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Extension of the Lanchester combat model to the Russian invasion of Ukraine

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The Russian invasion of Ukraine began on 24 February 2022. A unique feature of this war is that the Ukrainian armed forces not only use their own resources to fight, but also gather and deploy intact weapons left behind by their enemy. According to military experts, the capture of Russian weapons was paramount for Ukraine to achieve victory in the battles of Kharkiv and Lyman.

During the First World War, Lanchester constructed the first differential equation models to describe and quantify the losses of armies in war and the factors that influenced the outcome of battles. In Lanchester's model, the sign of a quadratic invariant determines which army will win the battle and which one will perish.

In this presentation we extend Lanchester's model to include capture of weapons from the enemy. For the extended model, we derive a new invariant, which generalizes the quadratic law, but has a much more complicated form. We analyze the role of capture in the outcome of battles, and parametrize the model for the Russian invasion using a database of documented military losses.

This is a joint work with Gergely Röst.