Questions and Answers Vol. 5

or

"The madness will never end."

Paul Pounds

11 May 2015

University of Queensland

But first…

Some house keeping

Calendar at a glance

Week	Dates	Lecture	Reviews	Demos	Assessment submissions
1	2/3 – 6/3	Introduction			
2	9/3 – 13/3	Principles of Mechatronic Systems design			Problem analysis
3	16/3 – 20/3	Professional Engineering Topics			Analysis peer review
4	23/3 – 27/3	Your soldering is (probably) terrible			
5	30/3 – 3/4	Q&A	Progress review 1		
Break	6/4 – 10/4	Q&A			
6	13/4 – 17/4	Radio module selection			
7	20/4 – 24/4	Aircraft flight	Progress seminar	25% demo	
8	27/4 – 2/5	Q&A			
9	4/5 – 8/5	NO LECTURE IN WEEK 9		50% demo	
10	11/5 – 15/5	Projective geometry	Progress review 2		
11	18/5 – 22/5			75% demo	Preliminary report
12	25/5 – 29/5				
13	1/6 – 5/6	Closing lecture		Final testing	Final report and reflection

You are here

Things about to get REAL

Progress Review III

Progress Reviews this week:

1. Present your group progress
2. PAF your fellow ~~offenders~~ team mates

Tues 12 – GPS 78-622

- Group 3 10:00-10:20
- Group 2 10:20-10:40
- Group 6 11:00-11:20
- Group 1 11:20-11:40
- Group 5 11:40-12:00

Friday 15 – GPS 78-622

- Group 8 10:00-10:20
- Group 7 10:20-10:40
- Group 4 10:40-11:00

Incremental Demo III

- The final incremental demo is next week
  - Send me an email requesting a slot.
- This demo is intended to be as close to the real thing as possible – no cutting corners
- This is also your last chance to qualify for the bonus task and bonus marks.

Inertial package now available

- Available for you to use until the end of the semester (whereupon I need them back)
- They require 3.0 to 3.3V of power
  - My one has a flight battery for testing, but I'm waiting for more
  - Loaners will need you to provide your own power source (a CR 2025 should work great)

Change to the spec

- You were told to expect a spec change at some point – that change will be today!
  - Not actually written yet… but will be today
- Will be fairly minor
  - Mostly procedural
  - Not expected to break anything you're doing
  - Buuuut... better to check anyway!

Coming up sooon

Preliminary report is due end of next week

The reports

- The final report is the major written assessment piece of the class:
  - Detail work done to make your system function
  - Detail the analytical approach you used
  - Convince me that you followed a sane and considered approach in finding your solution
- The preliminary report is just the same
  - Only sooner!

The preliminary report

- The preliminary report allows us to give you useful feedback prior to assigning marks
- Once handed in, we will endeavour to return useful comments to you the next week
  - Use the comments to improve the final report!
- Pass/fail assessment – **10 per cent.**

The preliminary report

- The preliminary report must:
  - Contain the majority of content and structure of the final report
  - Constitute a complete, polished report in its own right (preliminary, ***not draft.***)
- The preliminary report must not:
  - Be an unstructured jumble of material
  - Be an incomplete, feeble effort

The preliminary report

- Preliminary report due in Week 11
  - That's next week
  - That's only *TWELVE* days away!
- The final report is due in Week 13
  - Last day of semester

OMG! Get started now!!

The preliminary report

- Comments back on the preliminary report are only intended to be suggestions for improving your writing and construction.
- They are NO indication of the mark you can expect on the final report.
- Mindlessly following the comments alone will not guarantee 100% on the final report.

FAQ Roundup

- **Can we recycle parts of our design analysis for the report?**
  - Sure. However, it's worth noting that a design analysis and a project report are two different types of document for two different purposes. You should think very carefully about what parts are recyclable and why you might choose to reuse them.

- **But what about self-plagiarism??**
  - Sigh….

  Allow me to explain.

Self-plagiarism

- "Self-plagiarism" is almost certainly does not mean what you think it means.
  - Only tangentially about copying your own work

Self-plagiarism is about *misrepresentation*.

Self-plagiarism

- In the rarefied airs of academic publishing, it is of utmost importance whether the material you publish is ‘novel’
  - Ie. never before seen nor published anywhere

“Nobody will pay for old news.”

Self-plagiarism

- Thus, if you take old academic work and try to pass it off as new research, the publishers will *destroy* you.
  - Or just sue you, or whatever.
  - Either way, your career is over.

Self-plagiarism

- In an educational context, rehashing old work does not fulfil the educational goal.
  - We want to know what you can do now, in the constraints imposed, rather than what you did last year without restrictions.

