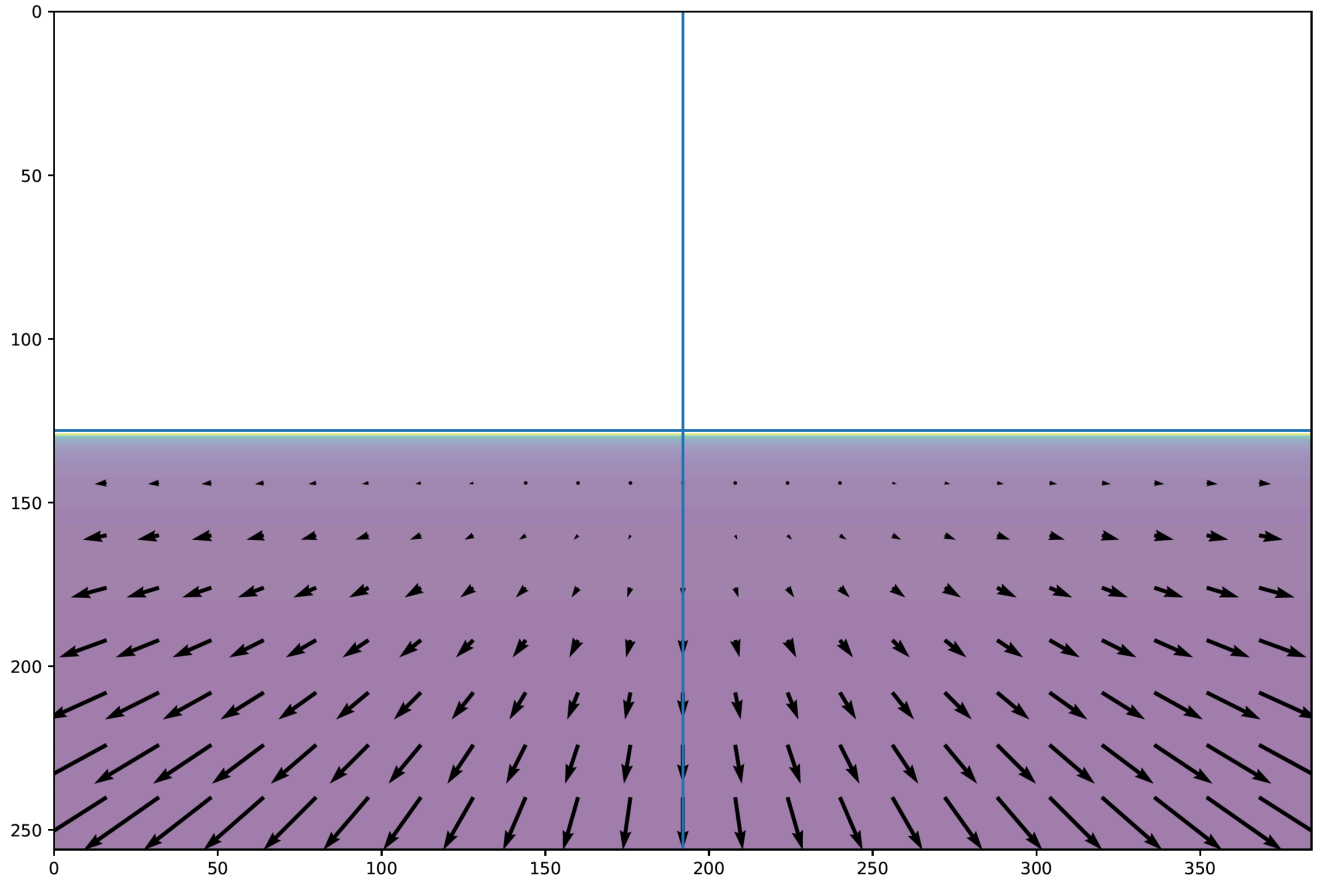
