**Ph.D. Research Proposal Summary**

Relative Combat Power and Force Ratio

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1. **Introduction**

+ In this research I will try to explain why and how some armies in history fight and win the war although they have less manpower or means to fight. This is not just force ratio comparison. It will be the first step to analyze. More generally I will analyze relative combat power and I will try to explain what was the other factors that made them win.

+ I would like to study this topic because I was a staff officer in Turkish Army and our way of military training includes doctrine that advises some sort of action according to force ratios. One general acceptance was if you have 3:1 force ratio you may plan to attack.

**2. What does literature says?**

+ Key historic writers who have addressed force ratios:

* Sun Tzu: “art of offensive strategy: when 10:1 surround, 5:1 attack, 2:1 divide, 1:1 engage or elude, if force ratio is less then enemy, capable of withdraw”.
* Clausewitz: “*if superiority reach the point where it is overwhelming*, superiority of numbers will be the most important factor in the outcome of an engagement, so long as it is great enough to counterbalance all other contributing circumstances”.
* F.W.Lanchester: **N-square law** as “*the fighting strength of a force is proportional to the square of its numerical strength multiplied by the fighting value of individual units*.

+Major projects of the field:

* **Soviet** approach (1960): **Correlation of Forces and Means**; an objective indicator of combat power to determine the degree of superiority of one side over another.
* **T.N. Dupuy: Quantified Judgment Method** (QJM); outcome of a battle is predicted using a multiplicative-additive formula in which various factors relating to the strength and firepower of the fighting parties as well as the circumstances are taken into account.

+ Master/Doctoral Thesis:

* Kevin Smith: **quantitative decision aids; explains** two schools of thought—moral (man is the decisive power on the battlefield) and quantitative (many battlefield phenomena are quantifiable either with deterministic, probabilistic or heuristic models)—and these are not competitors rather complimentary.
* Faruk Yigit: the force ratio is a valid estimator of battle outcome, after analyzing 660 battles of CDB90FT data set which covers the period of Netherlands War of Independence in 1600 and Israel-Lebanon War in 1982.
* Muzaffer Coban: He analyzed the same but updated data set of CDB90G with classification trees. Objective variables (force ratio) are alone not sufficient to classify battle outcomes. However, he finds that some of the relative variables, such as leadership, have a strong relationship with the battle outcome.

**3. What is the gap I Identified?**

+ Although the concept of force ratio is well explained theoretically, its explanatory power within the relative combat power factors is not analyzed systematically. A sophisticated model is needed.

+ Morale factor has not got enough attention due to its qualitative nature.

+ Judgements up to now relies limited data set, max battles analyzed to make deduction was 660 battles of CDB90G dataset, which has real missing data flaws.

**4. What is my research questions?**

* What is the degree of explanatory power of force ratios in the battles?
* What are the other major factors (such as morale, leadership) that affected the outcome of the battle?

**5. What will be the research methodology?**

+ Dependent variable: outcome of the battle.

+ Independent variables: Relative combat power factors (force ratio, morale, leadership, asymmetric factors).

**+ Models to be used:**

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| Name of Model | Reason |
| Linear regression | To get the percentages of variation in the outcome of the battle.  We would know together with other factors, what percentage force ratio explains of variation in the outcome of the battle. |
| Logistic Regression | To make classification.  Analyzing the outcome of the battle based on force ratios. |
| Predictions (up to potential Advisor’s recommendations) | Applying machine learning algorithms (decision trees, K Means Clustering and others) to data set.  To make a model to make predictions for future scenarios. |

**+ Initial null hypothesis** to be tested: “to win battle an army has to has greater force ratio than the opponent”.

**+ Data’s to be used:** From below databases and others, I am planning to make a comprehensive database with the help of Python Pandas Data Analysis Tool. This database will be the base from which we will further investigate.

* U.S. Concepts Analysis Agency’s updated version of the historical combat data set-660 battles
* Conflict Catalog and A Guide to Intra-State Wars.

**6. Conclusion**

I will collect data for the designated era wars and I will analyze these data in order to define certain patterns. I will try to reach meaningful conclusions whether our traditional belief of this force ratio is right or wrong based on scientific hypothesis testing. Further I will try to find to what degree explains force ratio and other combat power elements the result of war.