
Subject: Ellipse fitting?

Posted by [robparker23](#) on Tue, 12 May 2009 20:36:20 GMT

[View Forum Message](#) <> [Reply to Message](#)

Hi,

I was hoping that someone could help with this.

I have a satellite footprint which is more or less elliptical. I have the 4 coordinates of the top, bottom, left and right-most points and want to fit an ellipse to these 4 coordinates.

I've put a diagram here to explain: <http://img217.imageshack.us/img217/5048/ellipse.png>

I've googled this quite a bit and there seem to be lots of ways to fit ellipses to complicated data sets using techniques like optimal estimation but I can't find an easy/quick way of doing it. To do this manually I think I could just take the equation for an ellipse and adjust it to fit but I need to do this automatically for a large number of points where the shape of the ellipse will change depending on the location.

This gets slightly more complicated (doesn't it always) as the shape may not quite be an ellipse due to the geometry of the satellite (it might have one side slightly "fatter" than the other) and it might be tilted at an angle (so not horizontal).

Does IDL have any ellipse fitting capabilities built in or is anyone familiar with a solution that might work?

Cheers

Subject: Re: Ellipse fitting

Posted by [Kenneth P. Bowman](#) on Thu, 09 Sep 2010 13:29:43 GMT

[View Forum Message](#) <> [Reply to Message](#)

In article

<a8e942ee-0554-42d6-9bad-caf77b03935b@a11g2000vbn.googlegroups.com>,

- > Hi all,
- > I've got a problem when I try to find the orientation of a fitted
- > ellipse of a region of interest ([http://www.dfanning.com/ip_tips/](http://www.dfanning.com/ip_tips/fit_ellipse.html)
- > [fit_ellipse.html](http://www.dfanning.com/ip_tips/fit_ellipse.html)).
- > I've got an stack of images of an ellipse rotating. My problem arises
- > when I try to find the eigenvectors of the covariance matrix, the
- > signs of the components of them change randomly. In other words, I

- > start with my ellipse in the 3rd quadrant. The first image gives the
- > correct signs for the components of the principal eigenvector, but the
- > second image doesn't give the signs of the components well, so in this
- > case the eigenvector is located in the 4th quadrant, but my ellipse
- > still stands in the 3rd quadrant!
- > I don't know if I have explained my problem correctly. The problem
- > comes from the indeterminacy of the signs of the eigenvectors. If they
- > had the correct signs, I would use the atan2 function, which will give
- > the correct orientation. However, the signs aren't correct, so I can't
- > get the orientation of the ellipse after a whole rotation.
- > Thank you very much

As you say, the signs of the eigenvectors are indeterminate.

If the rotations between successive instances are small, you should be able to check which option gives you the smaller rotation.

That is, check $\text{ATAN}(y, x)$ and $\text{ATAN}(-y, -x)$ and see which gives the smaller angular difference from the previous orientation. You have to be careful when cross the origin.

Ken Bowman

Subject: Re: Ellipse fitting

Posted by [Jeremy Bailin](#) on Thu, 09 Sep 2010 13:50:57 GMT

[View Forum Message](#) <> [Reply to Message](#)

On Sep 9, 7:18 am, Oriol Güell Riera <oriolguellri...@gmail.com> wrote:

- > Hi all,
- > I've got a problem when I try to find the orientation of a fitted
- > ellipse of a region of interest ([http://www.dfanning.com/ip_tips/](http://www.dfanning.com/ip_tips/fit_ellipse.html)
- > [fit_ellipse.html](http://www.dfanning.com/ip_tips/fit_ellipse.html)).
- > I've got an stack of images of an ellipse rotating. My problem arises
- > when I try to find the eigenvectors of the covariance matrix, the
- > signs of the components of them change randomly. In other words, I
- > start with my ellipse in the 3rd quadrant. The first image gives the
- > correct signs for the components of the principal eigenvector, but the
- > second image doesn't give the signs of the components well, so in this
- > case the eigenvector is located in the 4th quadrant, but my ellipse
- > still stands in the 3rd quadrant!
- > I don't know if I have explained my problem correctly. The problem
- > comes from the indeterminacy of the signs of the eigenvectors. If they
- > had the correct signs, I would use the atan2 function, which will give
- > the correct orientation. However, the signs aren't correct, so I can't
- > get the orientation of the ellipse after a whole rotation.
- > Thank you very much

I can see how you might alternate between 3rd and 1st quadrant (or alternately 4th and 2nd quadrant), but not how you would go between the 3rd and 4th without the ellipse itself rotating.

