Computer Vision Research Projects

1. Robot arm with gorilla head tracking students in Erskine
Move robot arm to track people – scariest project wins a huge prize.

2. Recognise invasive biofouling organisms:
There is a need to automatically recognise biofouling species from images using computer vision and deep learning. (There is a new biofouling standard for all vessels entering New Zealand from 2018, but currently divers currently only make spot checks.)

3. Control an Unpiloted Aerial Vehicle
Various projects for autonomous control of a UAV using a depth camera, such as (suggestions only):
- automatically take off and land
- acquire 3D model of environment – for example to measure crop/pasture height (wrt fence post) or to measure volume of pile of produce (coal, fertiliser, etc). (with industry partner, Ravensdown)
- collision avoidance (walls/ceiling/floor)
- lock on to a proximity (such as 1m) to a wall, while controlling UAV to move up/down/left/right inspecting wall
- automatically follow the edge of a forest recently logged (cutover edge) (with industry partner, SCION)

4. Wheelchair Navigation and/or Wheelchair Docking
Obstacle detection, doorway detection and stairs and drop-offs detection to support robust drive assistance in indoor environments using computer vision and other sensors. Auto dock when near desk.
Generate 3D maps for indoor navigation. (Industry partner is Dynamic Controls)

5. UAVs Bird Deterrents
Tracking birds flocking and in foliage to enable using UAVs as a deterrent to birds in vineyards (and other crops). (with Lincoln University Viticulture)

6. Computer Vision for High School
Tim Bell needs the Computer Vision chapter updated in his CS Field Guide, including working in any web browser or tablet (i.e. HTML5) live with camera access. www.csfieldguide.org.nz/en/chapters/computer-vision.html

7. Interactive Public Display Projects:
Interact with a display above Reboot Cafe using gestures, head pose and face recognition
- Use hand gestures and head pose to control displays
- Play a simple computer game (e.g. pong) using head and/or hand gestures

8. Multiple Camera Video Delay
Continuously replay footage from multiple cameras (with a pre-defined delay), allowing athletes to view their performance immediately afterwards.

9. Pedestrian detection for collision avoidance
It is useful to avoid running over pedestrians with diggers, rollers, bobcats and graders on road construction sites. So the goal is to detect pedestrians within 5m of such vehicles (to extend successful summer project). (with industry partner, Trimble)

10. Calibrate robot arm in CV Lab
Enable automatic calibration of robot arm in CV Lab to align robot arm frame-of-reference with Kinect2 depth camera frame-of-reference – to direct robot arm to points in depth camera space using depth camera coordinates.

11. Group Tracker
Continuously track multiple people on field/court/classroom face recognition with automatic enrolment

12. Face Replace
Improve the face replace demo.

13. Robot Arm Tracking Motion
Move robot arm to track moving objects.

14. Mini Darpa Challenge

Race a robot around inside a UC building or outside from engineering to the library. May not win the official DARPA US$1m, but have fun solving challenging robot vision problems.

15. Robot Soccer

Aside from being a lot of fun, robot soccer is a great domain for studying several artificial intelligence issues, including computer vision. (There is a small robot soccer field in the CV Lab.)

16. Movement Skill Recognition

From continuous movement, recognise and temporally segment individual skills. (Similar to identifying phonemes and words in continuous speech recognition.)

17. Automatic Face Recognition and Tracking

With no prior training, automatically recognise new faces. Enable computers to become aware of the presence of users (location, duration, number of people, etc) and automatically recognise repeat users.

18. Tracking Person with Sequence of Cameras

Simulate moving camera used at Olympic events (similar application to "session based surveillance").

19. Sport Coach

Continuously overlay biomechanical traces (e.g. centre of mass) and overlay expert's movements.

20. Stereo webcams

Low cost stereo – to get good depth information, why pay $1000 for an expensive stereo camera when less than $100 can do it with a couple of webcams.

21. Multiple camera visual hull

For "matrix" style instant replay

22. Pet / human categorisation

To reduce all those surveillance false alarms

23. Find ground planes and wall planes

Use a single camera (indoors or outdoors) to find ground (assume horizontal) and wall (assume vertical) planes – to support robot path planning, better augmented reality, etc.

24. Cricket coach

With a birds-eye webcam, compare a novice batter with an expert batter.

25. 3D Motion Control of Avatar

Use the Kinect camera to control an open source computer game avatar.

26. Home Minder

Monitor elderly falling, pre-schooler safety and so on.

27. Piano Finger Teacher

Teach correct finger shape, position and movement using a webcam.

28. Kitchen Police

Kitchen webcam logging those who didn't wash up their stuff.

29. Music Score Reader

Improve music score recognition for Tim Bell's Digital Music Stand.