Self-plagiarism

- So, educators and academics care a great deal about self-plagiarism and warn students against it's sinful nature.

- Of course, most engineers live and work in the real world…

Self-plagiarism

- In engineering practice, replicating work needlessly is unprofessional and inappropriate.

- So long as you only take credit for your own work and credit others' appropriately (using their work by permission, of course) employers do not care if you copy

Self-plagiarism

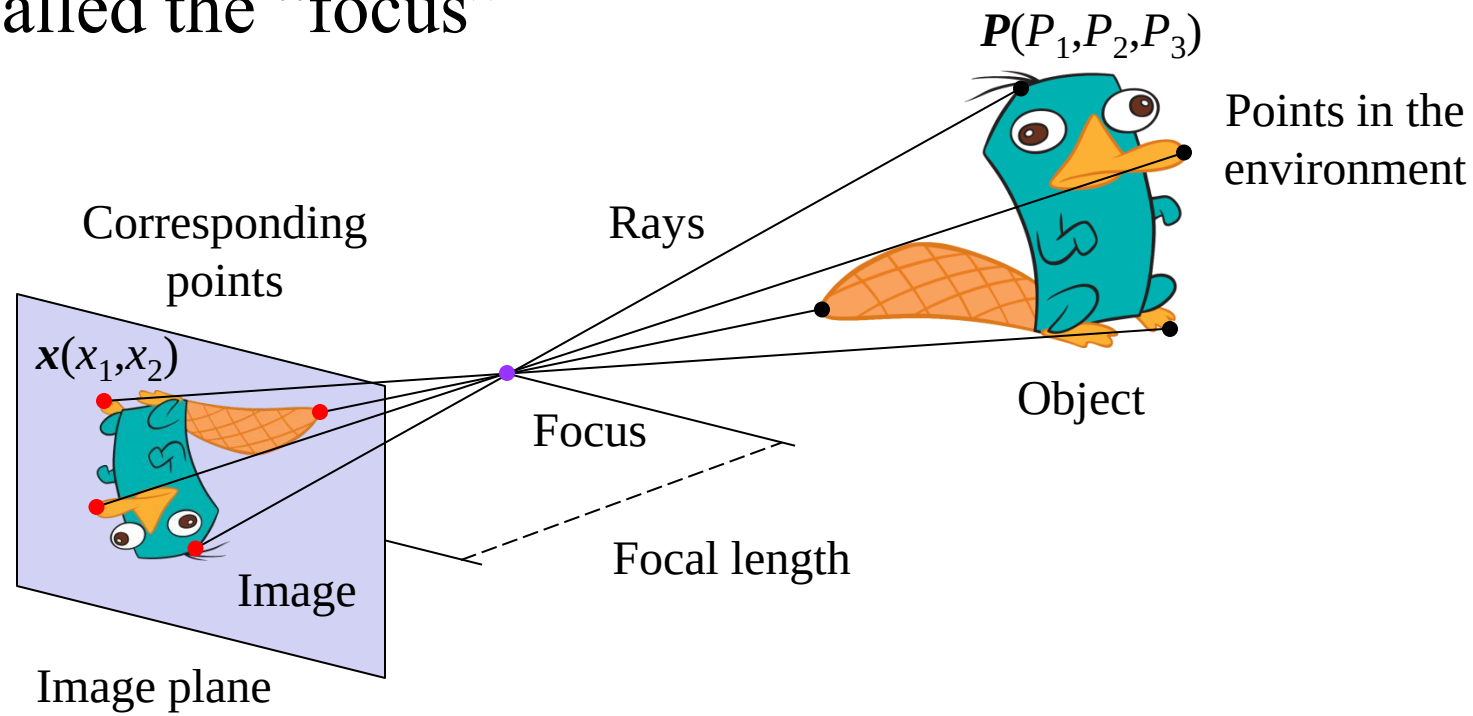
- This course is structured like a professional design and build project.
  - Your reporting should reflect this.
- Consequently, I have zero qualms about you reusing your own past work from the course.
  - Cite small quotes/extracts, but replication is ok.
  - Of course, do not copy the work of others without proper attribution, though.

Projective geometry

On to the mini lecture topic!

