FISHNETS

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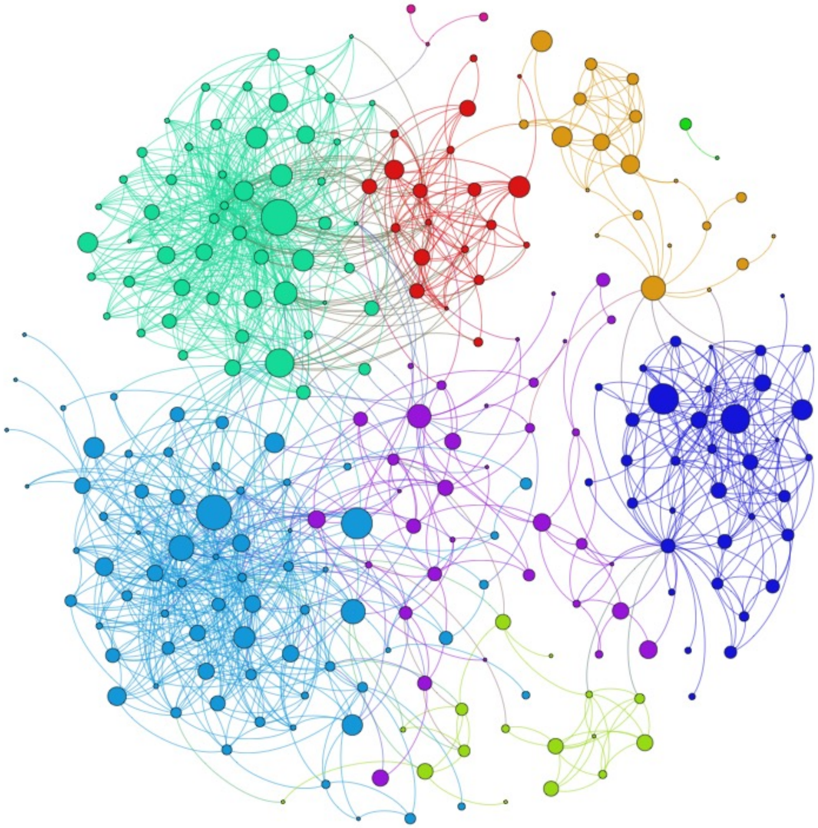
with Justin Alsing + Ben Wandelt

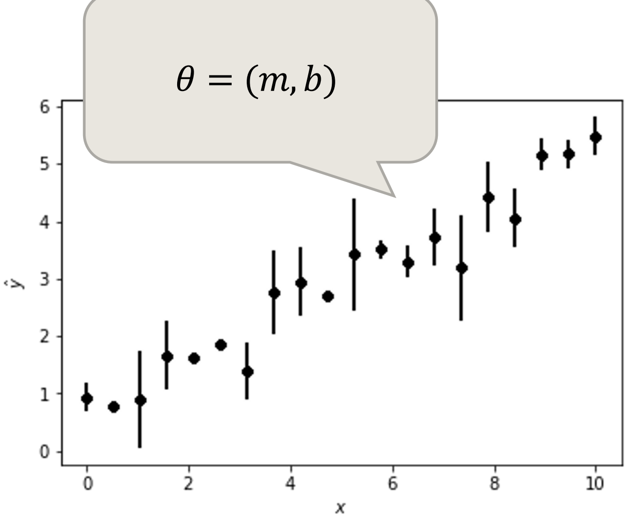
arxiv:2310.03812



FISHNETS

Given some data: $\{\mathbf{d}\} = \{\mathbf{x}, \mathbf{y}, \boldsymbol{\sigma}\}$

$$\ln p(\{\boldsymbol{d}\}|\boldsymbol{\theta}) = \sum_{i=1}^{n_{\text{data}}} \ln p(d_i|\boldsymbol{\theta})$$



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Dataset score is additive !

