Transformations

Outline

1. Homogeneous lines and properties
2. Frames vs Points
    a. Pre-multiply and post multiply
3. Linear affine and projective transform
4. Assignment

Homogenous lines and properties

Frames and Points

Linear transformations

Definition. A *linear transformation* is a transformation $T : \mathbf{R}^n \to \mathbf{R}^m$ satisfying

$$T(u+v) = T(u) + T(v)$$
$$T(cu) = cT(u)$$

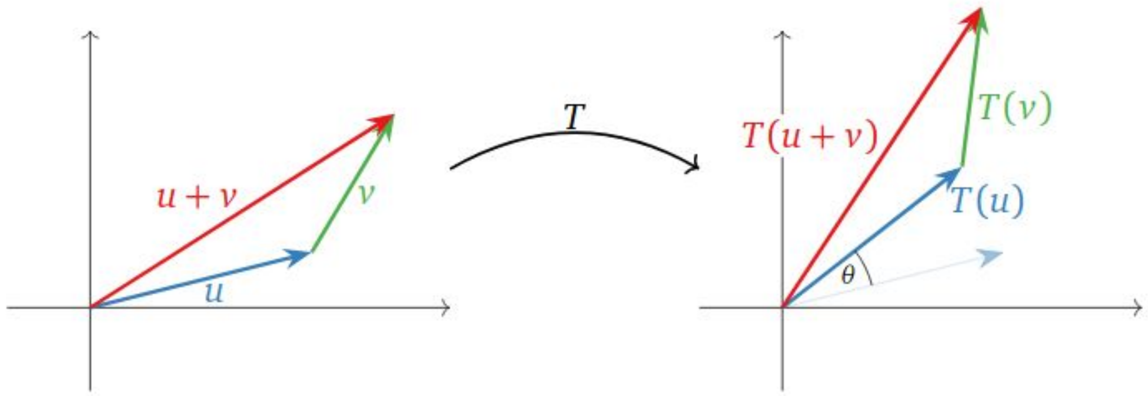
for all vectors u, v in $\mathbf{R}^n$ and all scalars c.

If a transformation is linear, a matrix exists to achieve that transformation.

Rotation, translation and scaling matrices are linear. Intuition for rotation next slide:

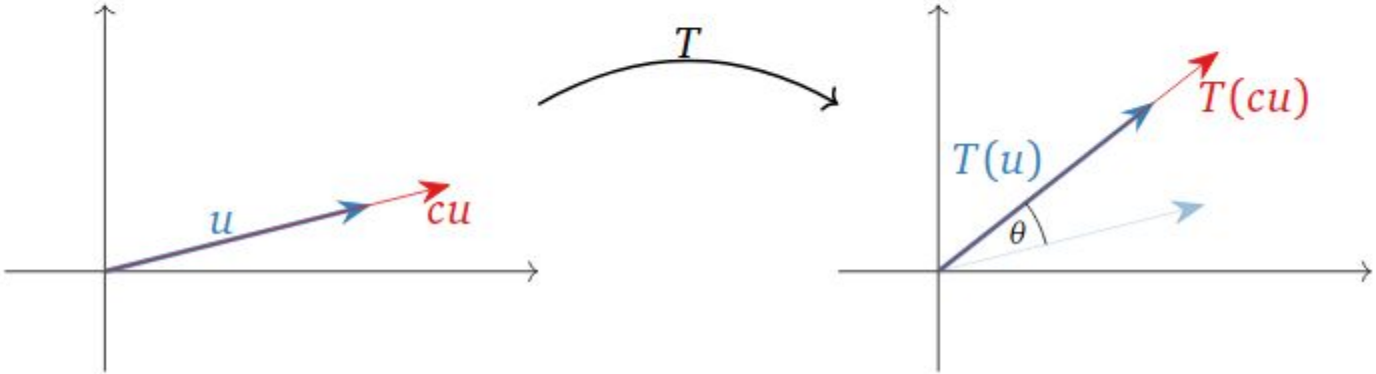
Linear transformations

Since T is defined geometrically, we give a geometric argument. For the first property, $T(u)+T(v)$ is the sum of the vectors obtained by rotating u and v by θ. On the other side of the equation, $T(u+v)$ is the vector obtained by rotating the sum of the vectors u and v. But it does not matter whether we sum or rotate first, as the following picture shows.



