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| cases | doc_1            |  | doc_2            |   | decision   | id  |
|       | authors          | <ul style="list-style-type: none"><li>Tian Qin</li><li>Alex Beatson</li><li>Deniz Oktay</li><li>Nick McGreivy</li><li>Ryan P. Adams</li></ul>  | authors          | <ul style="list-style-type: none"><li>Tian Qin</li><li>Alex Beatson</li><li>Deniz Oktay</li><li>N. McGreivy</li><li>R. Adams</li></ul>  | DUPLICATES | 191 |
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|       | doi              |  | doi              | 10.48550/arXiv.2211.01604   |            |     |
|       | urls             | <ul style="list-style-type: none"><li>http://arxiv.org/pdf/2211.01604v1</li><li>http://arxiv.org/abs/2211.01604v1</li><li>http://arxiv.org/pdf/2211.01604v1</li></ul>  | urls             | <ul style="list-style-type: none"><li>https://www.semanticscholar.org/paper/bd29458e2f46280deed89b7d317cf225afb753c7</li></ul>  |            |     |
|       | id               | id4024248098543541230  | id               | id504442775818289046  |            |     |
|       | abstract         | Partial differential equations (PDEs) are often computationally challenging to solve, and in many settings many related PDEs must be be solved either at every timestep or for a variety of candidate boundary conditions, parameters, or geometric domains. We present a meta-learning based method which learns to rapidly solve problems from a distribution of related PDEs. We use meta-learning (MAML and LEAP) to identify initializations for a neural network representation of the PDE solution such that a residual of the PDE can be quickly minimized on a novel task. We apply our meta-solving approach to a nonlinear Poisson's equation, 1D Burgers' equation, and hyperelasticity equations with varying parameters, geometries, and boundary conditions. The resulting Meta-PDE method finds qualitatively accurate solutions to most problems within a few gradient steps; for the nonlinear Poisson and hyper-elasticity equation this results in an intermediate accuracy approximation up to an order of magnitude faster than a baseline finite element analysis (FEA) solver with equivalent accuracy. In comparison to other learned solvers and surrogate models, this meta-learning approach can be trained without supervision from expensive ground-truth data, does not require a mesh, and can even be used when the geometry and topology varies between tasks. | abstract         | Partial differential equations (PDEs) are often computationally challenging to solve, and in many settings many related PDEs must be be solved either at every timestep or for a variety of candidate boundary conditions, parameters, or geometric domains. We present a meta-learning based method which learns to rapidly solve problems from a distribution of related PDEs. We use meta-learning (MAML and LEAP) to identify initializations for a neural network representation of the PDE solution such that a residual of the PDE can be quickly minimized on a novel task. We apply our meta-solving approach to a nonlinear Poisson’s equation, 1D Burgers’s equation, and hyperelasticity equations with varying parameters, geometries, and boundary conditions. The resulting Meta-PDE method finds qualitatively accurate solutions to most problems within a few gradient steps; for the nonlinear Poisson and hyper-elasticity equation this results in an intermediate accuracy approximation up to an order of magnitude faster than a baseline finite element analysis (FEA) solver with equivalent accuracy. In comparison to other learned solvers and surrogate models, this meta-learning approach can be trained without supervision from expensive ground-truth data, does not require a mesh, and can even be used when the geometry and topology varies between tasks. |            |     |
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