$$\boldsymbol{t} = \nabla_\theta \ln p(\{\boldsymbol{d}\}|\boldsymbol{\theta})$$

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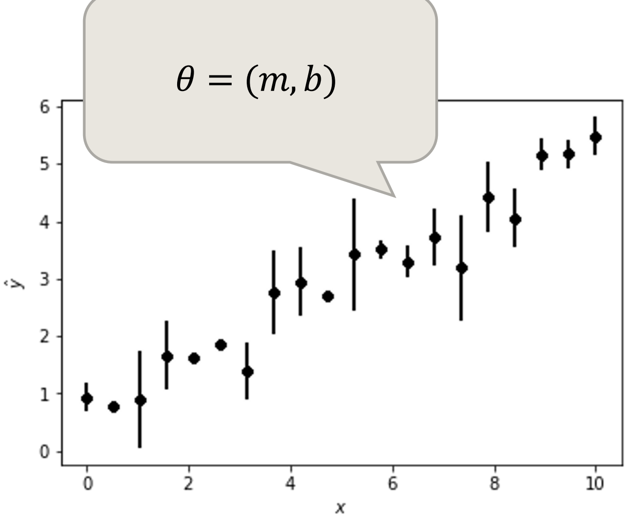
$$= \sum_{i=1}^{n_{\text{data}}} \boldsymbol{t}_i(d_i)$$



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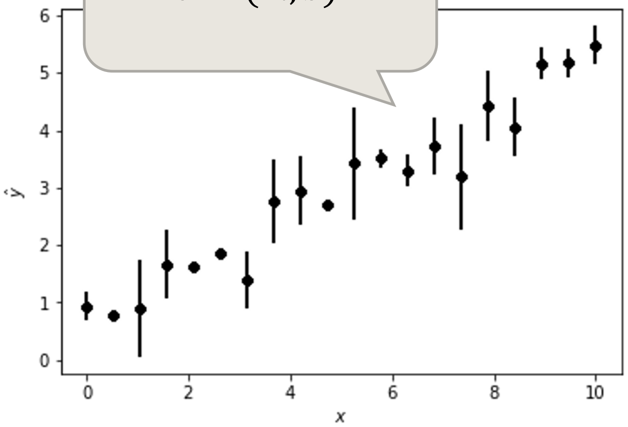
$\theta = (m, b)$



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Fisher is also additive !

$$\mathbf{F}(\{\mathbf{d}\}) = \sum_{\boldsymbol{i=1}}^{n_{\text{data}}} \mathbf{F}_{\text{i}}(x_i, \sigma_i)$$

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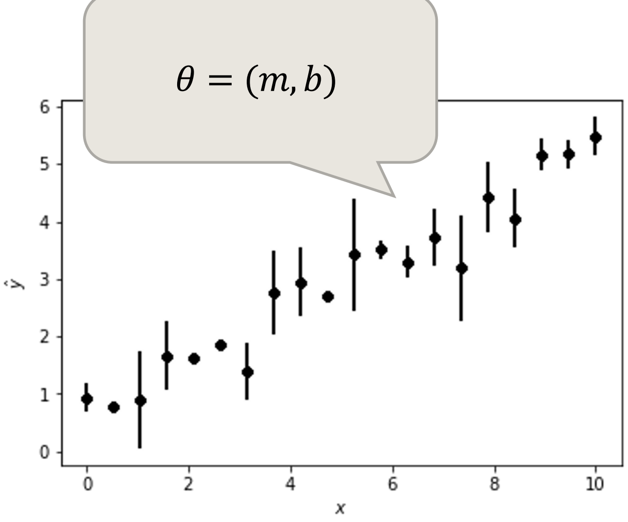

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learn with neural networks !

FISHNETS

create pseudo-MLE estimate

$$\widehat{\boldsymbol{\theta}}^{\mathrm{MLE}} = \boldsymbol{F}_{NN}^{-1}\boldsymbol{t}_{NN} + \boldsymbol{\theta}_{fid}$$

Train the networks using a "KL"-type loss:

$$\mathcal{L} = \frac{1}{2}(\boldsymbol{\theta} - \hat{\boldsymbol{\theta}}^{\mathrm{MLE}})^T \mathbf{F}_{NN}^{-1} (\boldsymbol{\theta} - \hat{\boldsymbol{\theta}}^{\mathrm{MLE}}) - \frac{1}{2} \ln \det \mathbf{F}_{NN}$$