How best to deal with it depends on what you're planning on doing with the eigenvectors. It sounds like you're trying to measure the angle of the major axis and compare it between images. In that case, I'd just use `atan2` and then do a check afterwards to see whether the angle has changed by more than 90degrees - if so, add/subtract 180degrees from the angle in the second image as appropriate (of course, that assumes that the ellipse isn't *actually* changing by more than 90degrees between images). If you really need the eigenvectors, then do something similar - take the dot product and if it's negative, use the negative of the eigenvector.

-Jeremy.

Subject: Re: Ellipse fitting

Posted by

on Thu, 09 Sep 2010 18:55:29 GMT

[View Forum Message](#) <> [Reply to Message](#)

On 9 sep, 15:50, Jeremy Bailin <astroco...@gmail.com> wrote:

> On Sep 9, 7:18 am, Oriol Güell Riera <oriolguellri...@gmail.com>

> wrote:

>

>

>

>> Hi all,

>> I've got a problem when I try to find the orientation of a fitted
>> ellipse of a region of interest (http://www.dfanning.com/ip_tips/fit_ellipse.html).

>> I've got an stack of images of an ellipse rotating. My problem arises
>> when I try to find the eigenvectors of the covariance matrix, the
>> signs of the components of them change randomly. In other words, I
>> start with my ellipse in the 3rd quadrant. The first image gives the
>> correct signs for the components of the principal eigenvector, but the
>> second image doesn't give the signs of the components well, so in this
>> case the eigenvector is located in the 4th quadrant, but my ellipse
>> still stands in the 3rd quadrant!

>> I don't know if I have explained my problem correctly. The problem
>> comes from the indeterminacy of the signs of the eigenvectors. If they
>> had the correct signs, I would use the `atan2` function, which will give
>> the correct orientation. However, the signs aren't correct, so I can't
>> get the orientation of the ellipse after a whole rotation.

>> Thank you very much

>

> I can see how you might alternate between 3rd and 1st quadrant (or

> alternately 4th and 2nd quadrant), but not how you would go between
> the 3rd and 4th without the ellipse itself rotating.
>
> How best to deal with it depends on what you're planning on doing with
> the eigenvectors. It sounds like you're trying to measure the angle of
> the major axis and compare it between images. In that case, I'd just
> use atan2 and then do a check afterwards to see whether the angle has
> changed by more than 90degrees - if so, add/subtract 180degrees from
> the angle in the second image as appropriate (of course, that assumes
> that the ellipse isn't *actually* changing by more than 90degrees
> between images). If you really need the eigenvectors, then do
> something similar - take the dot product and if it's negative, use the
> negative of the eigenvector.
>
> -Jeremy.

You're true, I made a typo when I wrote 3rd-4th quadrant, sorry! And you're right, I've got a video of an ellipse rotating in the xy plane. I've transformed it in an image stack and I'm tracking the centroid and the orientation of the ellipse.

I will try the combinations of the signs of the eigenvectors and I'm going to choose the one with the smaller angular difference. The ellipse shouldn't change by more than 90 degrees, I made the image stack with a lot of frames per second to avoid these problems. In fact, the difference is 0.01 radians more or less, so there should be no problems

I also tried to use the atan2 function and I had the same problem, but I was wondering if there was some kind of solution for the problem of the signs. I had no hope in finding this solution because, but I decided to ask you to check it.

I'll tell you if I have solved this problem soon.

Thank you very much for your help again.

Oriol
