Artificial Intelligence in Healthcare

Identifying neuroimaging endophenotypes with AI

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Outline

Plan for the day

1. Why do we need new imaging phenotypes?
2. How can we find new phenotypes with AI?
3. Use case: Explainable AI for dementia
4. Use case: Pretraining with multitask learning
5. Use case: Explainable brain age predictions

How can we find new phenotypes with AI?

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What does neural networks do?

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\begin{aligned}
\hat{y} = \max(0, & 0.45 * \max(0, 0.67 * \max(0, 0.12 * x_0 + 0.34 * x_1 + 0.56 * x_2 + 0.78 * x_3 + 0.91) + \\
& 0.23 * \max(0, 0.11 * x_0 + 0.22 * x_1 + 0.33 * x_2 + 0.44 * x_3 + 0.55) + \\
& 0.89 * \max(0, 0.66 * x_0 + 0.77 * x_1 + 0.88 * x_2 + 0.99 * x_3 + 0.10) + \\
& 0.21) + \\
& 0.54 * \max(0, 0.76 * \max(0, 0.12 * x_0 + 0.34 * x_1 + 0.56 * x_2 + 0.78 * x_3 + 0.91) + \\
& 0.65 * \max(0, 0.11 * x_0 + 0.22 * x_1 + 0.33 * x_2 + 0.44 * x_3 + 0.55) + \\
& 0.43 * \max(0, 0.66 * x_0 + 0.77 * x_1 + 0.88 * x_2 + 0.99 * x_3 + 0.10) + \\
& 0.32) + \\
& 0.98 * \max(0, 0.87 * \max(0, 0.12 * x_0 + 0.34 * x_1 + 0.56 * x_2 + 0.78 * x_3 + 0.91) + \\
& 0.76 * \max(0, 0.11 * x_0 + 0.22 * x_1 + 0.33 * x_2 + 0.44 * x_3 + 0.55) + \\
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& 0.31 * \max(0, 0.21 * \max(0, 0.12 * x_0 + 0.34 * x_1 + 0.56 * x_2 + 0.78 * x_3 + 0.91) + \\
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& 0.65) + \\
& 0.06 * \max(0, 0.27 * \max(0, 0.12 * x_0 + 0.34 * x_1 + 0.56 * x_2 + 0.78 * x_3 + 0.91) + \\
& 0.85 * \max(0, 0.11 * x_0 + 0.22 * x_1 + 0.33 * x_2 + 0.44 * x_3 + 0.55) + \\
& 0.17 * \max(0, 0.66 * x_0 + 0.77 * x_1 + 0.88 * x_2 + 0.99 * x_3 + 0.10) + \\
& 0.42) + \\
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