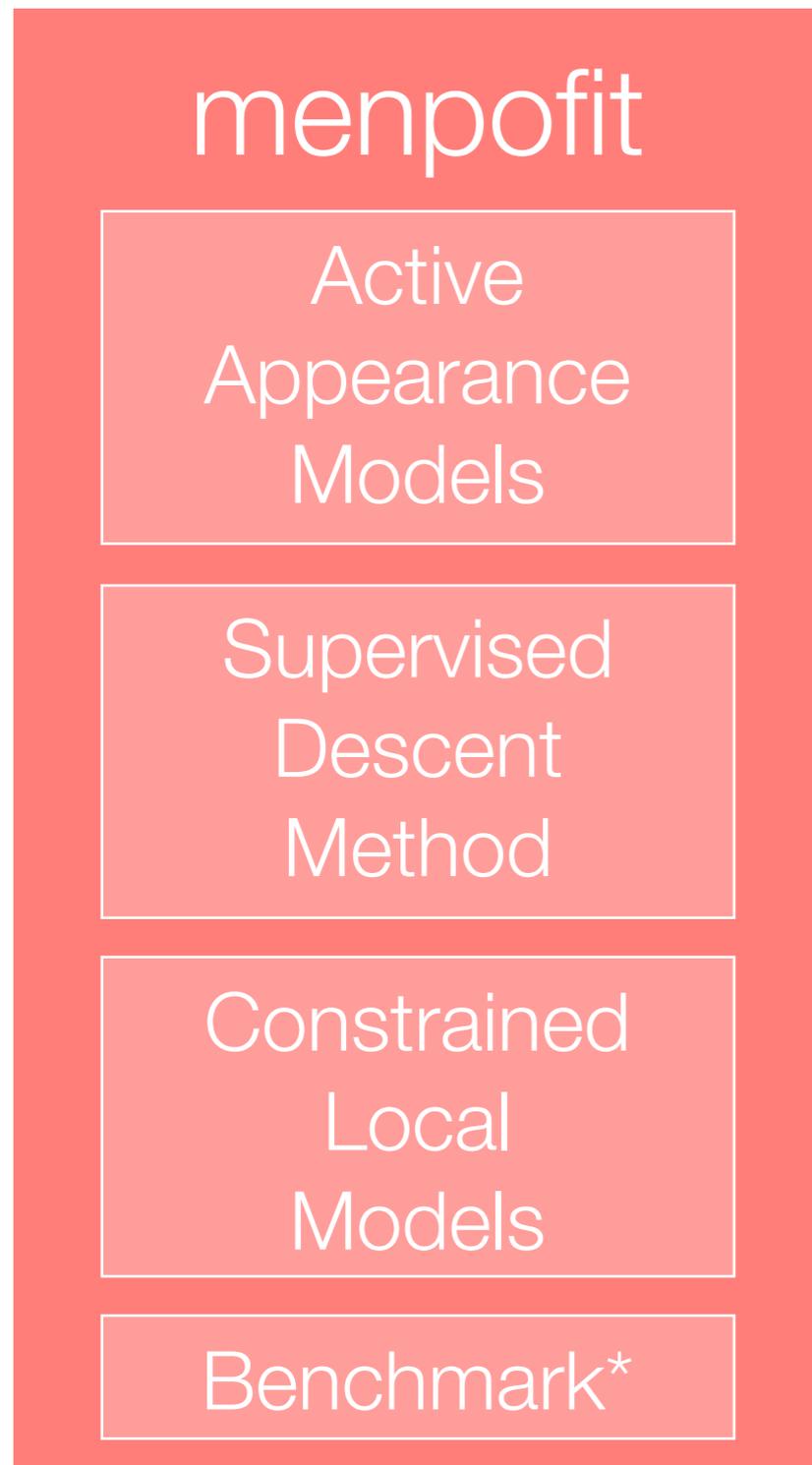


.as_vector()
 .from_vector()

