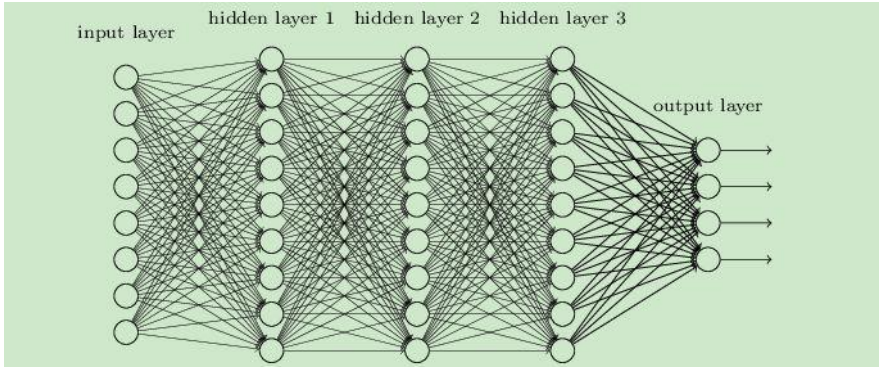
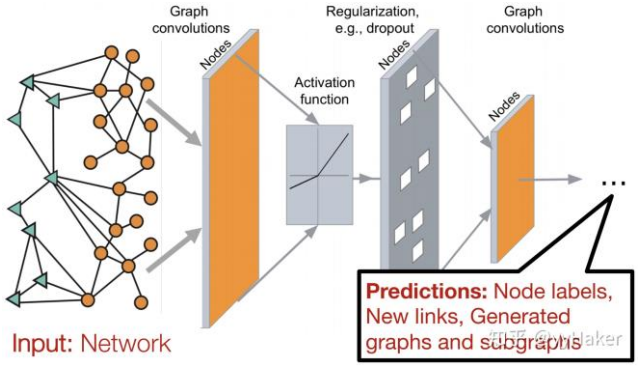
Outline

1. WL-Test
2. *How powerful are graph neural networks*
3. *Weisfeiler and Leman Go Neural: Higher-order Graph Neural Networks*
4. Github repository

GNN的表达能力



Deep Neural Network



Graph Neural Network

Kurt Hornik, Maxwell Stinchcombe, and Halbert White. Multilayer feedforward networks are universal approximators. Neural networks, 2(5):359–366, 1989

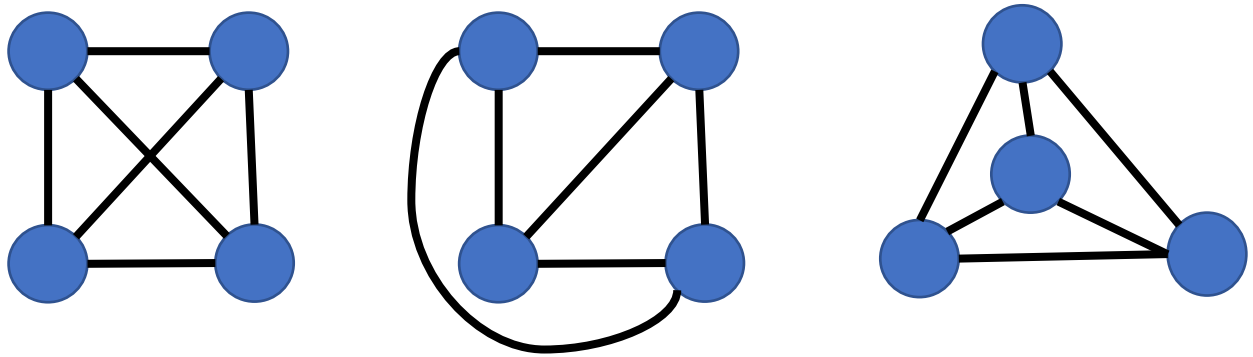
WL-Test and GNN

1. **ICLR 2019*:*** *How powerful are graph neural networks*
2. **AAAI 2019*:*** *Weisfeiler and Leman Go Neural: Higher-order Graph Neural Networks*

