SOLUTION FOR HOMEWORK ASSIGNMENT NO. 08

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Exercise 8.1

Given a note on the possibility of combining results from ATLAS and CMS we have to answer the following ten questions:

1. How is the CL_s method used for the search of the Higgs boson?

   Put very nice answer here.

2. What is the shape of a hypothetical Higgs boson signal?

   Put very nice answer here.

3. How is the test statistic constructed?

   The test statistic $\tilde{q}_\mu$ was constructed as

   $$\tilde{q}_\mu = -2 \cdot \ln \left(\frac{\mathcal{L}\left(\text{data}|\mu, \hat{\theta}_\mu\right)}{\mathcal{L}\left(\text{data}|\hat{\mu}, \hat{\theta}\right)} \right), \quad \text{with} \quad 0 \leq \hat{\mu} \leq \mu. \tag{1}$$

   $\mathcal{L}$ is as always the Likelihood and data refers to real observations or toy datasets. μ is a *signal strength modifier* which is applied to the SM Higgs boson cross sections. A hat over the variable signals them the be likelihood estimators. Therefore $\hat{\Theta}_\mu$ is the estimator given μ. The pair $\hat{\mu}$ and $\hat{\theta}$ are together the global maximum of the Likelihood function. $\hat{\mu}$ has to be bigger than zero as the signal is positive.

4. How is the p-value converted to the significance?

   Put very nice answer here.

5. Why is the look-elsewhere effect relevant and how was it estimated?

   Put very nice answer here.

6. Why does the analysis introduce nuisance parameters and how many of them are there for ATLAS and CMS?

   Put very nice answer here.

7. Which shape do these nuisance parameters have?

   Put very nice answer here.

8. How is the starting point of the Higgs boson mass chosen?

   Put very nice answer here.

9. Explain what figures 8, 9 and 10 represent.

   Put very nice answer here.

10. Explain how the likelihood of equation 20 is constructed.

    Put very nice answer here.