Vectorization



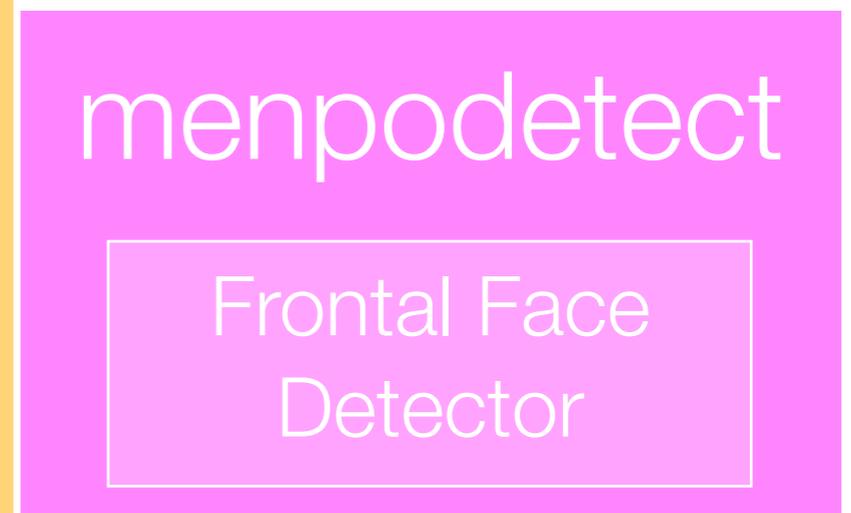
Feature Point Localisation



3D Model Construction



Object detection





computation



2D plotting



3D plotting



machine learning

PIL

image importing

Assimp

3D asset importing



object detection



interactive computing

GLFW

OpenGL management



image warping

VLFeat.org

image features



Anaconda

dependency management

Blending the best from the scientific software community

and contributing back

Adaptive and Constrained Algorithms for Inverse Compositional Model Fitting

Adaptive and Constrained Algorithms for Inverse Compositional Model Fitting

George Papadopoulos and Demos Malpas
School of E.E.E., National Technical University of Athens, Greece
http://www.eee.ntua.gr

Abstract

Parametric models of shape and texture, such as Active Appearance Models (AAMs) or Active Blends, are widely used techniques for object appearance modeling. Employing a number of parameters controlling shape and texture variations, these models bring a target image into registration with a reference template, even in cases that the target image is deformed version of the template. Inverse compositional image alignment techniques have recently received considerable attention due to their potential for high efficiency. However, existing fitting approaches perform poorly when used in conjunction with models exhibiting significant appearance variations, such as AAMs trained on multiple-subject human face images. We introduce an inverse-compositional model fitting approach that overcomes this limitation. First, we propose fitting algorithm adaptation, by means of fit fitting matrix adjustment and (3) AAM mean template update. Second, we show how prior information can be incorporated and enhance the AAM fitting process. The inverse-compositional nature of the algorithm allows efficient implementation of these enhancements. Both techniques simultaneously improve AAM fitting performance, as demonstrated with experiments on publicly available multi-person face datasets.

1. Introduction

Parametric models of shape and texture, such as Active Appearance Models (AAMs) [1], Active Blends [2], Morphable Models [3], and other related approaches [5, 11, 16] are widely used techniques for object appearance modeling. Employing a number of parameters controlling shape and texture variations, these models bring a target image into registration with a reference template, even in cases that the target image is deformed version of the template. Inverse compositional image alignment techniques have recently received considerable attention due to their potential for high efficiency. However, existing fitting approaches perform poorly when used in conjunction with models exhibiting significant appearance variations, such as AAMs trained on multiple-subject human face images. We introduce an inverse-compositional model fitting approach that overcomes this limitation. First, we propose fitting algorithm adaptation, by means of fit fitting matrix adjustment and (3) AAM mean template update. Second, we show how prior information can be incorporated and enhance the AAM fitting process. The inverse-compositional nature of the algorithm allows efficient implementation of these enhancements. Both techniques simultaneously improve AAM fitting performance, as demonstrated with experiments on publicly available multi-person face datasets.

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Parametric Image Alignment Using Enhanced Correlation Coefficient Maximization

Georgios D. Evangelidis and Emmanouil Z. Panagiotou

Abstract—In this work, we propose the use of a modified version of the correlation coefficient as a similarity measure for image registration. The proposed modification has the desirable characteristic of being invariant to image rotation. This is achieved by using a rotation-invariant version of the correlation coefficient. The proposed method is evaluated on a set of images from the Brodatz database. The results show that the proposed method outperforms other methods in terms of registration accuracy and robustness to image rotation. The proposed method is also evaluated on a set of images from the Brodatz database. The results show that the proposed method outperforms other methods in terms of registration accuracy and robustness to image rotation.

Supervised Descent Method and its Applications to Face Alignment

Xuhao Xiong, Fernando De la Torre
The Robotics Institute, Carnegie Mellon University, Pittsburgh PA, 15213

Abstract—Many computer vision problems (e.g. camera calibration, image alignment, structure from motion) are solved through a nonlinear optimization method. It is generally difficult to find a good initialization for these problems. In this paper, we propose a supervised descent method for solving these problems. The proposed method is based on the idea of supervised descent. The proposed method is based on the idea of supervised descent. The proposed method is based on the idea of supervised descent.