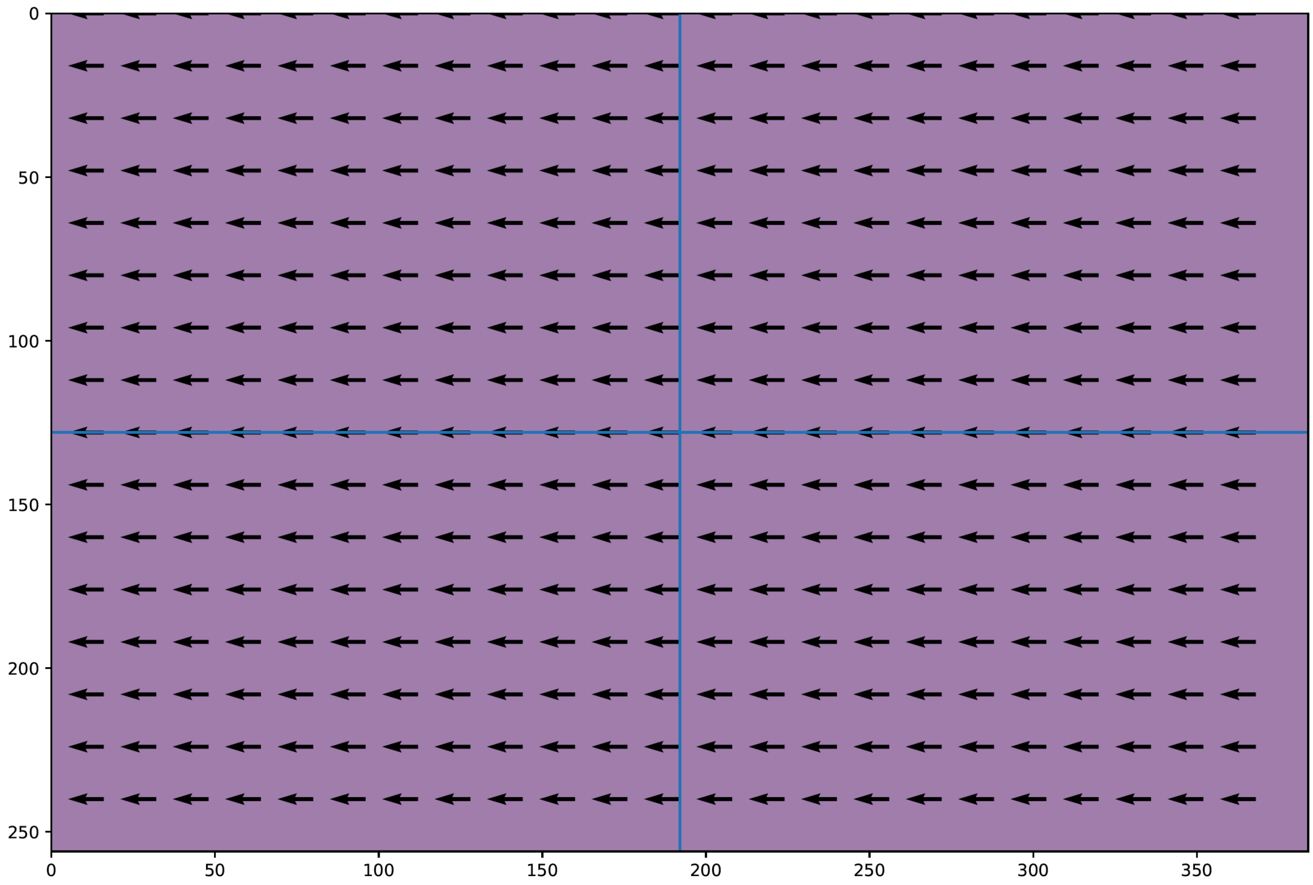
CS543 MP1 Q4.2