Linear transformations

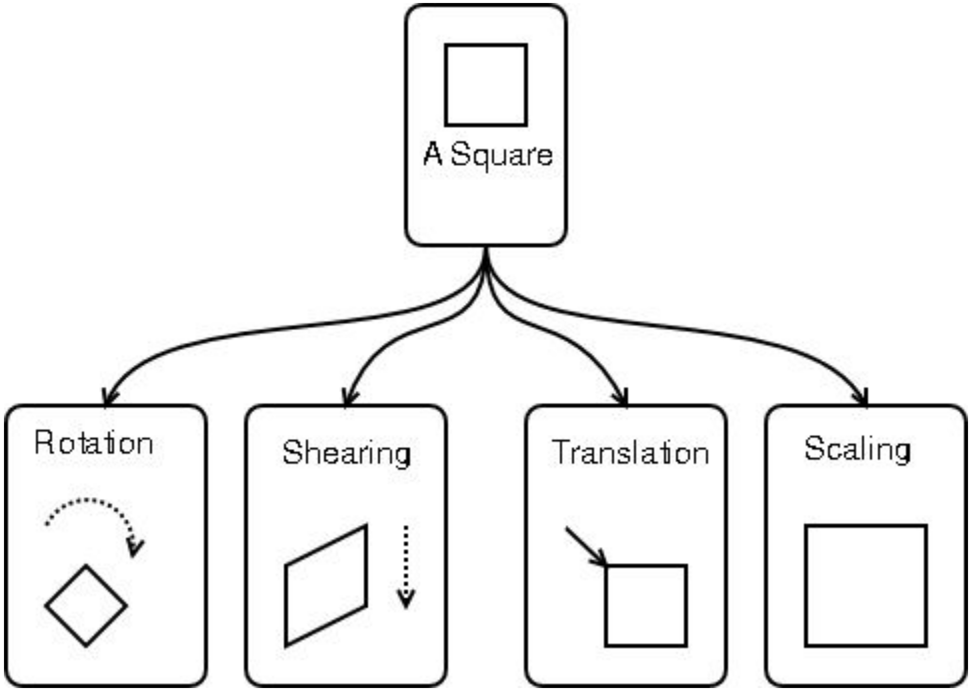
For the second property, $cT(u)$ is the vector obtained by rotating u by the angle θ, then changing its length by a factor of c (reversing direction of $c < 0$. On the other hand, $T(cu)$ first changes the length of c, then rotates. But it does not matter in which order we do these two operations.



