When naïve Bayesian approach will fail

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Example from tumor classification

- **Adrenal tumors** are common (1-2%) and mostly found incidentally

- Adrenocortical carcinomas (ACC) account for 2-11% of all adrenal tumors
- Adrenocortical adenomas (ACA) are benign – no metastases
- Conventional diagnostic tools (CT, MRI) lack sensitivity and are labour and cost intensive. Biopsy has risks in case of ACC.
- Alternative: tumor classification based on steroid excretion profile

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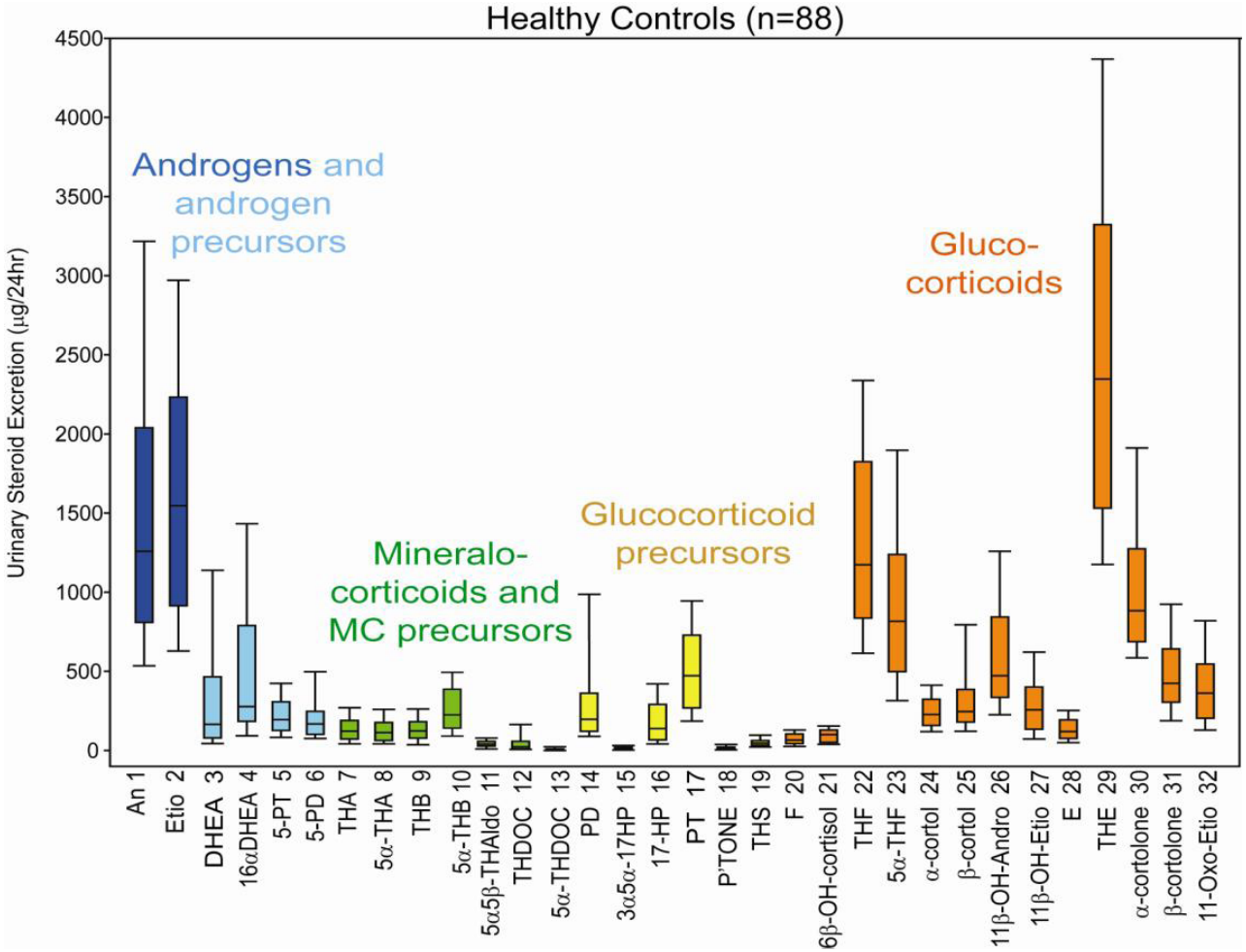
Example from tumor classification

