

Paradigmatic Revolutions in Computer Vision

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Pre-Science: No model of understanding (paradigm) mature enough to solve the field's main problems.

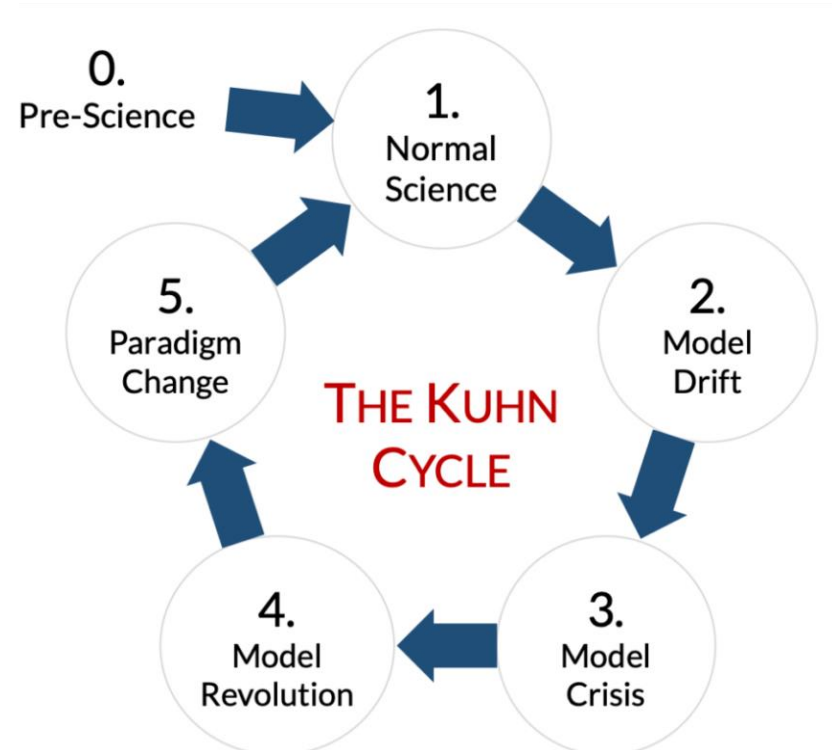
Normal Science: Most prevalent stage, paradigm established. Research firmly based upon past scientific achievement(s).

Model Drift: Issues and phenomena appear the paradigm cannot explain, drift away from normal science.

Model Crisis: Prevailing theory under attack from all sides. Foundation for solving central problems shattered by anomalies.

Revolution: From competing models one paradigm emerges, slow and rocky adoption begins. People have a lot to lose here.

Paradigm Change: New paradigm taught to newcomers and researchers. If generally accepted move to Normal Science.



Paradigm: (1) Exemplar or concrete scientific achievement (Newton mechanics) (2) Disciplinary matrix, cluster of problems, assumptions, beliefs, values, techniques, methods shared by scientific community.

Deep Learning: Cybernetic devices in 50s and 60s, multi-layer perceptrons, shallow CNNs to deep neural networks using backpropagation and gradient descent on vast data. Exemplar? Depends, what you require from exemplars. DL models have **no explanatory capabilities – simply correlation machines.**

Computer Vision for Human-like Perception: According to David Marr (Vision, 1982) - research tasked with computationally recreating human perception. Did any paradigms for this ever exist?

RANSAC (1981) – “paradigm for model fitting with applications to image analysis”, perhaps only exemplar.

De La Torre & Black (2001) – “automated learning of low-dimensional linear models” as paradigm in CV?

Klette & Reulke (2005) – “paradigm shift by gradual transition” for modelling 3D scenes, not Kuhnian.

Current DNN's are no help in understanding or recreating human vision

Computer Vision for Real-world Applications: Maybe CV is engineering, for automation?

Too many problems with DL: brittleness, data dependency, ecological and economical problems, diminishing returns, too many theories (models), ethical considerations, model opaqueness...

A mature vision paradigm would surely not suffer from all these problems

Computer Vision is at a paradigmatic crossroads.

If we don't accept DL as a paradigm, CV is still in the Pre-Science stage.

If we do accept it, we are in Model Drift heading towards Crisis.

DL models are useful but not enough to solve either human perception or real-world.