Deformable Model Fitting by Regularized Landmark Mean-Shift

Joan M. Saez, Simon Lucey, Jeffrey F. Cohn

Abstract—Deformable model fitting has been actively pursued in the computer vision community for over a decade. As a result, numerous approaches have been proposed with varying degrees of success. A class of approaches that has shown substantial promise is one that makes independent predictions regarding location of the model's landmarks, which are combined by enforcing a prior over their joint motion. A common theme in research in this approach is the replacement of the distribution of probable landmark locations, obtained from each local detector, with simpler parametric forms. In this work, a principled optimization strategy is proposed where semiparametric representations of these likelihoods are represented within a hierarchy of multiresolution landmark sets. The resulting optimization method is robust to outliers and can be used for landmark-based registration. Experiments on face alignment and registration demonstrate the effectiveness of the proposed method. The code is available at <http://www.cmu.edu/~xiong/>.

Lucas-Kanade 20 Years On: A Unifying Framework

Simon Baker and Srinivas Aravamudan

Abstract—The Lucas-Kanade algorithm was proposed in 1981 widely used and techniques in computer vision. Applications range from motion estimation and face tracking. Numerous algorithms have been built on the original formulation. We present an overview of the Lucas-Kanade algorithm and its variants. We present an efficient algorithm that we recently proposed. We describe which of the many computational algorithms address any significant loss of accuracy. In future papers, we will cover the choice of the fit function, and how to improve priors on the parameters.

Robust and Efficient Parametric Face Alignment

Georgios Tzimiopoulos, Stefano Zafeiriou, Maja Pantic

Abstract—We propose a correlation-based approach to parametric face alignment. The proposed method is based on the idea of correlation-based alignment. The proposed method is based on the idea of correlation-based alignment. The proposed method is based on the idea of correlation-based alignment.

Generic Active Appearance Models Revisited

George Tzimiopoulos, Joan M. Saez, Stefano Zafeiriou, Maja Pantic

Abstract—The proposed Active Appearance Models (AAMs) are generic models of a certain visual phenomenon. Although linear in both shape and appearance, overall, AAMs are nonlinear parametric models in terms of the pixel intensities. Fitting an AAM to an image consists of minimizing the error between the input image and the closest model instance; i.e. solving a nonlinear optimization problem. We propose an efficient fitting algorithm for AAMs based on the inverse compositional image alignment algorithm. We show that the effects of appearance variation during fitting can be precompensated ("projected out") using this algorithm and how it can be extended to include a global shape normalising warp, typically a 2D similarity transformation. We evaluate our algorithm to determine which of its novel aspects improve AAM fitting performance.

Active Appearance Models Revisited

Iain Matthews and Simon Baker

The Robotics Institute, Carnegie Mellon University

Abstract

Active Appearance Models (AAMs) and the closely related concept of Morphable Models and Active Blends are generative models of a certain visual phenomenon. Although linear in both shape and appearance, overall, AAMs are nonlinear parametric models in terms of the pixel intensities. Fitting an AAM to an image consists of minimizing the error between the input image and the closest model instance; i.e. solving a nonlinear optimization problem. We propose an efficient fitting algorithm for AAMs based on the inverse compositional image alignment algorithm. We show that the effects of appearance variation during fitting can be precompensated ("projected out") using this algorithm and how it can be extended to include a global shape normalising warp, typically a 2D similarity transformation. We evaluate our algorithm to determine which of its novel aspects improve AAM fitting performance.

Keywords: Active Appearance Models, AAMs, Active Blends, Morphable Models, fitting, efficiency, Gauss-Newton gradient descent, inverse compositional image alignment.

