

Spring 2010 Research Report
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 End of the Quarter Research Report
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Tasks

In Winter 2010, we developed numerous propositions. We had a situation whereby our geminals were non - linear and we found that it was too expensive to compute formulas represented by those

non - linear geminals. For example, this case  generates the three subcases:

, , and  and they cost $\mathcal{O}(MM_*)$, $\mathcal{O}(MM_* + NM^2)$, and $\mathcal{O}(N^2MM_*)$ respectively, which is too expensive compared to the other cases that we have treated so far. For this quarter, were to:

- Investigate methods beyond just ordering sums and integrals in order to reduce the cost of the cases which are too costly like the one above.
- Check whether the Propositions we have treated already were correct.
- Present our research at the Ohio University Expo Day 2010.

We were therefore dubbed the ‘miracle’ group because we were to find some ‘miracle’ to reduce the cost.

Accomplishments

We were able to check our propositions for correctness and we couldn’t find any mistake. We presented our poster at the Expo Day and we couldn’t make it to the top two places. In trying to accomplish the other task, we first read a bunch of papers which we thought had information about what we were doing. We couldn’t find any breakthrough or ‘divine intervention’ from them.

Dr. Mohlenkamp brought to our attention some ‘minor miracle’. He considered an Integral with Gaussians

$$\int e^{-a\|r-r'\|^2} e^{-b\|r-r'\|^2} \theta(\gamma'') \phi(\gamma'') d\gamma'' \tag{1}$$

which costs $\mathcal{O}(M^2)$ to compute. We hoped that this was going to help us reduce the cost of 

from $\mathcal{O}(MM_*)$ to $\mathcal{O}(M^2)$, the cost of  from $\mathcal{O}(MM_* + NM^2)$ to $\mathcal{O}(NM^2)$, and the cost of

 to $\mathcal{O}(N^2M^2)$ from $\mathcal{O}(N^2MM_*)$. We tried our best to come out with possible ways to reduce the cost by using integrals with Gaussians but we didnt come out with something positive. However, this is not the end of the road. We will never give up but we will try to read more papers and try new strategies if need be.

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Conclusion

We were able to accomplish some of our tasks. Personally, I've learnt a lot of things this quarter. One, it was presenting in such a big conference where we displayed our poster. It was huge success judging from what we achieved. I also learnt that it is not easy reading articles. Like I said, this is not the end of the road, we are still battling out to find ways of lowering the costs of the non-linear cases.