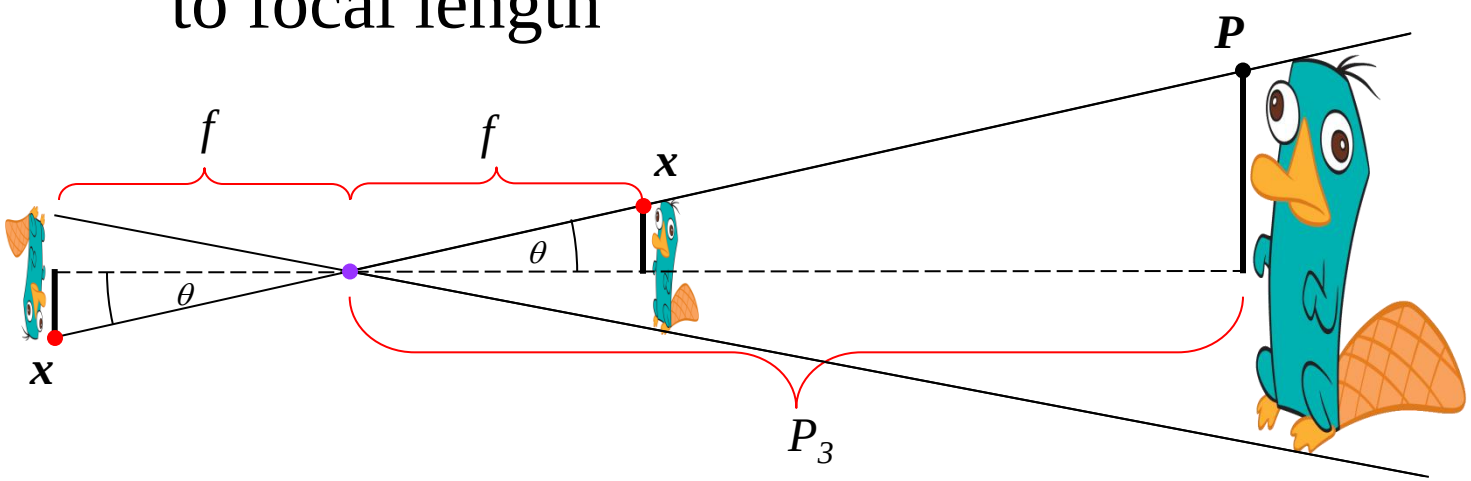
Projective geometry

- Cameras images points in space through focusing light on an imaging sensor plane
  - Light passes through a single geometry point called the “focus”



Projective geometry

- Similar triangles everywhere
  - Pixel coordinate scales with ratio of point depth to focal length



Projective geometry

- We can consider each pixel in the image plane as a 3-vector, and the 3D point as a scaled ratio of pixel position:

$$\boldsymbol{x}(x_1, x_2, f)$$

$$\boldsymbol{P}(P_1, P_2, P_3) = \lambda \boldsymbol{x}$$

$$\lambda = f / P_3$$

- Scale factor, λ, cannot usually be determined from just the information in one image