Supervised Descent Method and its Applications to Face Alignment

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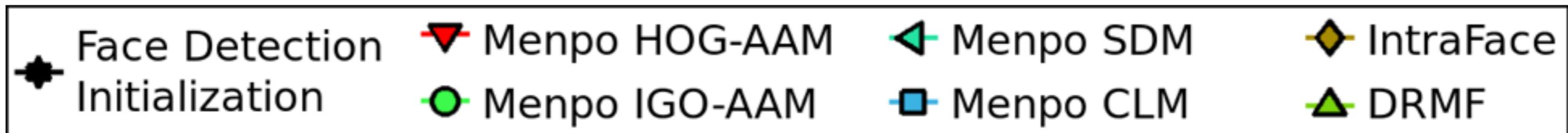
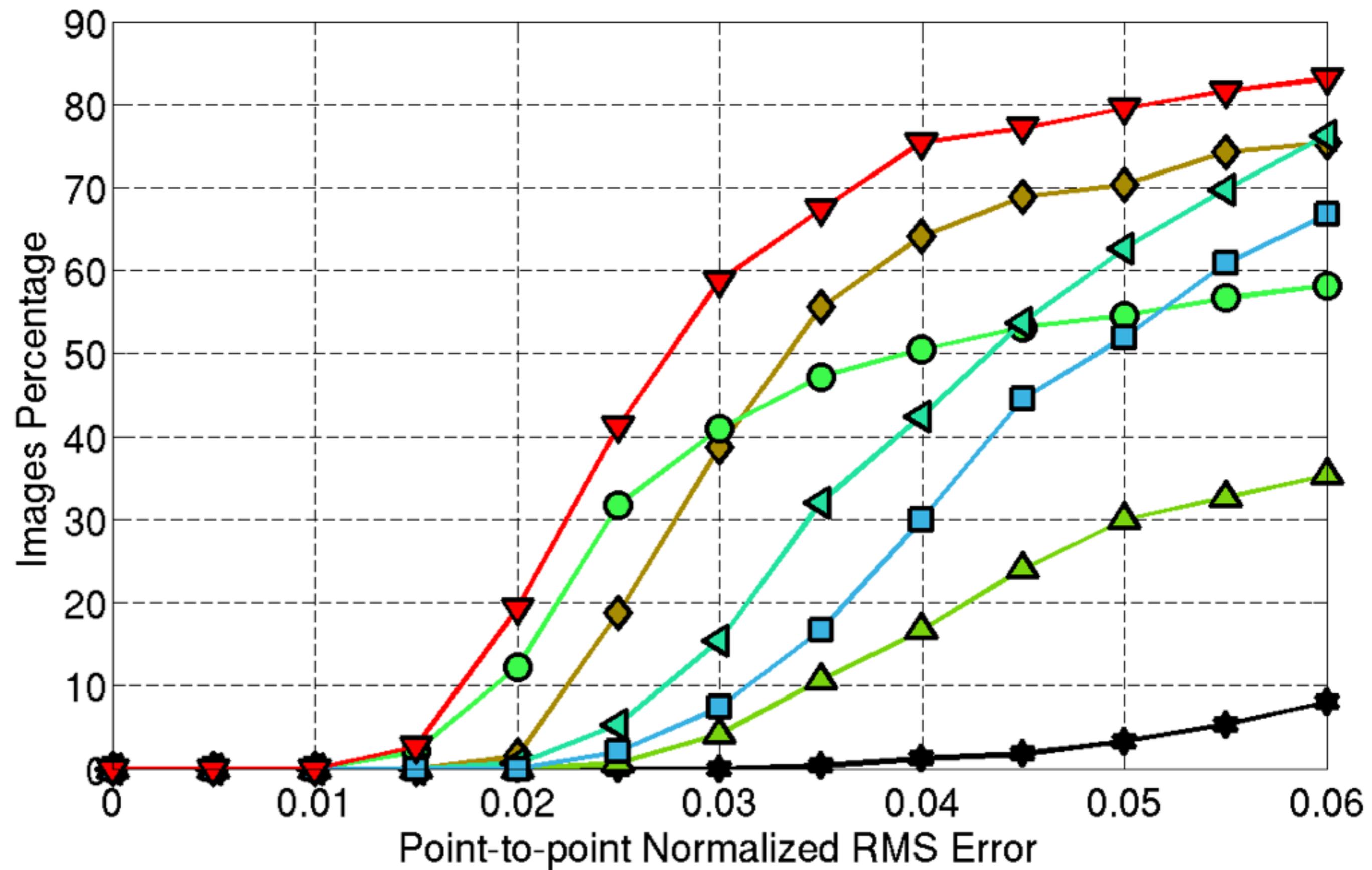
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Keywords: Active Appearance Models, AAMs, Active Blends, Morphable Models, fitting, efficiency, Gauss-Newton gradient descent, inverse compositional image alignment.

Implemented Research

Unified design accentuates similarities across papers



Demo

Patrick

PYTHON

Access full power of Menpo

Long term strategy to make your future research easier

Learn a powerful new language (useful outside of research)

Learn a new language

Can't easily leverage existing code (*do you need it?*)

COMMAND LINE INTERFACE

Simple interface for common Menpo operations

Short term - no need to learn Python!

Great for comparing against methods

Only scratches the surface of what's possible

Cannot contribute back to improve Menpo

Upcoming talks

- Held with either ACM Student Chapter/IC Python
- Aim - Improve software engineering in research

Python

- *Python basics*
- *Python for Matlab users*
- *Menpo basics*
- *Advanced Python*

Git (Version Control)

- *Git basics*
- *Collaborating with Github*
- *Advanced Git*



Site: menpo.org

Code: github.com/menpo

Google Group: [menpo-users](https://groups.google.com/group/menpo-users)

Licence: New BSD

Unit tests: 500+

menpofit
v0.1.0

menpo3d
v0.1.0

menpodetect
v0.1.0

menpo
v0.4.4