# More Thorough Error vs Residual Analysis

Clamped upper results to help visualise areas of highest accuracy.

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| C:\Users\mn17jilf\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Residual_vs_uError_NotClamped.pngC:\Users\mn17jilf\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Residual_vs_uError_ClampedAt4.png |
| Figure 1 – Comparison of PDE residual (the cost function) vs actual error in U, averaged over 10 runs. |

# Gradient Estimates using ML vs Ground Truth

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| --- | --- | --- | --- |
| Gradient | PINNs, minimal training | PINNs, fully trained | From Ground Truth |
| du/dx | InitialTest - u_x |  | GroundTruth2 - u_x |
| du/dt | InitialTest - u_t |  | GroundTruth2 - u_t |
| Figure 2 – Gradients obtained from PINNs vs Ground Truth | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Curvature | PINNs, minimal training | PINNs, fully trained | Ground Truth |
|  | InitialTest - u_xx |  | GroundTruth2 - u_xx |
|  | InitialTest - u_tt | C:\Users\mn17jilf\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Trained grad estimate - u_tt.png | GroundTruth2 - u_tt |
|  | InitialTest - u_tx | C:\Users\mn17jilf\AppData\Local\Microsoft\Windows\INetCache\Content.Word\Trained grad estimate - u_xt.png | GroundTruth2 - u_tx |
| Figure 3 - Curvature obtained from PINNs vs Ground Truth | | | |

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| C:\Users\mn17jilf\Uni\PhD\Projects\JPINN-Sampling\pinn-sampling\results\plots\Gradients and Curvature\InitialTest - Resampling from Gradients.png |
| Figure 4 – Point Resampling using different information without further tuning |
| C:\Users\mn17jilf\Uni\PhD\Projects\JPINN-Sampling\pinn-sampling\results\plots\Gradients and Curvature\InitialTest - Resampling from Curvature.png |
| Figure 5 – Whilst , the points are differently placed due to inherent randomness |

# Cases

RAD: Investigate Hammersley initialisation

RAR-D: Gradients, Gradient Combinations and Curvature based refinement. For random point initialisation and Hammersley initialisation.

Later: Vary NN fidelity. Tuning of k and c. Tuning of PDF equation (especially for curvature combinations).