2019年，两篇文章分别独立的发现并提出了WL-Test是传统GNN（MPNN）表达能力的上限

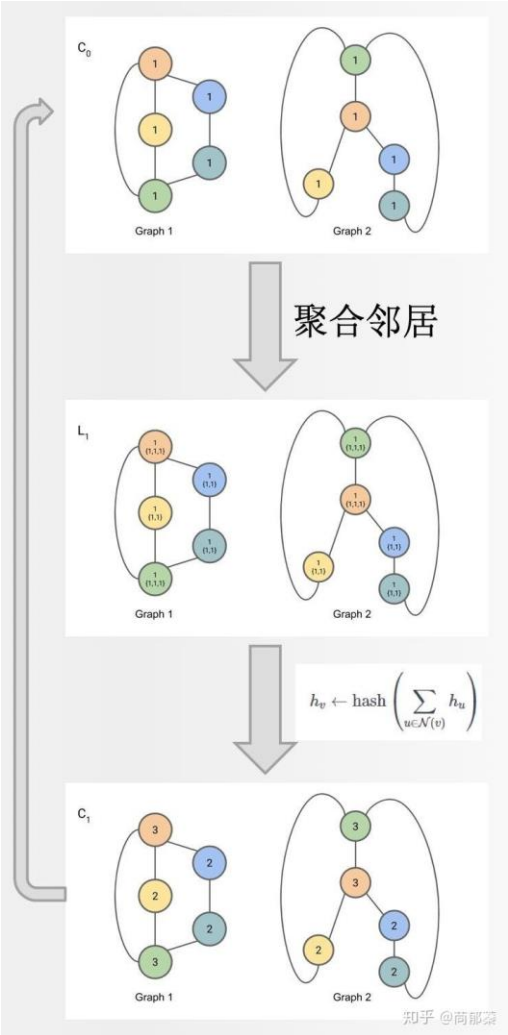
图同构

1. 图同构问题，目前不存多项式时间复杂度的算法
2. WL-Test是一种近似多项式时间的图同构检验方法



Brendan L Douglas. The weisfeiler-lehman method and graph isomorphism testing. arXiv preprint arXiv:1101.5211, 2011

WL-test

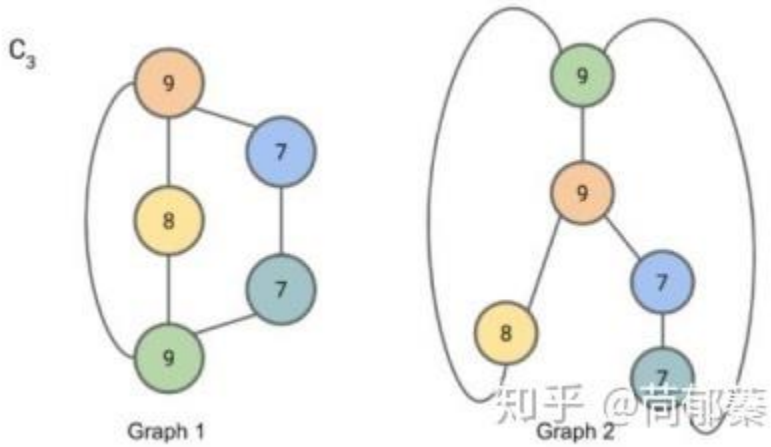


稳定时：统计各个label的分布

图1： 1个8，2个7，2个9

图2： 1个8，2个7，2个9

则，我们不排除其同构的可能性



WL-test

$hash(h_v, \{h_u : u \in N_v\})$

↓ injective function.

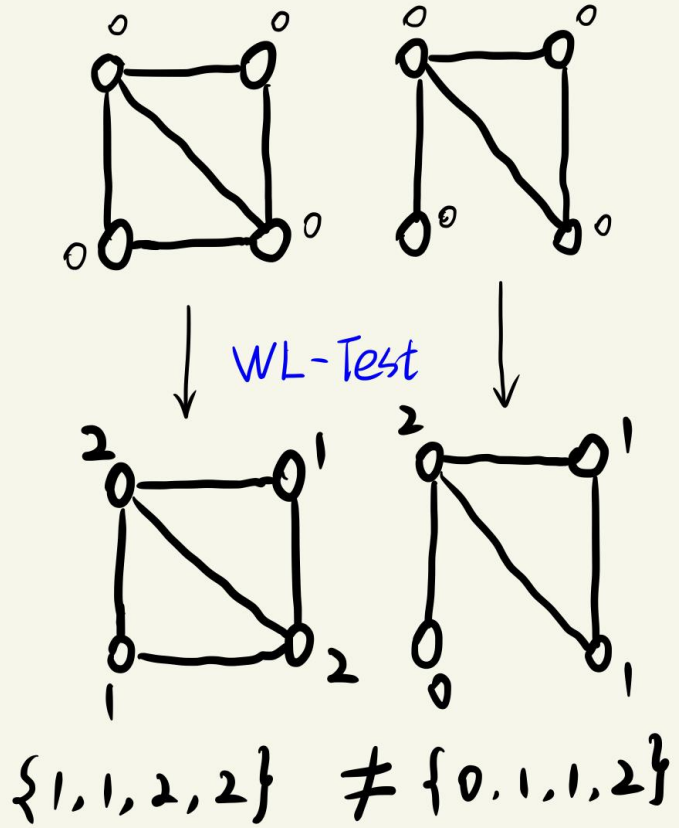
↓

$hash(0, \{0\}) = 0$

$hash(0, \{0, 0\}) = 1$

$hash(0, \{0, 0, 0\}) = 2$

...



WL-test

hash(0, {0,0}) = 1

hash(0, {0,0,0}) = 2

hash(1, {1,2}) = 3

hash(2, {1,2,1}) = 4