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<tr><td>authors</td><td>Tianhao Hu and Bangti Jin and Zhi Zhou</td></tr>
<tr><td>title</td><td>Solving Elliptic Problems with Singular Sources using Singularity Splitting Deep Ritz Method</td></tr>
<tr><td>publication_date</td><td>2022-09-07 00:00:00</td></tr>
<tr><td>source</td><td>SupportedSources.INTERNET_ARCHIVE</td></tr>
<tr><td>journal</td><td></td></tr>
<tr><td>volume</td><td></td></tr>
<tr><td>doi</td><td></td></tr>
<tr><td>urls</td><td>https://web.archive.org/web/20220916002959/https://arxiv.org/pdf/2209.02931v1.pdf</td></tr>
<tr><td>id</td><td>id-4198966178035049848</td></tr>
<tr><td>abstract</td><td>In this work, we develop an efficient solver based on deep neural networks for the Poisson equation with variable coefficients and singular sources expressed by the Dirac delta function Î´(ð±). This class of problems covers general point sources, line sources and point-line combinations, and has a broad range of practical applications. The proposed approach is based on decomposing the true solution into a singular part that is known analytically using the fundamental solution of the Laplace equation and a regular part that satisfies a suitable elliptic PDE with smoother sources, and then solving for the regular part using the deep Ritz method. A path-following strategy is suggested to select the penalty parameter for penalizing the Dirichlet boundary condition. Extensive numerical experiments in two- and multi-dimensional spaces with point sources, line sources or their combinations are presented to illustrate the efficiency of the proposed approach, and a comparative study with several existing approaches is also given, which shows clearly its competitiveness for the specific class of problems. In addition, we briefly discuss the error analysis of the approach.</td></tr>
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