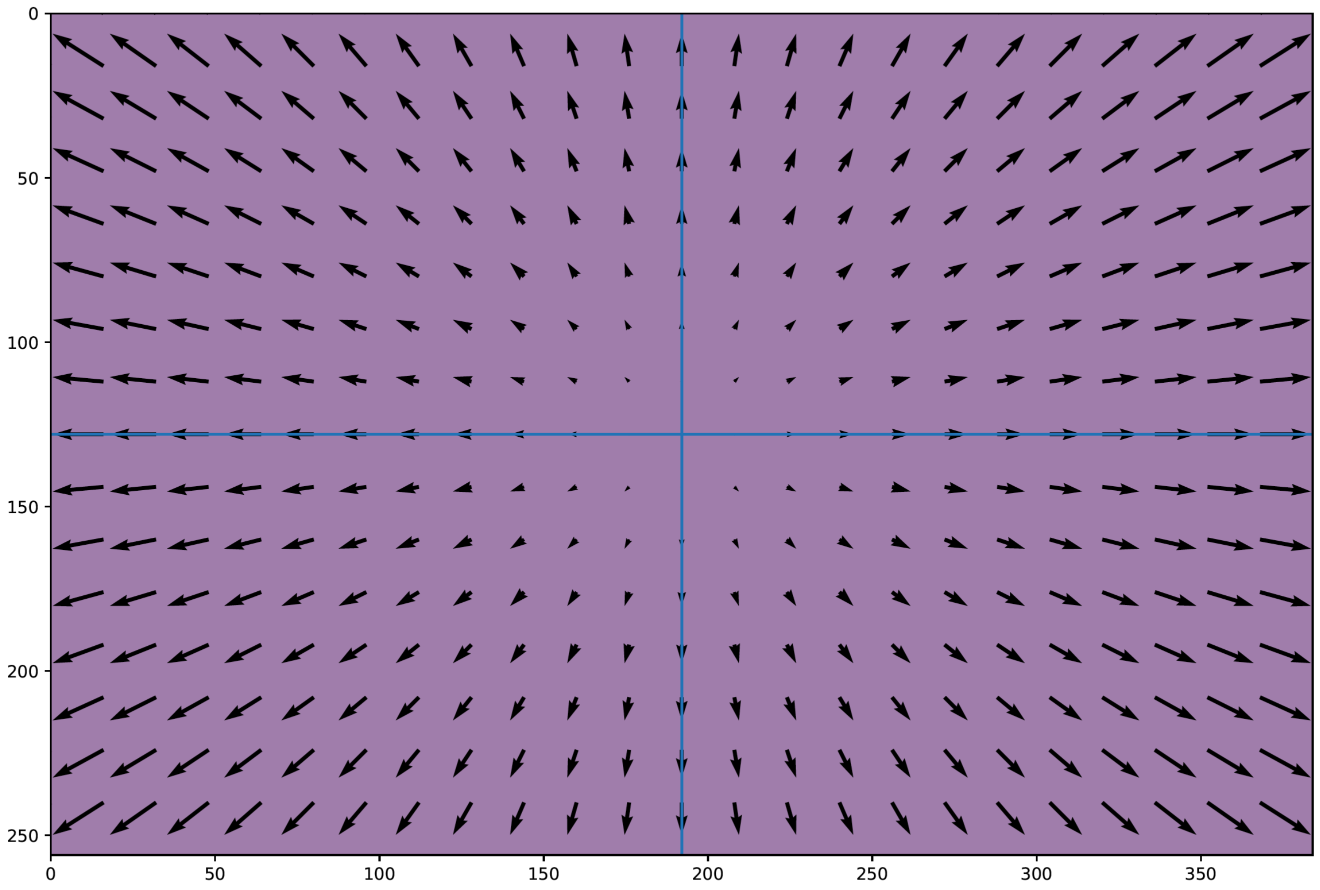
1. Looking forward on a horizontal plane while driving on a flat road.