Train the networks using a "KL"-type loss:

fisher network

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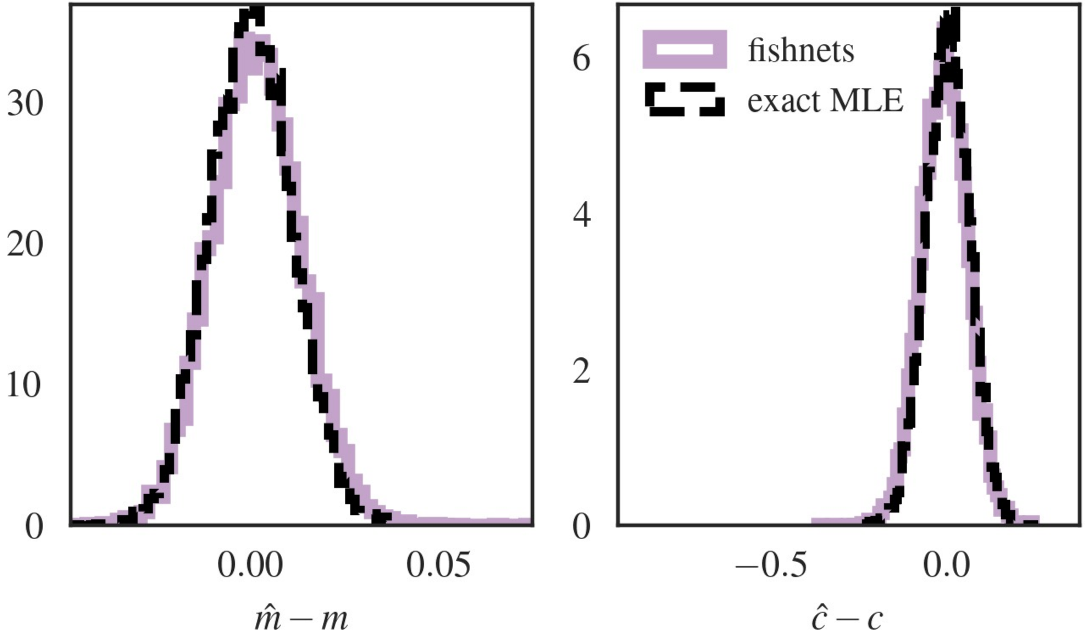
score network

optimal for linear regression ...



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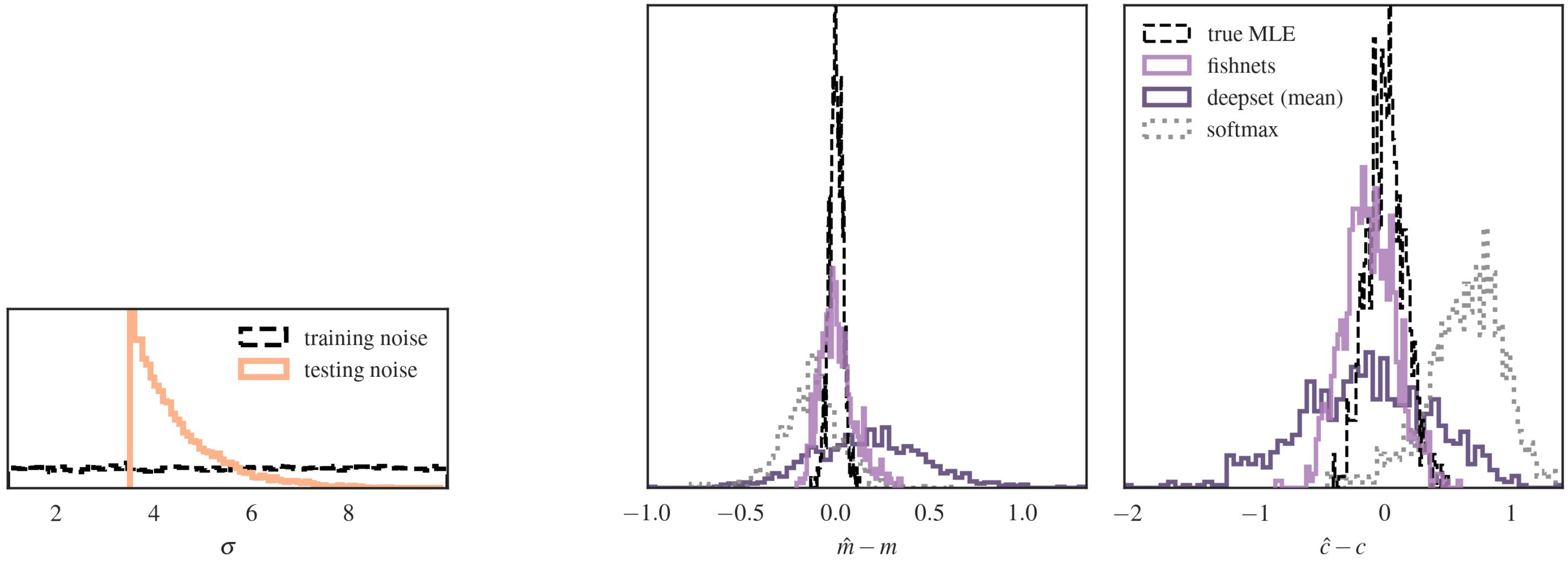
... even when the global noise distribution changes !