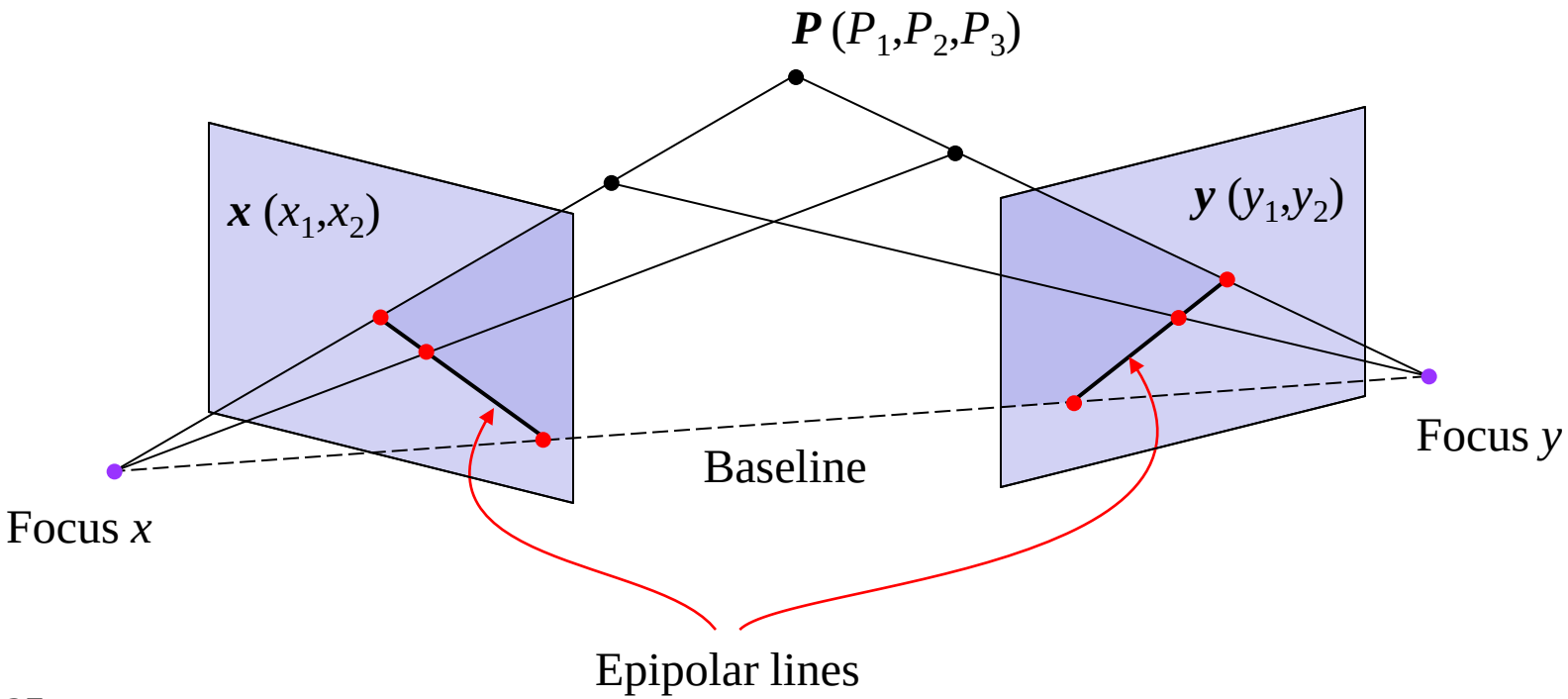
Projective geometry

- If you know something about the geometry you're looking at, you can extract depth:
  - Known geometric relationships between points
  - Angle or orthogonality of intersecting lines
  - Length of a known object or separation between two points

Example: multiple views of an object provide epipolar constraints to extract 3D position

Epipolar geometry

- The ray of pixel point as seen in another projected view is an “epipolar line”



Triangulation

- Solving for ***P*** from ***x*** and ***y*** is called "triangulation"
  - For a single point in ideal conditions, where the baseline is known, this is trival:

$$P = \lambda_x \begin{pmatrix} x_1 \\ x_2 \\ f_x \end{pmatrix} = T\lambda_y \begin{pmatrix} y_1 \\ y_2 \\ f_y \end{pmatrix}$$

Two equations, two unknowns (λ_x and λ_y)

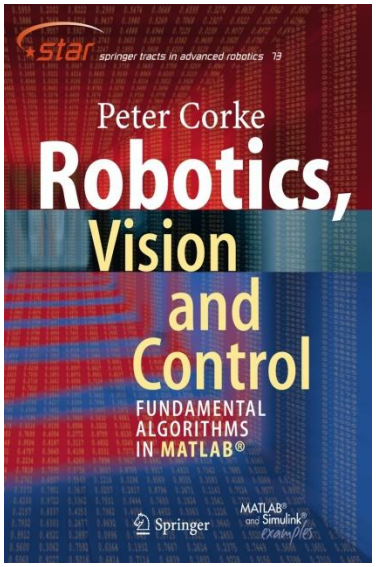
Triangulation

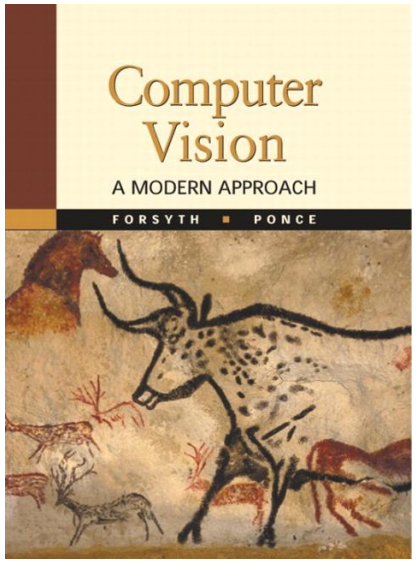
- In practice, this often cannot be solved exactly due to noise and quantisation error
  - Ends up being a multi-variable minimisation problem, usually for hundreds of feature points in an image all at the same time.

- Not going to go into that here, but computer vision fascinating…

Quick plug*

"**Robotics, Vision and Control**", by Peter Corke (including quadrotor dynamic model by Paul!), and "**Computer Vision a Modern Approach**" by Forsythe and Ponce





* No, they're not paying me – they're just really good books!

Lab tutorial or Q&A?

- Students will often get more value out of interactive lab troubleshooting sessions around this time of year.

- How do people feel about segueing to the lab rather than coffee after announcements?

Questions

Tune-in next time for…

Questions and Answers Vol. 6

or

"Help, help, I'm trapped in a lecture factory!"

Fun fact: There are now more drones than cars.