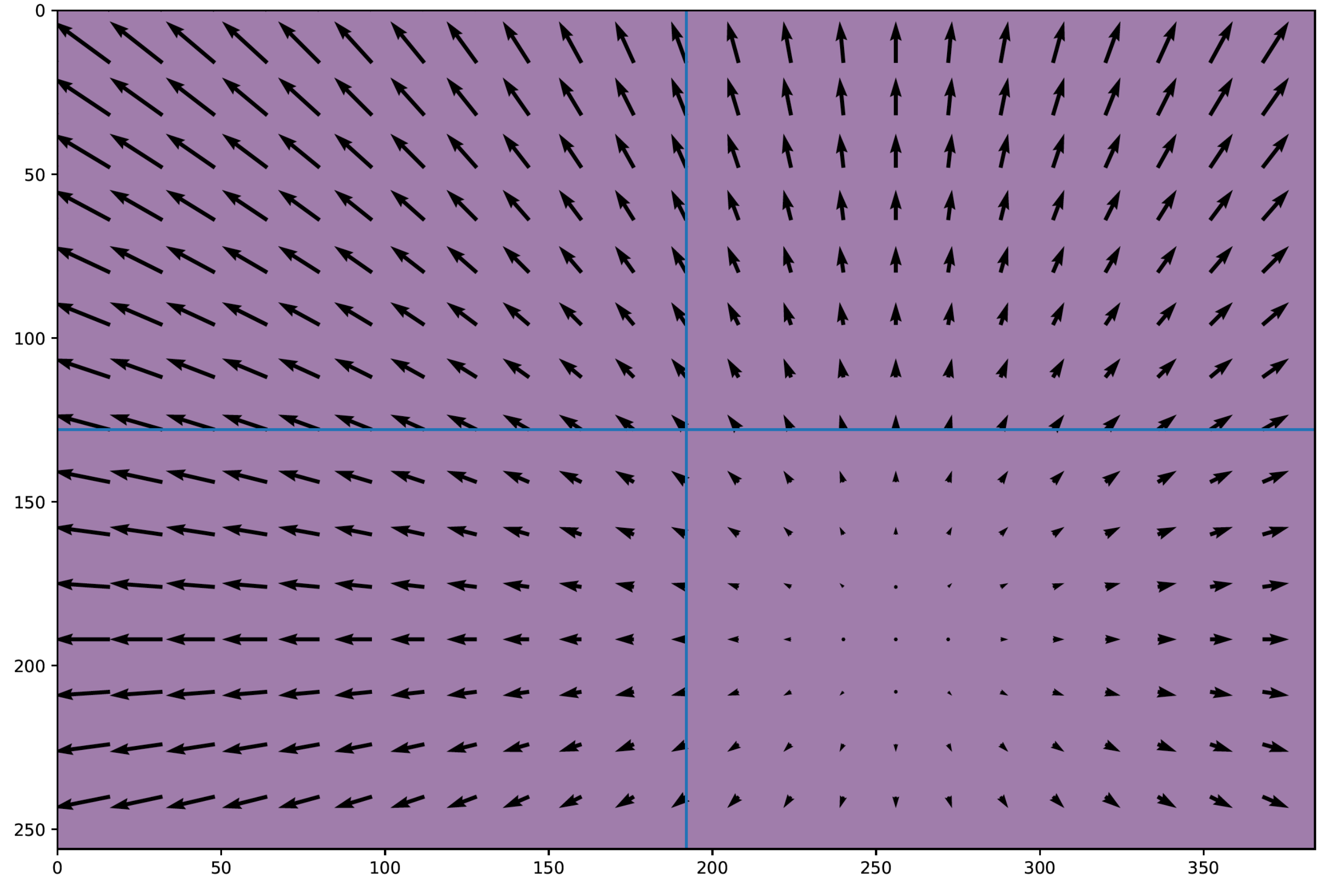
2. Sitting in a train and looking out over a flat field from a side window.



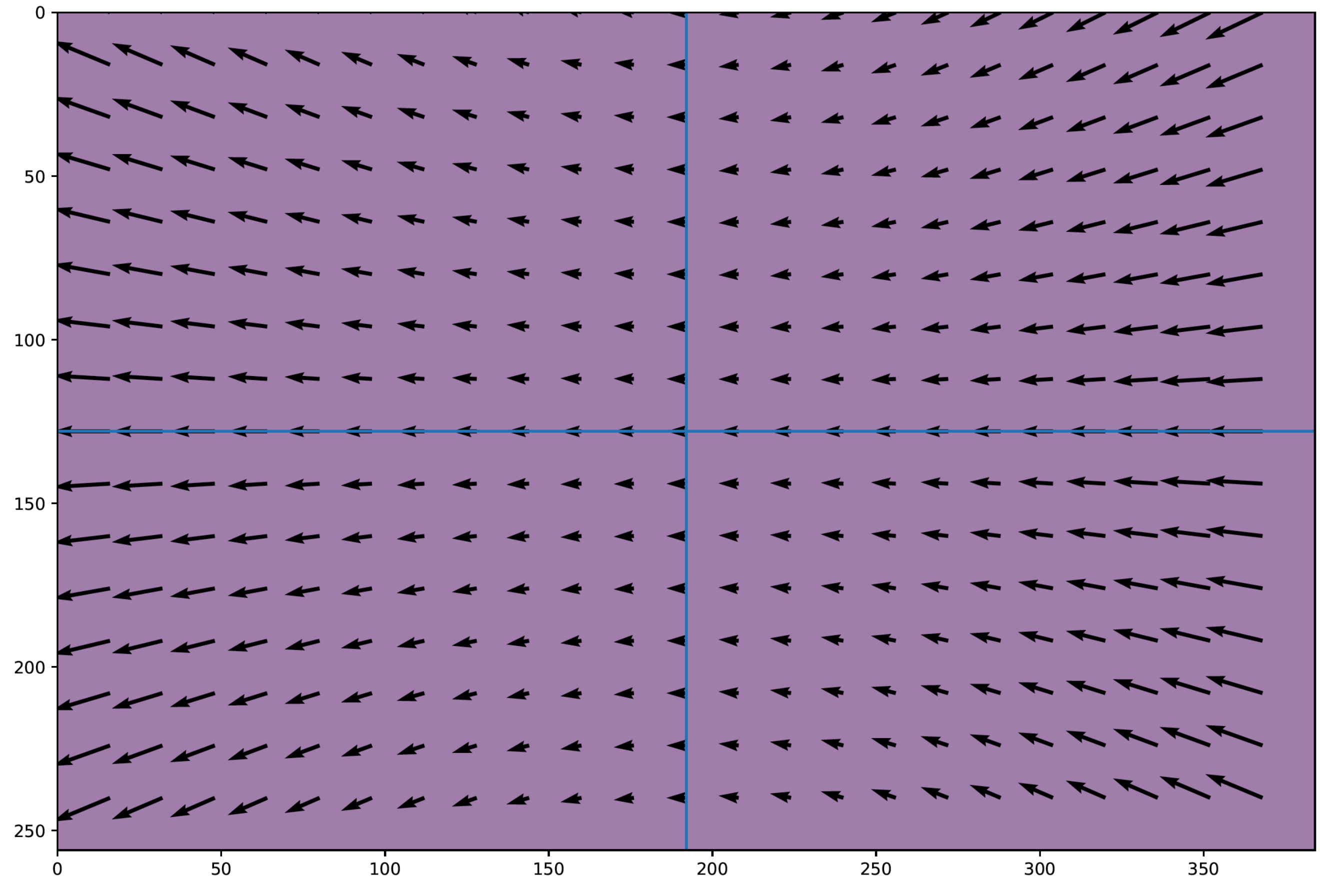
3. Flying into a wall head-on.



4. Flying into a wall but also translating horizontally, and vertically.



5. Counter-clockwise rotating in front of a wall about the Y-axis.



```
#q1 Looking forward on a horizontal plane while driving on a flat road.