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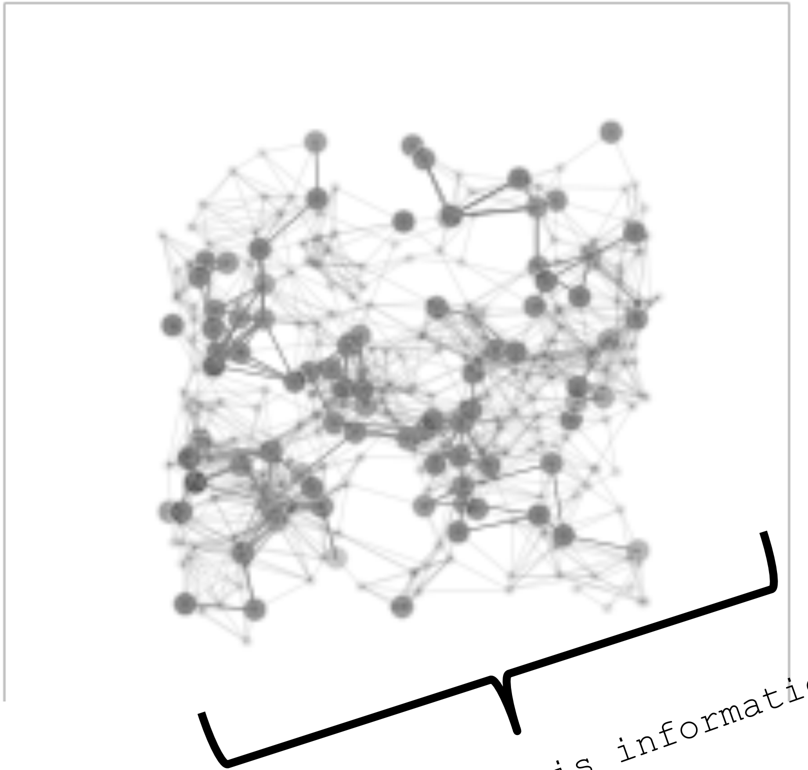
what about graphs ?



aggregate this information !