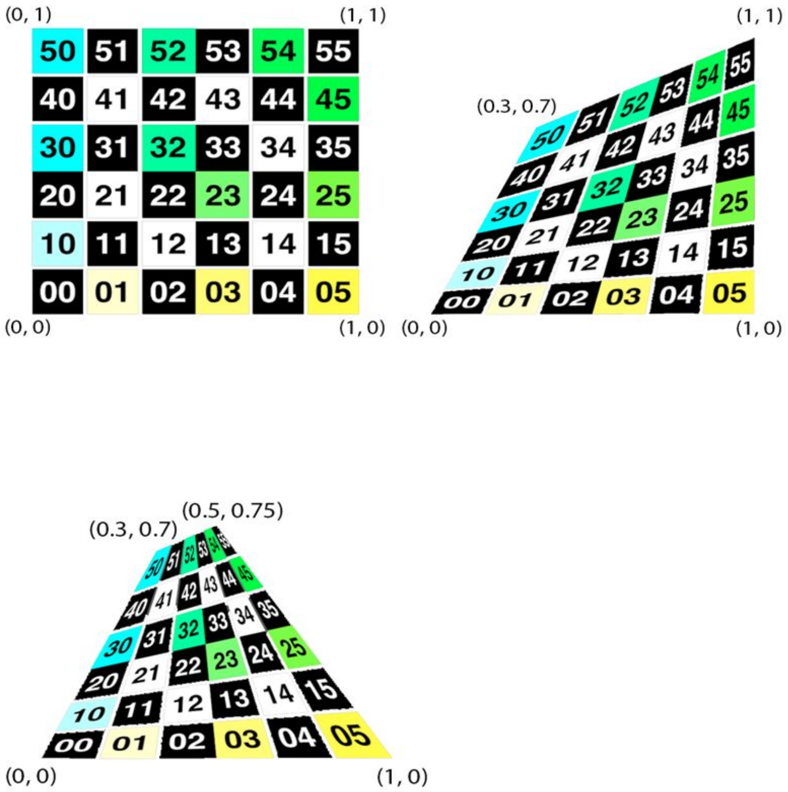
Affine

- Linear
- Line preserving
- Parallelism is also preserved

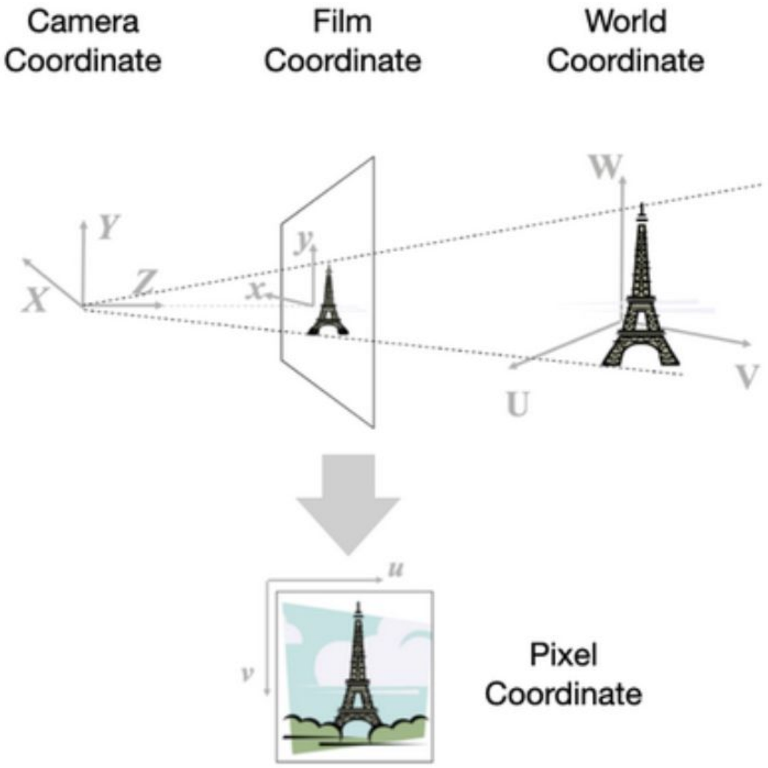
Affine Transforms

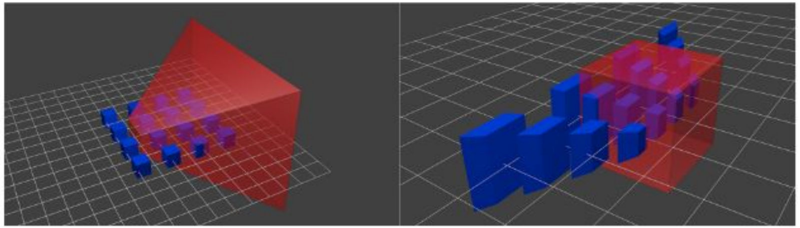


Non Affine Transforms



Projective Transforms





http://www.opengl-tutorial.org/beginners-tutorials/tutorial-3-matrices/

And some
other stuff

Assignment

- Pose reconstruction in g2o file
- Post-multiply and pre-multiply example
  - Will be released by tomorrow
  - Expected time spent ~3 hours