T = np.array([0,0,1])
W = np.array([0,0,0])
Z = Z2

#q2 Sitting in a train and looking out over a flat field from a side window.okay
T = np.array([1,0,0])
W = np.array([0,0,0])
Z = Z1

#q3 Flying into a wall head-on.
T = np.array([0,0,1])
W = np.array([0,0,0])
Z = Z1

#q4 Flying into a wall but also translating horizontally, and vertically.
T = np.array([0.5,0.5,1])
W = np.array([0,0,0])
Z = Z1

#q5 Counter-clockwise rotating in front of a wall about the Y-axis.
T = np.array([0,0,0])
W = np.array([0,1,0])
Z = Z1
u,v = calculate_view(x,y,fx,Z,T,W)
```

The whole functions I use:

```
def calculate_view(x,y,f,Z,T,W):
    #Looking forward on a horizontal plane while driving on a flat road.

    tx = T[0]
    ty = T[1]
    tz = T[2]

    wx = W[0]
    wy = W[1]
    wz = W[2]
    u = ((tz * x - tx * f)/Z) - (wy * f) + (wz * y) + (wx * x * y / f) - (wy * x * x / f)
    v = ((tz * y - ty * f)/Z) + (wx * f) - (wz * x) - (wy * x * y / f) + (wx * y * y / f)


    return u,v


if __name__ == "__main__":
    # Focal length along X and Y axis. In class we assumed the same focal length
    # for X and Y axis. but in general they could be different. We are denoting
    # these by fx and fy, and assume that they are the same for the purpose of
    # this MP.
    fx = fy = 128.

    # Size of the image
    szy = 256
    szx = 384

    # Center of the image. We are going to assume that the principal point is at
    # the center of the image.
    cx = 192
    cy = 128

    # Gets the image of a wall 2m in front of the camera.
    Z1 = get_wall_z_image(2., fx, fy, cx, cy, szx, szy)


    # Gets the image of the ground plane that is 3m below the camera.
    Z2 = get_road_z_image(3., fx, fy, cx, cy, szx, szy)

#     fig, (ax1, ax2) = plt.subplots(1,2, figsize=(14,7))
#     ax1.imshow(Z1)
#     ax2.imshow(Z2)

    # Plotting function.
    f = plt.figure(figsize=(13.5,9))
    u = np.ones(Z1.shape)
    v = np.ones(Z1.shape)
    x, y = np.meshgrid(np.arange(szx), np.arange(szy))
    x = x - cx
    y = y - cy

    # #q1 Looking forward on a horizontal plane while driving on a flat road.
    # T = np.array([0,0,1])
    # W = np.array([0,0,0])
    # Z = Z2
    #q2 Sitting in a train and looking out over a flat field from a side window.okay
    T = np.array([1,0,0])
    W = np.array([0,0,0])
    Z = Z1

    # #q3 Flying into a wall head-on.
    # T = np.array([0,0,1])
    # W = np.array([0,0,0])
    # Z = Z1

    # #q4 Flying into a wall but also translating horizontally, and vertically.
    # T = np.array([0.5,0.5,1])
    # W = np.array([0,0,0])
    # Z = Z1

    # #q5 Counter-clockwise rotating in front of a wall about the Y-axis.
    # T = np.array([0,0,0])
    # W = np.array([0,1,0])
    # Z = Z1
    # u,v = calculate_view(x,y,fx,Z,T,W)

    plot_optical_flow(f.gca(), Z, u, v, cx, cy, szx, szy, s=16)
    f.savefig('optical_flow_output_2.pdf', bbox_inches='tight')
```