- urinary steroid excretion (24 hours)
- 32 potential biomarkers



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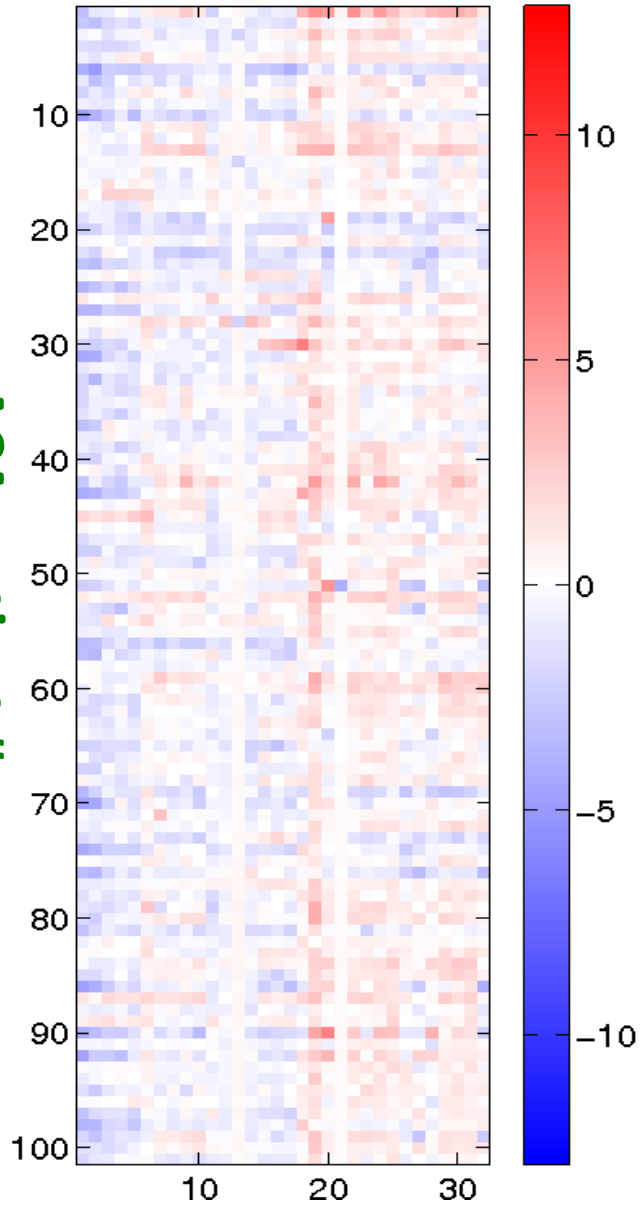
Example from tumor classification

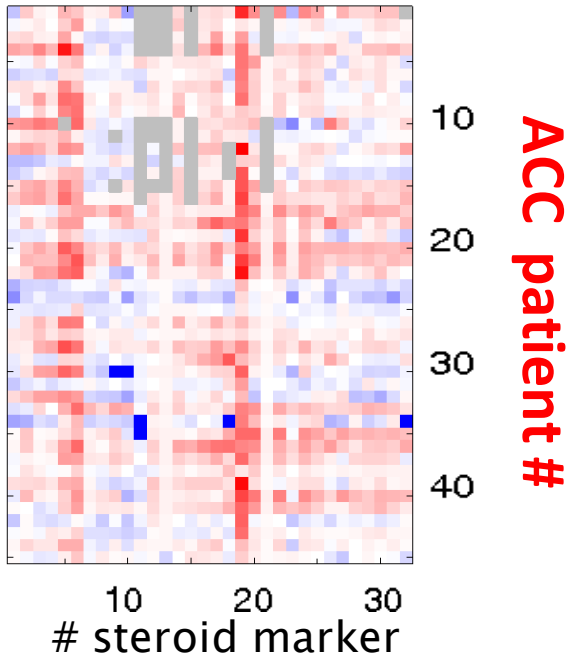


Data set:

102 patients with benign ACA

45 patients with malignant ACC

Color coded excretion values
(log. scale, relative to healthy controls)



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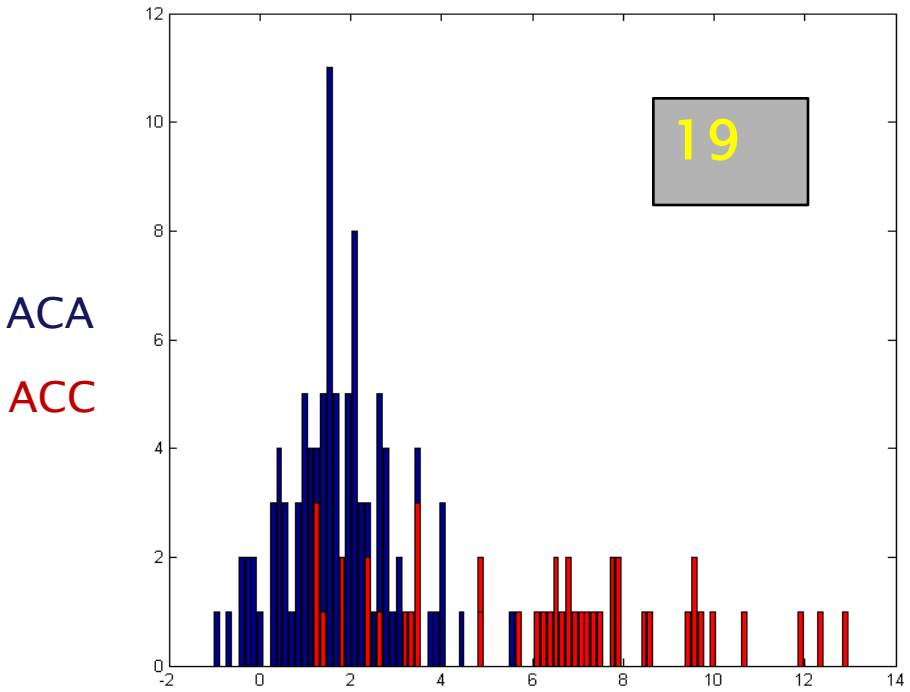
Example from tumor classification



Steroid 19 is discriminative on its own.

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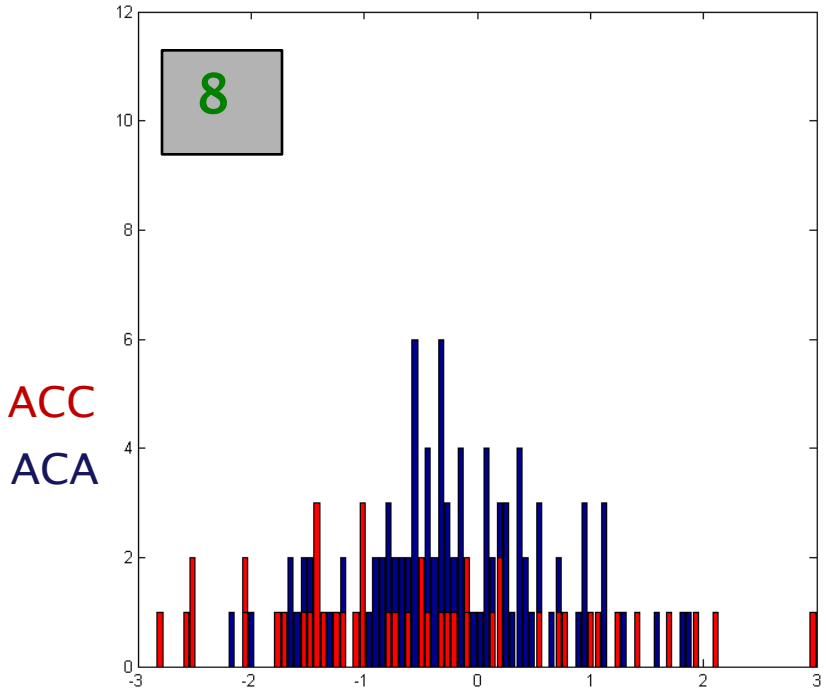
Example from tumor classification



On its own, steroid 8 is not discriminative because the two histograms overlap heavily.