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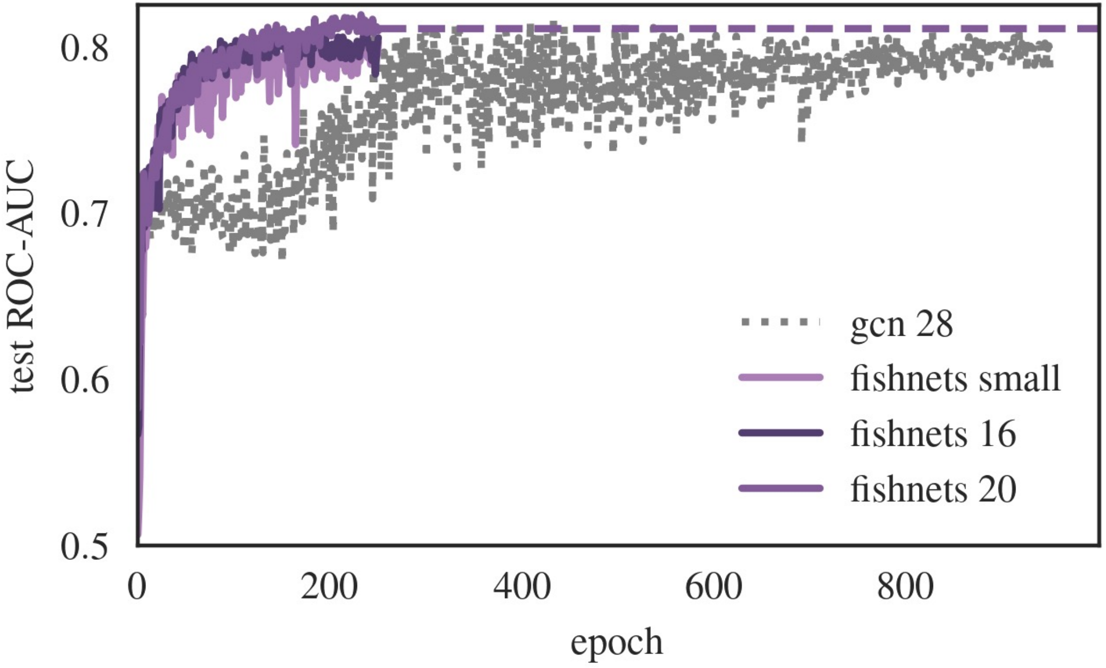
Use as a drop-in replacement for graph network aggregation



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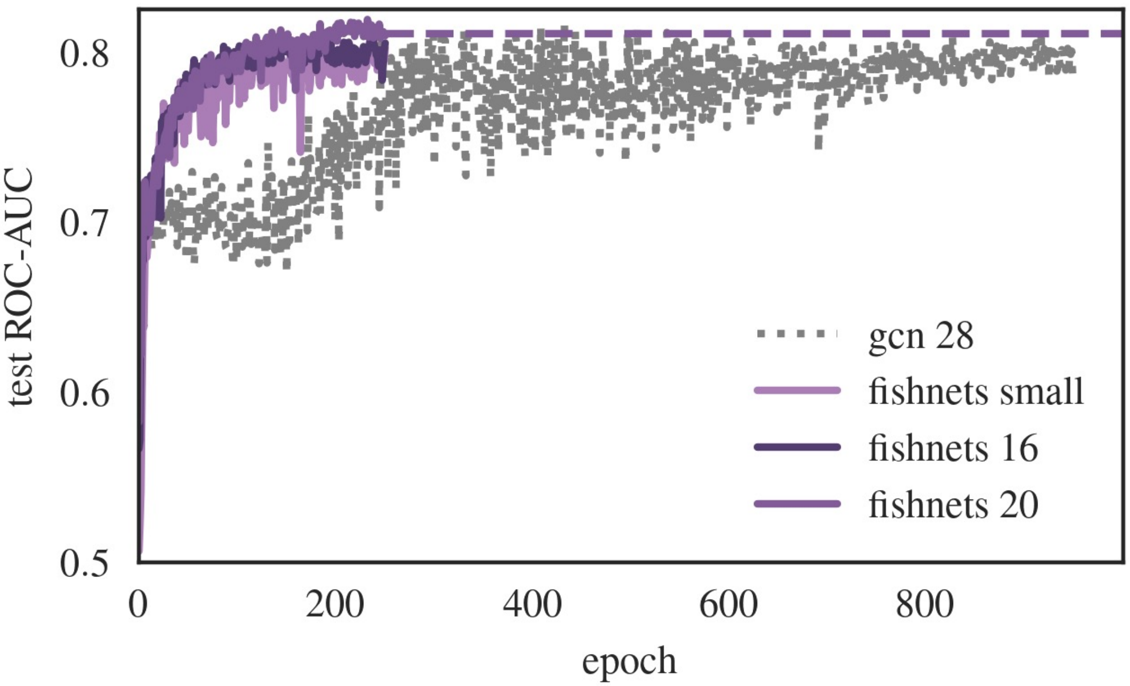
improve information embedding + extraction for common benchmarks



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