**Study on Supercritical Fluid Phases : Machine Learning Techniques**

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Machine learning technique (MLT) is used to directly classify liquid-like and gas-like particles in SCF. The number fraction of gas-like particles (π\_gas) shows a robust sigmoidal dependence on the bulk fluid density, even in the deeply supercritical condition. Moreover, the locus found by MLT agrees with and extends the conventional Widom line, which is well-defined only in the vicinity of the critical point. The new Widom line is clearly distinguished from the Frenkel line, and we partition the supercritical phase diagram into three sub-regions: gas-like, soft-liquid-like and rigid-liquid-like. This result suggests a novel solution to the problem of distinguishing liquid and gas in supercritical phase diagram, and can be widely applied to explain the anomalous nature of inhomogeneous systems.