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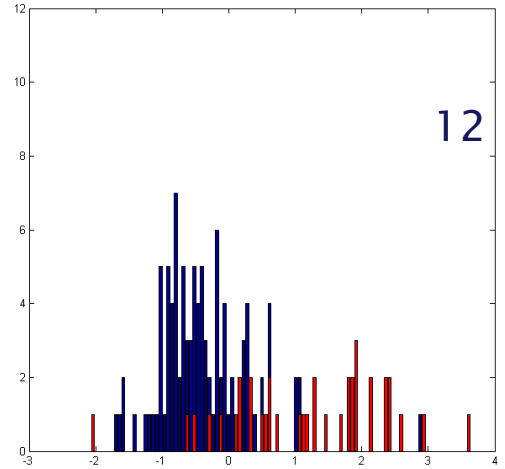
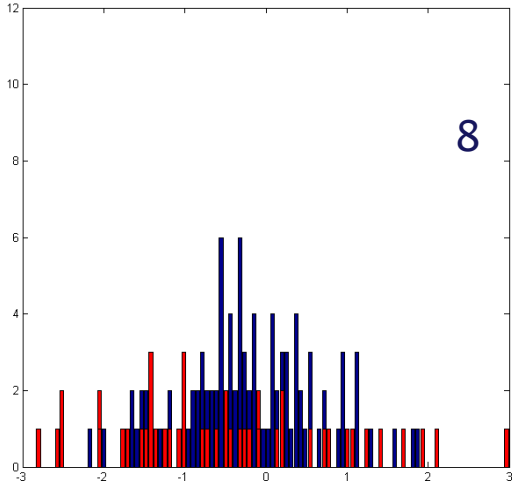
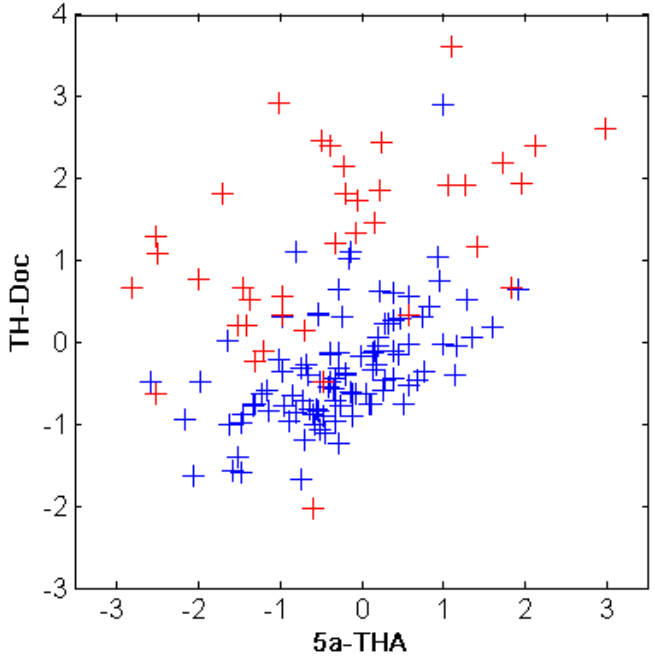
Example from tumor classification

On their own, marker 8 is not discriminative and Marker 12 is weakly discriminative.





But *the combination* of markers 8 and 12 is highly discriminative!



Naïve Bayes approach which uses the two marginal pdfs (on the left) and computes the 2D pdf as a produc will fail here because it will be a bad approximation of the real pdf (above).

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